APJ Abdul Kalam Technological University

Cluster 4: Kottayam

M. Tech Program in Computer Science & Engineering

Scheme of Instruction and Syllabus: 2015 Admissions

Compiled By

Rajiv Gandhi Institute of Technology, Kottayam

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APJ Abdul Kalam Technological University

(Kottayam Cluster)

M. Tech Program in Computer Science and Engineering

Scheme of Instruction

Credit requirements **:** 66 credits (22+18+14+12)
Normal Duration : Regular: 4 semesters; External Registration: 6 semesters
Maximum duration : Regular: 6 semesters; External Registration: 7 semesters
Courses: Core Courses: Either 4 or 3 credit courses; Elective courses: All of 3 credits
Allotment of credits and examination scheme:-

Semester 1 (Credits: 22)

Exam Slot	Course No:	Name	L- T - P	Internal Marks	End Semester Exam		Credits
					Marks	Duration (hrs)	
A	04 CS 6101	Computational Intelligence	3-1-0	40	60	3	4
B	04 CS 6103	Advanced Data Structures and Algorithms	3-1-0	40	60	3	4
C	04 CS 6105	Computer Security and Applied Cryptography	3-0-0	40	60	3	3
D	04 CS 6107	Modern Computer Networks	3-0-0	40	60	3	3
E	04 CS 6XXX*	Elective - I	3-0-0	40	60	3	3
	04 GN 6001	Research Methodology	0-2-0	100	0	0	2
	04 CS 6191	Seminar - I	0-0-2	100	0	0	2
	04 CS 6193	Network Simulation Lab	0-0-2	100	0	0	1
		Total	23				22

**See List of Electives-I for slot E*

List of Elective - I Courses

Exam Slot	Course No.	Course Name
E	04 CS 6109	Web Services
E	04 CS 6111	Object Oriented Software Engineering
E	04 CS 6113	Logic in Computer Science
E	04 CS 6115	Social Network Analytics

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Semester 2 (Credits: 18)

Exam Slot	Course No:	Name	L- T - P	Internal Marks	End Semester Exam		Credits
					Marks	Duration (hrs)	
A	04 CS 6102	Advanced Database Management	3-0-0	40	60	3	3
B	04 CS 6104	Automata Theory and Computability	3-0-0	40	60	3	3
C	04 CS 6106	High Performance Computer Architecture	3-0-0	40	60	3	3
D	04 CS 6XXX*	Elective 2	3-0-0	40	60	3	3
E	04 CS 6XXX^	Elective 3	3-0-0	40	60	3	3
	04 CS 6192	Mini Project	0-0-4	100	0	0	2
	04 CS 6194	Advanced Computing Lab	0-0-2	100	0	0	1
		Total	21				18

**See List of Electives -II for slot D* *^See List of Electives -III for slot E*

List of Elective - II Courses

Exam Slot	Course Code	Course Name
D	04 CS 6108	Information Retrieval and Data Mining
D	04 CS 6112	VIRTUALIZING TECHNIQUES
D	04 CS 6114	Web Security
D	04 CS 6116	Agent Based Systems

List of Elective - III Courses

Exam Slot	Course Code	Course Name
E	04 CS 6118	Bioinformatics
E	04 CS 6122	Digital Image Processing
E	04 CS 6124	Operating System Design Concepts
E	04 CS 6126	Embedded Systems

Summer Break

Exam Slot	Course No:	Name	L- T - P	Internal Marks	End Semester Exam		Credits
					Marks	Duration (hrs)	
NA	04 CS 7190	Industrial Training	0-0-4	NA	NA	NA	Pass /Fail
		Total	4				0

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Semester 3 (Credits: 14)

Exam Slot	Course No:	Name	L- T - P	Internal Marks	End Semester Exam		Credits
					Marks	Duration (hrs)	
A	04 CS 7XXX*	Elective - IV	3-0-0	40	60	3	3
B	04 CS 7XXX^	Elective - V	3-0-0	40	60	3	3
	04 CS 7191	Seminar - II	0-0-2	100	0	0	2
	04 CS 7193	Project (Phase - I)	0-0-12	50	0	0	6
		Total	20				14

**See List of Electives-IV for slot A* ^*See List of Electives-V for slot B*

List of Elective - IV Courses

Exam Slot	Course Code	Course Name
A	04 CS 7101	Cyber Forensics
A	04 CS 7103	Distributed Computing Systems
A	04 CS 7105	Wireless Sensor Networks
A	04 CS 7107	Text Mining and Language Processing

List of Elective - V Courses

Exam Slot	Course Code	Course Name
B	04 CS 7109	Big Data processing
B	04 CS 7111	Computer Vision
B	04 CS 7113	Compiler Design
B	04 CS 7115	Parallel Algorithms

Semester 4 (Credits: 12)

Exam Slot	Course No:	Name	L- T - P	Internal Marks	External Evaluation Marks		Credits
NA	04 CS 7194	Project (Phase -II)	0-0-21	70	30	NA	12
		Total	21				12

Total: 67

COURSE CODE	COURSE NAME	L-T-P:C	YEAR
04 CS 6101	Computational Intelligence	3-1-0: 4	2015

Pre-requisites:

Course Objectives:

- To apply the knowledge on various soft computing techniques like Fuzzy logic, Artificial Neural networks, Genetic algorithm and swarm intelligence into various applications.

Syllabus

Genetic Algorithms: Introduction, implementation of genetic algorithm, Applications of GA, Support vector machines: applications, Swarm intelligent systems: Introduction, ant colony systems-Ant Colony Optimization algorithm, Particle Swarm Optimization (PSO) Algorithm, SI applications, Fuzzy systems: Introduction, fuzzy logic in control and decision making application, Artificial Neural Networks: Introduction, back propagation algorithm, Neuro fuzzy model, ANFIS, ART Networks.

Course Outcome:

The student will demonstrate the ability to apply the fuzzy logic, Artificial Neural Networks, Genetic Algorithms and Swarm Intelligence into various real-world applications.

Text Books:

1. N.P. Pandy, Artificial Intelligence and Intelligent systems, Oxford Press, New Delhi.

References:

1. Jang J.S.R., Sun C.T. and Mizutani E, Neuro-Fuzzy and Soft computing, Pearson Education 2003.
2. Hung T. Nguyen,Elbert A. Walker,A First Course in Fuzzy Logic,2nd Edn.
3. Timothy J.Ross, Fuzzy Logic with Engineering Applications, McGraw Hill, 1997.
4. Yegnanarayana B, Artificial Neural Networks, PHI.
5. David E. Goldberg, Genetic algorithms in search, optimization & Machine Learning,PearsonEducation, 2006
6. Mitchell Melanie, An Introduction to Genetic Algorithm, Prentice Hall, 1998.
7. AndriesEngelbrecht, Computational Intelligence: An Introduction, 2007

COURSE PLAN

COURSE CODE:	COURSE TITLE	CREDITS	
04 CS 6101	Computational Intelligence	3-1-0: 4	
MODULES		Contact Hours	Sem. Exam Marks (%)
MODULE 1: Genetic Algorithms: Introduction, theoretical foundation of genetic algorithm, implementation of genetic algorithm. Applications of GA in Machine Learning – machine learning approach to knowledge acquisition		9	15
MODULE 2: Support vector machines for learning – linear learning machines – support vector classification – support vector regression – applications		8	15
INTERNAL TEST 1 (MODULE 1 & 2)			
MODULE 3: Swarm intelligent systems: Introduction, ant colony systems- Stigmergic behaviour, Ant Colony Optimization algorithm, Traveling Salesman Problem and Ant System.		9	15
MODULE 4: Particle Swarm Optimization (PSO) Algorithm, Comparison of PSO with Genetic Algorithm, SI applications		8	15
INTERNAL TEST 2 (MODULE 3 & 4)			
MODULE 5: Fuzzy systems: Introduction, Fuzzy relations, Arithmetic operations of fuzzy numbers Linguistic descriptions, Fuzzy measures, Defuzzification methods,Mamdani and Sugeno Models, fuzzy logic in control and decision making application		11	20
MODULE 6: Artificial Neural Networks:Introduction, Artificial neurons, perceptron, Multilayer perceptron. Back propagation algorithm, Competitive networks, Recurrent Networks. Neuro fuzzy model, ANFIS, ART Networks		11	20
END SEMESTER EXAM			

COURSE CODE	COURSE NAME	L-T-P:C	YEAR
04 CS 6103	Advanced Data Structures and Algorithms	3-1-0: 4	2015

Pre-requisites:

Course Objectives:

- To choose the appropriate data structures that effectively model the information in a problem.
- To judge efficiency tradeoffs among alternative data structure implementations or combinations.
- To apply algorithm analysis techniques to evaluate the performance of an algorithm and to compare data structures.
- To implement and know when to apply standard algorithms for searching and sorting.
- To introduce the algorithms for computational geometric problems

Syllabus

Trees - Threaded Binary Trees, Red-Black Trees, Splay Trees, Priority Queues - Single and Double Ended Priority Queues, Leftist Trees, Symmetric Min-Max Heaps,Maximum Flow- Maximum bipartite matching. Computational Geometry- Line segment properties, Determining whether any pair of segments intersect, Finding the convex hull, Finding the closest pair of points Approximation algorithms: NP completeness, Reductions, Amortized Analysis: Aggregate Graph colouring, Randomized algorithms: Las Vegas and Monte Carlo algorithm, Random variables and their expectations. Probabilistic analysis and uses of indicator random variables: Birthday paradox, coupon collector's problem, the online hiring problem, Randomized version of quick sort, Miller Rabin randomized Primality Test

Course Outcome:

The student will demonstrate the ability to understand the role of data structures in algorithm design and apply complexity analysis to determine how data structures affects performance.

Text Books:

1. Ellis Horowitz, SartajSahni, Susan Anderson Freed, "Fundamentals of Data Structures in C", Second Edition, Universities Press, 2008.

2. Thomas Cormen, Charles E Leiserson, Ronald Rivest, Clifford Stein, "Introduction to Algorithms", Third edition, PHI Learning Pvt. Ltd., 2004 .

References:

1. Ellis Horowitz and SartajSahni, SanguthevarRajasekaran, "Fundamentals of Computer Algorithms", Second Edition,Universities Press, 2008.

2. YedidyahLangsam, Moshe J. Augenstein, Aaron M. Tenenbaum, "Data Structures using C and C++", Second Edition, PHI Learning Private Limited, 2010.

COURSE PLAN

COURSE CODE:	COURSE TITLE	CREDITS	
04 CS 6103	Advanced Data Structures and Algorithms	3-1-0: 4	
MODULES		Contact Hours	Sem. Exam Marks (%)
MODULE 1: Trees - Threaded Binary Trees, Binary Search Trees, Forests Selection Trees, Red-Black Trees, Splay Trees, Digital Search Trees, Binary Tries and Patricia, Multiway Tries, Suffix Trees.		9	15
MODULE 2: Priority Queues - Single and Double Ended Priority Queues, Leftist Trees, Binomial Heaps, Fibonacci Heaps, Pairing Heaps, Symmetric Min-Max Heaps, Interval Heaps.		8	15
INTERNAL TEST 1 (MODULE 1 & 2)			
MODULE 3: Maximum Flow-Flow Networks, Ford-Fulkerson method-analysis of Ford-Fulkerson, Edmonds-Karp algorithm, Maximum bipartite matching.		8	15
MODULE 4: Computational Geometry- Line segment properties, Determining whether any pair of segments intersect, Finding the convex hull, Finding the closest pair of points.		9	15
INTERNAL TEST 2 (MODULE 3 & 4)			
MODULE 5: Approximation algorithms: NP completeness, Reductions, coping with NP completeness The vertex cover problem. The travelling Amortized Analysis : Aggregate ,Accounting and Potential Method, Salesman problem, The set covering problem, Graph colouring		11	20
MODULE 6: Randomized algorithms: Las Vegas and Monte Carlo algorithm, Random variables and their expectations. probabilistic analysis and uses of indicator random variables: Birthday paradox, coupon collector's problem, The online hiring problem. Randomized version of quick sort, Miller Rabin randomized primality Test		11	20
END SEMESTER EXAM			

COURSE CODE	COURSE NAME	L-T-P:C	YEAR
04 CS 6105	**Computer Security and Applied Cryptography**	3-0-0: 3	**2015**

Pre-requisites:

Course Objectives:

- To give an insight of the fundamental security services that can be implemented with the methods of modern cryptography.
- To understand how to apply sound principles to designing secure systems and to discovering.
- To describe current standardized network security protocols and mechanisms.
- Exposure to current methods for the formal analysis of security protocols and vulnerabilities in existing systems.

Syllabus

Mathematical Concepts of Cryptography, Modular Arithmetic, Introduction to Number Theory, Classical Encryption Techniques, DES,AES, Public Key Cryptography, Elgamal Cryptographic System, Transport-Level Security, System Security, Firewalls.

Course Outcome:

The students will demonstrate a general knowledge and understanding of data security and encryption with a special focus on techniques appropriate for communication systems.

Text Books:

1. William Stallings, "Cryptography and Network Security-Principles and Practices", Fifth Edition, Pearson Education, 2011
2. William Stallings, "Cryptography and Network Security-Principles and Practices", Third Edition, Pearson Education, 2003

References:

1. Behrouz A Forouzan, "Cryptography and Network Security", Tata McGraw Hill, 2008
2. Matt Bishop, "Computer Security: Art and Science", Addison-Wesley Professional, 2003
3. Wade Trappe, Lawrence C Washington, "Introduction to Cryptography with Coding Theory", Second Edition, Pearson Education, 2005

COURSE PLAN

COURSE CODE:	COURSE TITLE	CREDITS	
04 CS 6105	Computer Security and Applied Cryptography	3-0-0:3	
MODULES		Contact Hours	Sem. Exam Marks (%)
MODULE 1: Mathematical Concepts of Cryptography – Divisibility and Division Algorithm – Euclidean Algorithm, Modular Arithmetic- Groups - Rings – Fields, Finite Fields of the Form GF(p) – Polynomial Arithmetic – Finite Fields of the Form GF(2n)		10	15
MODULE 2: Introduction to Number Theory – Prime Numbers – Fermat's and Euler's Theorems, Testing for Primality – Discrete Logarithms. Case Study: Implement Encryption using binary Exclusive OR (XOR)		8	15
INTERNAL TEST 1 (MODULE 1 & 2)			
MODULE 3: Classical Encryption Techniques – Substitution Techniques – Transposition Techniques –Steganography. Block Ciphers and Encryption Standards -- Block Cipher Principles -- Data Encryption Standard(DES). Advanced Encryption Standard(AES) – RC5 – Blowfish		12	15
MODULE 4: Public Key Cryptography – Principles of Public Key Cryptosystems -- RSA -- Other Public-Key Cryptosystems – Diffie-Hellman Key Exchange, Elgamal Cryptographic System – Elliptic Curve Arithmetic – Elliptic Curve Cryptography. Case Study: Analyze the attacks on public key cryptography		10	15
INTERNAL TEST 2 (MODULE 3 & 4)			
MODULE 5: Transport-Level Security –Secure Socket Layer –Transport Layer Security – HTTPS - Secure Shell(SSH). System Security – Intruders – Intrusion Detection- Password Management. Malicious Softwares – Viruses – Virus Countermeasures – Worms – Distributed Denial of Service Attacks		8	20
MODULE 6: Firewalls – Need for Firewalls –Firewall Characteristics – Types of Firewalls. Firewall Basing –Firewall Location and Configurations		6	20
END SEMESTER EXAM			

COURSE CODE	COURSE NAME	L-T-P:C	YEAR
04 CS 6107	Modern Computer Networks	3-0-0: 3	2015

Pre-requisites:

Course Objectives:

- To understand the operations of various layers of TCP/IP Protocol stack and to apply knowledge on suitable protocol in each layer in a network design

Syllabus

Physical Layer: Data Transmission,Signal Encoding Techniques.Data link layer: TCP/IP Protocol Architecture, Framing.Network Layer: Connecting Devices. ARP, RARP. IP Address,NAT. ICMP messages.Routing Protocols-RIP, OSPF. UDP: UDP datagram, UDP services. TCP: TCP services andfeatures, TCP connection, Flow and Error control, Congestion control,SCTP- SCTP services and features.Application Layer: DNS- HTTP-Architecture, DHCP operation,SNMP- SMI, MIB,RTP, RTCP.

Course Outcome:

The student will demonstrate the ability to understand various protocols used in TCP/IP.

Text Books:

1. William Stallings, “Data and Computer Communications”, Pearson Education.
2. Behrouz A Forouzan, ”TCP/IP Protocol Suite”, Tata McGraw-Hill

References:

1. Peterson and Davie, “Computer Networks A systems approach”, Elsevier.
2. Kurose and Ross, “Computer Networks A systems approach”, Pearson Education.
3. Behurouz A Forouzan, “Data Communications & Networking”,4th edition, McGraw-Hill.

COURSE PLAN

COURSE CODE:	COURSE TITLE	CREDITS	
04 CS 6107	Modern Computer Networks	3-0-0:3	
MODULES		Contact Hours	Sem. Exam Marks (%)
MODULE 1:Physical Layer: Data Transmission- Analog and Digital Transmission, Transmission Impairments, Channel Capacity. Transmission Media- Wired Transmission, Wireless Transmission, Wireless Propagation, Line-of Sight Transmission, Signal Encoding Techniques.		7	15
MODULE 2:Data link layer: TCP/IP Protocol Architecture, Framing, Reliable Transmission, Ethernet (802.3)and Token Ring (802.5).		6	15
INTERNAL TEST 1 (MODULE 1 & 2)			
MODULE 3:Network Layer: Connecting Devices. ARP, RARP.Datagram Fragmentation, NAT. ICMP messages.		6	15
MODULE 4:IP Address – Sub netting / Super netting, Packet Forwarding with Classful / Classless Addressing Routing Protocols, Special address- Private IP - Distance Vector Routing-RIP, Link-State Routing-OSPF.		7	15
INTERNAL TEST 2 (MODULE 3 & 4)			
MODULE 5:UDP- Port Addressing, UDP datagram, UDP services. TCP- TCP services andfeatures, TCP segment, TCP connection, TCP state transitions, Windows in TCP. Flow and Error control, Congestion control, TCP Timers.SCTP- SCTP services and features, Packet format, SCTP association, State Transitions, Flow and Error control.		8	20
MODULE 6:Application Layer: DNS- Name Space, Name Resolution, DNS messages, HTTP-Architecture, HTTP Transaction, DHCP operation,SNMP- SMI, MIB, SNMP PDUs, Real Time Data Transfer- RTP, RTCP, Voice over IP-Session Initiation Protocol.		8	20
END SEMESTER EXAM			

COURSE CODE	COURSE NAME	L-T-P:C	YEAR
04 CS 6109	Web Services	3-0-0: 3	2015

Pre-requisites:

Course Objectives:

- Students will be able to understand the Web Services concepts and will be able to apply the same in various engineering and web applications.

Syllabus

Web Services –Web Services Architecture, Web Services Communication Models, Implementing Web Services. SOAP- SOAP Message Exchange Model, SOAP Communication, SOAP Messaging, SOAP Bindings for Transport Protocols, SOAP Security, Building SOAP Web Services, SOA: Overview of SOA Implementation Methodology, SOA Reference Architecture, Service Context and Common Semantics: The Importance of Semantics in SOA, Core Information Modeling, Documents and XML,XML Patterns, Designing Service Interfaces: Services, Design Guidelines, Illustrated Solution Model Interface Design. WSDL UDDI- UDDI Registries, Implementations of UDD, Publishing,searching and deleting Information to a UDDI Registry,XML Processing and Data Binding with Java APIs Java API for XML Processing (JAXP), Java Architecture for XML Binding (JAXB)

Course Outcome:

The students will demonstrate the ability to understand the concept of web services.

Text Books:

1. Ramesh Nagappan, Robert Skoczylas,Rima Patel Sriganesh, Developing Java Web Services, Wiley Publishing Inc.,2003.

2. Richard Monson Haefel, J2EE Web Services, Pearson Education, 2004.

References:

1. Travis Vandersypen, Jason Bloomberg, Madhu Siddalingaiah, Sam Hunting, Michael D Qualls, David Houlding, Chad Darby, Diane Kennedy, XML and Web Services Unleashed, Pearson Education, 2002.

2. Frank P Coyle, XML Web Services and Data Revolution, Pearson Education, 2002.

3. Mark Hansen, SOA Using Java Web Services, Pearson Education, 2007.

4. Applied SOA, Michael Rosen, Boris Lublinsky, Kevin T Smith, Marc J Balcer., Wiley India.

5. SOA Principles of Service Design, by Thomas Erl, Prentice Hall

6. Service Oriented Architecture Compass: Business Value, Planning, and Enterprise Roadmap,

COURSE PLAN

COURSE CODE:	COURSE TITLE	CREDITS	
04 CS 6109	Web Services	3-0-0:3	
MODULES		Contact Hours	Sem. Exam Marks (%)
MODULE 1: Web Services – Introduction to Web Services, Web Services Architecture, Web Services Communication Models, Implementing Web Services.		6	15
MODULE 2: SOAP- Anatomy of a SOAP Message, SOAP Message Exchange Model, SOAP Communication, SOAP Messaging, SOAP Bindings for Transport Protocols, SOAP Security, Building SOAP Web Services		7	15
INTERNAL TEST 1 (MODULE 1 & 2)			
MODULE 3: SOA: The Promise of SOA, Challenges of SOA, Meeting the Challenge, Best Practices in SOA Analysis and Design. Overview of SOA Implementation Methodology, SOA Reference Architecture, Business Architecture, Business Processes, Information Design, Service Identification, Service Specification, Services Realization, Service Life Cycle, The Service Design Process		6	15
MODULE 4: Service Context and Common Semantics: The Importance of Semantics in SOA, Core Information Modeling, Defining Types, Identifiers and Uniqueness constraints, Documents, Documents and XML,XML Patterns, Designing Service Interfaces: Services, Design Guidelines, Illustrated Solution Model Interface Design.		6	15
INTERNAL TEST 2 (MODULE 3 & 4)			
MODULE 5:WSDL- Anatomy of a WSDL Definition Document, WSDL Bindings, WSDL Tools **UDDI**- UDDI Registries, Implementations of UDD, Registering as a Systinet, UDDI Registry User ,Publishing ,searching and deleting Information to a UDDI Registry		8	20
MODULE 6: XML Processing and Data Binding with Java APIs - Extensible Markup Language (XML)Basics, Java API for XML Processing (JAXP), Java Architecture for XML Binding (JAXB)		9	20
END SEMESTER EXAM			

COURSE CODE	COURSE NAME	L-T-P:C	YEAR
04 CS 6111	Object Oriented Software Engineering	3-0-0: 3	2015

Pre-requisites:

Course Objectives:

- To apply the knowledge on System concepts, Requirement elicitation, Analysis object model, model transformations and case tools.

Syllabus

System Concepts-Project Organization - Communication- Life cycle models-Unified Process –Interactive and Incremental - Workflow – Agile Processes; Requirements Elicitation – Requirement Documentation-Use Cases; UML-various diagrams in UML; Analysis Object Model (Domain Model)– Analysis Dynamic Models-Non-functional requirements – Analysis Patterns; System Design Architecture– Design Principles – Design Concepts - Design Patterns; Mapping Design (Models) to Code – Model Transformation-Refactoring; Testing-Configuration Management; Familiarization of CASE Tools, Case study on library management with UML diagrams using CASE tools.

Course Outcome:

The student will be able to do project design in CASE tools.

Text Books:

1. Bernd Bruegge, Alan H Dutoit, “Object-Oriented Software Engineering” Second edition, Pearson Education, 2004

References:

1. Craig Larman, “Applying UML and Patterns” Third edition, Pearson Education, 2005.
2. Stephen Schach, “Software Engineering” Seventh edition, McGraw-Hill, 2007.
3. Ivar Jacobson, GrandyBooch, James Rumbaugh, “The Unified Software Development Process”, Pearson Education, 1999.
4. Alistair Cockburn, “Agile Software Development” Second edition, Pearson Education, 2007.
5. Roger S Pressman” Software Engineering:A Practitioners Approach “Fifth edition,, McGraw Hill.

COURSE PLAN

COURSE CODE:	COURSE TITLE	CREDITS	
04 CS 6111	Object Oriented Software Engineering	3-0-0:3	
MODULES		Contact Hours	Sem. Exam Marks (%)
MODULE 1: System Concepts – Project Organization – Communication-Life cycle models, Unified Process – Iterative and Incremental - Workflow – Agile Processes- Project Planning & Estimation.		7	15
MODULE 2: Requirements Elicitation – Requirement Documentation-Use Cases-Analysis Object Model (Domain Model) – Analysis Dynamic Models- Non-functional requirements– Analysis Patterns		7	15
INTERNAL TEST 1 (MODULE 1 & 2)			
MODULE 3: Unified Modeling language- Introduction, UML Diagrams – Class diagrams, Sequence diagrams, Object diagrams, Deployment diagrams, Use case diagrams, State diagrams, Activity diagram, Component diagrams – Case Study-Identifying Classes- Noun Phrase Approach, Common class Pattern Approach, Use-Case Driven Approach, CRC.		7	15
MODULE 4: System Design Architecture – Design Principles – Design Concepts - Design Patterns – Architectural Styles-Dynamic Object Modeling – Static Object Modeling – Interface Specification – Object Constraint Language.		7	15
INTERNAL TEST 2 (MODULE 3 & 4)			
MODULE 5: Mapping Design (Models) to Code – Model Transformation-Refactoring- Mapping Associations- Mapping Activities- Testing- Configuration Management-Maintenance Process- System documentation – program evolution dynamics		7	20
MODULE 6: Introduction to CASE Tools, Building blocks- Taxonomy of CASE tools-Integrated CASE environment-Integration Architecture- CASE Repository- Case study on library management with UML diagrams using CASE tools		7	20
END SEMESTER EXAM			

COURSE CODE	COURSE NAME	L-T-P:C	YEAR
04 CS 6113	Logic in Computer Science	3-0-0: 3	2015

Pre-requisites:

Course Objectives:

- Establish concepts on various logics used in computer science.
- Introduction to model checking.
- Introduction to formalization of systems so as to make solid proofs on properties.
- Introduction to model checking tools.
- Introduction to formal verification in computer science

Syllabus

Propositional logic, Predicate logic, Linear Temporal Logic, Computation Tree Logic, Model Checking, Modal Logics

Course Outcome:

- The student will model any system / process formally using logics used in computer science.
- The student will prove / disprove various properties of the model formulated.

Text Books:

1. Michael Huth, Mark Ryan: “Logic in Computer Science: Modelling and Reasoning about Systems”, Cambridge University Press, 2004.
2. Christel Baier, Joost-Pieter Katoen: “Principles of Model Checking”, The MIT Press, 2008.
3. Daniel Kroening, Ofer Strichman: “Decision Procedures: An Algorithmic Point of View”, Springer, 2008.

References:

1. Stuart Russel, Peter Norwig, “Artificial Intelligence – A Modern Approach”, 2nd Edition, Prentice Hall, 2002.
2. Brian F. Chellas, “Modal Logic: An Introduction”, Cambridge University Press, 2012.

COURSE PLAN

COURSE CODE:	COURSE TITLE	CREDITS	
04 CS 6113	**Logic in Computer Science**	**3-0-0:3**	
MODULES		**Contact Hours**	**Sem. Exam Marks (%)**
MODULE 1: Propositional logic [1] - Declarative sentences, Natural deduction – rules for natural deduction, derived rules, provable equivalence, Proof by contradiction. Propositional logic as a formal language, Semantics of propositional logic – the meaning of logical connectives, mathematical induction, soundness of propositional logic, completeness of propositional logic Normal forms – semantic equivalence, satisfiability and validity, CNF, Horn clause SAT solvers – a linear solver, a cubic solver Binary Decision Diagrams [3]		8	15
MODULE 2: Predicate logic [1] - The need for a richer language, Predicate logic as a formal language – terms, formulas, free and bound variables, substitution Proof theory of predicate logic – natural deduction rules, quantifier equivalences Semantics of predicate logic – models, semantic entailment, the semantics of equality. Undecidability of predicate logic. Expressiveness of predicate logic – existential second order logic, universal second order logic. Micromodels of software – state machines, modeling using ALLOY		8	15
INTERNAL TEST 1 (MODULE 1 & 2)			
MODULE 3: Linear Temporal Logic [2] - Syntax, Semantics. Specifying properties, Equivalence of LTL formulae, Positive Normal Form, Fairness in LTL. Automata based LTL model checking		7	15
MODULE 4: Computation Tree Logic [2] - Syntax, Semantics, Equivalence of CTL formulae, Normal forms for CTL.		5	15
INTERNAL TEST 2 (MODULE 3 & 4)			
MODULE 5: Introduction to Model Checking [1] - Mutual Exclusion problem, The NuSMV model checker, Running NuSMV, Example Problems - Mutual Exclusion, Ferryman, Alternating Bit Protocol.		9	20
MODULE 6: Modal Logics and Agents [1] – Modes of truth, Basic modal logic – syntax, semantics, Logic Engineering – the stock of valid formulas, important properties of the accessibility relation, correspondence theory, some modal logics. Natural deduction, Reasoning about knowledge in a multi-agent system – some examples, the modal logic KT45n, natural deduction for KT45n, formalizing the examples.		7	20
END SEMESTER EXAM			

COURSE CODE	COURSE NAME	L-T-P:C	YEAR
04 CS 6113	Social Network Analytics	3-0-0: 3	**2015**

Pre-requisites:

Course Objectives:

- To inspire the students with interest, excitement, and urge to learn the subject of Social Network Analytics
- To understand the fundamental concepts, theories and methods of Social Networks.

Syllabus

Basic of Graph, overview of Network Datasets, Triadic Closure, Tie Strength, Social Media, Structural balance, characterization, Design Framework for Social Networks, examples, application of analysis, Types of Networks, Identifying Communities , Tools for analyzing Social Networks, Power in Social Networks, Diffusion in Networks, Extensions of the Basic Cascade Model, Six Degrees of Separation, Epidemics in Social Networks, Web Analytics 2.0, Direct Traffic Analysis,Conversion Rates, Power of Testing, Emerging Analytics

Course Outcome:

The student will be able to demonstrate the concepts of social network analytics.

Text Books:

1. Networks, Crowds and Markets, Reasoning about a Highly Connected World by David Easley and Jon Klienberg

2. AvinashKaushik. 2004 . Web Analytics 2.0; Wiley Publishing, Inc, 2010.

References:

1. Analyzing Social Media Networks with Node XL,Derek L Hansen, Ben Shneiderman, Marc A. Smith

COURSE PLAN

COURSE CODE:	COURSE TITLE	CREDITS	
04 CS 6113	Social Network Analytics	3-0-0:3	
MODULES		**Contact Hours**	**Sem. Exam Marks (%)**
MODULE 1: Graphs-Basic Definitions-Paths and Connectivity-Network Datasets: An Overview-Strong and Weak ties-Triadic Closure-Strength of Weak Ties-Tie Strength. Social Media, and Passive Engagement - Positive and Negative Relationships-Structural balance-Characterizing the structure of Balanced Networks-Applications of Structural Balance.Design Framework for Social Networks- Examples of Social Networks – Applications of Social Network Analysis-Types of Networks-One Mode Networks-Two-Mode Networks-Ego-Centered Networks		8	15
MODULE 2: Network Centrality-Betweenness, Closeness-Eigen vector centrality-Network Centralization.Identifying Communitiesin Social Networks-Triads-Analyzing Triads in Real networks-Cliques-Clustering-Hierarchical Clustering, Community Structure,Modularity-Overlapping Communities. Tools for analyzing Social Networks- NodeXL, UCINET- AnalyzingFacebook using UCINET, NetLogo-simulating social interactions with NetLogo.		9	15
INTERNAL TEST 1 (MODULE 1 & 2)			
MODULE 3: Power in Social Networks-Experimental Studies of Power and Exchange-A Connection to Buyer-Seller Networks-Modeling Two-Person Interaction: The Nash Bargaining Solution.Diffusion in Networks-Modeling Diffusion through a Network-Cascades and Clusters Diffusion, Thresholds, and the Role of Weak Ties.Extensions of the Basic Cascade Model ,Knowledge, Thresholds, and Collective Action		8	15
MODULE 4: Six Degrees of Separation, Structure and Randomness, Decentralized Search, Empirical Analysis and Generalized Models, Core-Periphery Structures and Difficulties in Decentralized Search.Epidemics in Social Networks: Diseases and the Networks that Transmit Them,Branching Processes,The SIR Epidemic Model, The SIS Epidemic Model,Synchronization,Transient Contacts and the Dangers of Concurrency		6	15
INTERNAL TEST 2 (MODULE 3 & 4)			
MODULE 5: Web Analytics 2.0 – Eight Critical Web Metrics , Attributes of a Great Web Metric,Web Analytics Primer,Understanding Visitor Acquisition Strengths,Click Density Analysis, Measuring Visits to Purchase. Direct Traffic Analysis, Moving Beyond Conversion Rates, Measuring Macro and Micro Conversions, Measuring Success for a Non- E Commerce Website.		11	20
MODULE 6: Competitive Intelligence Analysis- CI Data Sources, Types &Secrets,Website Traffic Analysis,Search and Keyword Analysis, Audience Identification and Segmentation Analysis, Google Trends – Case Study. Power of Testing- A/B Testing, MultiVariate Testing. Emerging Analytics- Social , Mobile and Video, Measuring the New Social Web,Analyzing Offline Customer		12	20

Experiences,Analyzing Mobile Customer Experience,Measuring the Success of Blogs, Quantifying the Impact of Twitter		
END SEMESTER EXAM		

COURSE CODE	COURSE NAME	L-T-P-C	YEAR
04 GN 6001	RESEARCH METHODOLOGY	0-2-0:2	2015

Pre-requisites:

Course Objectives:

To enable the students:

- To get introduced to research philosophy and processes in general.
- To formulate the research problem and prepare research plan
- To apply various numerical /quantitative techniques for data analysis
- To communicate the research findings effectively

Syllabus

Introduction to the Concepts of Research Methodology, Research Proposals, Research Design, Data Collection and Analysis, Quantitative Techniques and Mathematical Modeling, Report Writing.

Course Outcome:

Students who successfully complete this course would learn the fundamental concepts of Research Methodology, apply the basic aspects of the Research methodology to formulate a research problem and its plan. They would also be able to deploy numerical/quantitative techniques for data analysis. They would be equipped with good technical writing and presentation skills.

Text Books:

1. Research Methodology: Methods and Techniques', by Dr. C. R. Kothari, New Age International Publisher, 2004
2. Research Methodology: A Step by Step Guide for Beginners' by Ranjit Kumar, SAGE Publications Ltd; Third Edition

References:

1. Research Methodology: An Introduction for Science & Engineering Students', by Stuart Melville and Wayne Goddard, Juta and Company Ltd, 2004
2. Research Methodology: An Introduction' by Wayne Goddard and Stuart Melville, Juta and Company Ltd, 2004
3. Research Methodology, G.C. Ramamurthy, Dream Tech Press, New Delhi
4. Management Research Methodology' by K. N. Krishnaswamy et al, Pearson Education

COURSE CODE:	COURSE TITLE	CREDITS	
04 GN 6001	RESEARCH METHODOLOGY	0-2-0: 2	
MODULES		Contact Hours	
MODULE : 1 Introduction to Research Methodology: Concepts of Research, Meaning and 2 Objectives of Research, Research Process, Types of Research, Type of research: Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, and Conceptual vs. Empirical		5	
MODULE :2 Criteria of Good Research, Research Problem, Selection of a problem, Techniques involved in definition of a problem, Research Proposals – Types, contents, Ethical aspects, IPR issues like patenting, copyrights.		4	
INTERNAL TEST 1 (MODULE 1 & 2)			
MODULE: 3 **Research Design :** Meaning, Need and Types of research design, Literature Survey and Review, Identifying gap areas from literature review, Research Design Process, Sampling fundamentals, Measurement and scaling techniques, Data Collection – concept, types and methods, Design of Experiments.		5	
MODULE 4: **Quantitative Techniques:** Probability distributions, Fundamentals of Statistical analysis, Data Analysis with Statistical Packages, Multivariate methods, Concepts of correlation and regression - Fundamentals of time series analysis and spectral analysis.		5	
INTERNAL TEST 2 (MODULE 3 & 4)			
MODULE: 5 **Report Writing:** Principles of Thesis Writing, Guidelines for writing reports & papers, Methods of giving references and appendices, Reproduction of published material, Plagiarism, Citation and acknowledgement.		5	
MODULE: 6 Documentation and presentation tools – LaTeX, Office with basic presentations skills, Use of Internet and advanced search techniques.		4	

COURSE CODE	COURSE NAME	L-T-P: C	YEAR
04 CS 6191	SEMINAR	0-0-2: 2	2015

Course Outcome:

COURSE CODE	COURSE NAME	L-T-P: C	YEAR
04 CS 6193	NETWORK SIMULATION LAB	0-0-2: 1	2015

Pre-requisites:

Course Objectives:

- To acquire practical understanding of Network Simulation Environment in Wired and Wireless networks

Syllabus

List of Experiments

1. A thorough study of packet capturing tool called WireShark.
2. Familiarizing Network Simulator – 2 (NS2) with suitable examples
3. Simulate a wired network consisting of TCP and UDP Traffic using NS2 and then calculate their respective throughput using AWK script.
4. Performance evaluation of different routing protocols in wired network environment using NS2
5. Performance evaluation of different queues and effect of queues and buffers in wired network environment using NS2
6. Compare the behavior of different variants of TCP (Tahoe, Reno, Vegas….) in wired network using NS2. Comparison can be done on the congestion window behavior by plotting graph.
7. Simulation of wireless Ad hoc networks using NS2
8. Simulate a wireless network consisting of TCP and UDP Traffic using NS2 and then calculate their respective throughput using AWK script.
9. Performance evaluation of different ad-hoc wireless routing protocols (DSDV, DSR, AODV …) using NS2
10. Create different Wired-cum-Wireless networks and MobileIP Simulations using NS2

COURSE CODE	COURSE NAME	L-T-P: C	YEAR
04 CS 6102	ADVANCED DATABASE MANAGEMENT	3-0-0: 3	2015

Pre-requisites:

Course Objectives:

- To analyze and model requirements and constraints for the purpose of designing and implementing Web database systems.
- To design and implement advanced database system that accommodates specified requirements and constraints, based on modelling or requirements specification.
- To motivate and explain complex next generation database application concepts, relevant alternatives, emerging technologies and recommendations via technical presentations.

Syllabus

Web Databases, Advanced databases, Spatial Indexes, Embedded Databases, Distributed databases, Cloud Databases, Graph databases, Multimedia Databases, Mobile Databases

Course Outcome:
The student will have the ability to understand the principles and practice of designing and implementing advanced databases, and analyse about issues in the performance of Web database systems and will be capable of developing next generation databases.

Text Books:
1. Elmasri R. Navathe S.B, "Fundamentals of Database Systems", Pearson Education/Addison Wesley,Fifth Edition, 2007.
2. Henry F Korth, Abraham Silberschatz, Sudharshan S., “Database System Concepts”, McGraw Hill, Fifth Edition, 2006
3. Raghu Ramakrishnan, Johannes Gehrke, “Database Management Systems”, McGraw Hill, Third Edition, 2004
4. Vijay Kumar, “Mobile Database Systems”, A John Wiley & Sons, Inc., Publication

References:

1. Serge Abiteboul, IoanaManolescu, Philippe Rigaux, Marie -Christine Rousset, Pierre Senellart, Web Data Management, Cambridge University Press, 450 pages,2011.
2. Bhavani Thuraisingham, XML Databases and the Semantic Web, CRC Press, 2002.
3. Big Table and Column Databases, LingLiu, College of Computing http://www.cc.gatech.edu/~lingliu/courses/cs4440/notes/17.BigTableColumnDB.pdf
4. Fay Chang, Jeffrey Dean, Sanjay Ghemawat, Wilson C. Hsieh, Deborah A. Wallach Mike Burrows, Tushar Chandra, Andrew Fikes, Robert E. Gruber, Bigtable: A Distributed Storage System for Structured Data at http://static.googleusercontent.com/external_content/untrusted_dlcp/research.google.com/en//archive/bigtable-osdi06.pdf
5. Graph databases- Ian Robinson, Jim Webber, Emil Eifrem, O’Reilly

COURSE PLAN

COURSE CODE:	COURSE TITLE	CREDITS	
04 CS 6102	ADVANCED DATABASE MANAGEMENT	3-0-0: 3	
MODULES		**Contact Hours**	**Sem. Exam Marks (%)**
MODULE 1: Web Databases: NoSQL Databases - MongoDB example -Semi-structured data management.XML, XPath and XQuery Document data-stores -Examples, Key-Value data-stores – Examples- In-memory databases-VoltDB example		8	15
MODULE 2: Advanced databases: Spatial Data Management: Types Of Spatial Data And Queries- Point And Region Data Queries-Applications Involving Spatial Data. Spatial Indexes-indexing using Space Filling Curves Region Quad Trees and Z Ordering – Index Structures - Grid Files, Rtrees		10	15
INTERNAL TEST 1 (MODULE 1 & 2)			
MODULE 3: Embedded Databases - definition- Example - SQLite internal architecture and data types Distributed databases- distributed file systems- Examples- distributed query processing		8	15
MODULE 4: Next Generation Databases: Cloud Databases- methods to run-virtual machine deployment, as a service Column Stores-Examples- Cassandra, HBase-Aggregation and Join - Case study. BigTable Google's distributed storage system for structured data-building blocks-GFS, Scheduler, Lock Service, MapReduce		10	15
INTERNAL TEST 2 (MODULE 3 & 4)			
MODULE 5: Graph databases- Comparison of Twitter's FlockDB and Neo4j-Overview of NewSQL- Case study -Google's Spanner. Emerging Technologies: Multimedia Databases-Multimedia Sources Image Databases-Compressed Representations-Similarity Based Retrieval.		8	20
MODULE 6: Mobile Databases- Mobile Database Systems – Transaction Execution in MDS Mobile Transaction Models -Concurrency Control Mechanism-Transaction Commit Protocols Mobile database Recovery: Log management in mobile database systems - Mobile database recovery schemes		10	20
END SEMESTER EXAM			

COURSE CODE	COURSE NAME	L-T-P: C	YEAR
04 CS 6104	AUTOMATA THEORY AND COMPUTABILITY	3-0-0: 3	2015

Pre-requisites:

Course Objectives:

- To establish concepts on formal theory of computation.
- To Introduce to concepts on proving correctness of computing.

Syllabus

Finite Automata, DFA, NFAPumping Lemma and Ultimate Periodicity Regular Expressions, Context-Free Languages, PDA, PDAs and CFGs, Simulating NPDA by CFGs, Deterministic Pushdown Automata.Turing Machines and Effective Computability, Undecidability, Rice's Theorem, Undecidable problems about Context Free Languages

Course Outcome:

The student will formalize any type of computing and will prove its correctness.

Text Books:

1. Dexter Kozen: “Automata and Computability”. Springer 1999.

References:

1. Hopcroft J.E. and Ullman J.D.: “Introduction to Automata, Languages and Computation”. Addison Wesley, 1979.
2. H. R. Lewis and C. H. Papadimitriou:” Elements of the Theory of Computation”. Prentice Hall, 1981.

Note on Buchi's MSO characterisation of regular languages

COURSE PLAN

COURSE CODE:	COURSE TITLE	CREDITS	
04 CS 6104	AUTOMATA THEORY AND COMPUTABILITY	3-0-0: 3	
MODULES		**Contact Hours**	**Sem. Exam Marks (%)**
MODULE 1: Finite Automata: DFA, NFA – Examples, Equivalence (subset construction), Closure Properties (proof), Homomorphisms, Limitations of Finite Automata Pumping Lemma and Ultimate Periodicity DFA State Minimization (quotient construction)		6	15
MODULE 2: Regular Expressions: Pattern Matching and Regular Expressions, Regular Expressions and Finite Automata Myhill-Nerode Relations, Myhill-Nerode Theorem; problems		7	15
INTERNAL TEST 1 (MODULE 1 & 2)			
MODULE 3: Context-Free Languages: Context-Free Grammars and Languages, examples (proving correctness with mathematical induction), Chomsky Normal Form Pumping Lemma for CFL, Parikh'sTheorem		7	15
MODULE 4: PDA: Pushdown Automata, Final State Versus Empty Stack, PDAs and CFGs, Simulating NPDA by CFGs, Deterministic Pushdown Automata.		7	15
INTERNAL TEST 2 (MODULE 3 & 4)			
MODULE 5: Turing Machines and Effective Computability: Turing machine, examples, Equivalent Models. Universal Turing Machine and Diagonalization Decidable and Undecidable Problems, Reduction-problems		10	20
MODULE 6: Undecidability: Rice's Theorem –Proof Undecidable problems about Context Free Languages Buchi's Logical Characterisation of Regular Language, Proof		11	20
END SEMESTER EXAM			

COURSE CODE	COURSE NAME	L-T-P: C	YEAR
04 CS 6106	HIGH PERFORMANCE COMPUTER ARCHITECTURE	3-0-0: 3	2015

Pre-requisites:

Course Objectives:

- To develop the skills required to implement high-performance software, including the interaction between algorithms, computer architecture and compilers.
- To learn techniques for analyzing the performance of programs and their interaction with the underlying hardware.
- To understand features of modern processors that affects performance and be able to use these features in the design and optimization of high-performance software.
- To utilize techniques to automatically implement, optimize, and adapt programs to different platforms.

Syllabus

Introduction To Multiprocessors, Shared Memory Programming, Multithreaded Application Development, Processor Architecture, Gpu Programming, Measuring Program Execution

Course Outcome:

Students will able to demonstrate the interaction of hardware and software with respect to parallel systems design and implementation.

Text Books:

1. Michael J Quinn, “Parallel programming in C with MPI and OpenMP”, Tata McGraw Hill, 2003.

2. Kaihwang and NareshJotwani, “Advanced Computer Architecture ” 2nd edition Tata Mcgraw-Hill

References:

1. Randal E bryant and David O'Hallaron “Computer Systems A programmer's perspective” PearsonEducation
2. ShameemAkhter and Jason Roberts, “Multi-core Programming”, Intel Press, 2006.
3. John L. Hennessey and David A. Patterson, “Computer architecture Aquantitative approach”,Morgan Kaufmann/Elsevier Publishers, 4th. edition, 2007.
4. David E. Culler, Jaswinder Pal Singh, “Parallel computing architecture : A hardware/ software approach” , Morgan Kaufmann/Elsevier Publishers, 2004.
5. Wesley Petersen and Peter Arbenz, “Introduction to Parallel Computing”, Oxford University Press, 2004.
6. CUDA by Example: An Introduction to General-Purpose GPU Programming
7. SimaD,Fountain T and Kacsuk P “Advanced Computer Architecture: A Design Space Approach”Pearson Education

COURSE PLAN

COURSE CODE:	COURSE TITLE	CREDITS	
04 CS 6106	HIGH PERFORMANCE COMPUTER ARCHITECTURE	**3-0-0:3**	
MODULES		**Contact Hours**	**Sem. Exam Marks (%)**
MODULE 1: Introduction To Multiprocessors: Parallel computer models - Symmetric and distributed shared memory architectures- Performance Issues. Multi-core Architectures - Software and hardware multithreading SMT and CMP architectures Design issues-Case studies- Intel Multi-core architecture. SUN CMP architecture. IBM cell processor. NVIDIA GPU. AMD APU		10	15
MODULE 2: Shared Memory Programming: The OpenMP standard. Parallelisation using compiler directives. Threading and variable types. Loop and sections constructs Program correctness and reproducibility. Scheduling and false sharing as factors influencing performance		8	15
INTERNAL TEST 1 (MODULE 1 & 2)			
MODULE 3: Multithreaded Application Development: Algorithms, program development and performance tuning. Limitations to parallel performance: Strong vs weak scaling. Amdahl's law. Network contention in modern many-core architectures. Mixed mode OpenMP+MPI programming		8	15
MODULE 4: Processor Architecture : Y86 instruction set architecture, sequential Y-86 implementations, organizing processing into stages, sequential hardware structure, sequential timing, sequential stage implementations, General principles of pipelining, Pipelined Y86 implementation		8	15
INTERNAL TEST 2 (MODULE 3 & 4)			
MODULE 5: GpuProgramming : The CUDA standard. Kernels and host-device communication. Shared and constant memory, synchronicity and performance. GPU coding restrictions. Overview of Open CL, Open Acc		8	20
MODULE 6: Measuring Program Execution Time: Flow of time on a computer system, process scheduling and timer interrupts, measuring time by interval counting operation, reading the processor timers, accuracy of processor timers IA32 cycle counters, Measuring program execution time with cycle counter. Concurrent programming with processes, Concurrent program with Threads		10	20
END SEMESTER EXAM			

COURSE NO.	COURSE TITLE	CREDITS	YEAR
04 CS 6108	**INFORMATION RETRIEVAL AND DATA MINING**	**3-0-0: 3**	**2015**

Pre-requisites:

Course Objectives:

- To understand the basics of Information Retrieval with pertinence to modeling.
- To understand Data mining principles and techniques and introduce Data Mining as a cutting edge business intelligence.
- To gain the understanding of various applications and the current trends of Data Mining

Syllabus

Basic concepts of information retrieval and data mining, Information Retrieval-Models, similarity measures ,Indexing techniques, Evaluation of IR system, Vector-Space Retrieval, tokenizing, Query Operations and Languages, Fundamentals of Data mining, systems, major issues, Data Warehouse and OLAP Technology for Data Mining, Mining Frequent Patterns, Associations and Correlations, Classification and Prediction

Course Outcome:

On completion of this course student should have gained a good understanding of the basic concepts, principles and techniques of data mining

Text Books:

1. Jiawei Han, MichelineKamber, Data Mining Concepts and Techniques, 2ndedtn. , Elsevier New Delhi 2010
2. Christopher D. Manning, Prabhaka r Raghavan and HinrichSchütze, “Introduction to Information Retrieval”, Cambridge University Press, 2008

References:

1. Pieter Adriaans, DolfZantinge, Data Mining, Pearson Education Ltd., New Delhi,2008
2. M SudeepElayidom, Data Mining and Data Warehousing,Cengage Learning India Pvt. Ltd, 418, F.I.E., Patparganj, Delhi 11004 2
3. Thomas W Miller, Data and Text Mining, A Business Applications Approach, Pearson Education Ltd., New Delhi, 2008
4. GalitShmueli, Nitin R. Patel, Peter C. Bruce, Data Mining for Business Intelligence, Wiley India Pvt. Ltd.,New Delhi 2004
5. Ricard o Baeza –Yates, BerthierRibeiro –Neto, Modern Information Retrieval: The concepts and Technology behind Search (ACM Press Books), Second Edition 2011
6. AlexBersonandStephenJ. Smith,“DataWarehousing,DataMining&OLAP”,Tata McGraw–Hill Edition,Tenth Reprint2007

COURSE PLAN

COURSE NO:	COURSE TITLE:	CREDITS	
04 CS 6108	**INFORMATION RETRIEVAL AND DATA MINING**	**3-0-0: 3**	
MODULES		**Contact hours**	**Sem. Exam Marks; %**
MODULE: 1 - Basic concepts of information retrieval and data mining, such as the concept of relevance, association rules, and knowledge discovery. **Basic IR Models:** Boolean and vector-space retrieval models; TF-IDF (term frequency/inverse document frequency) weighting; cosine similarity.		6	15
MODULE: 2 – Various indexing techniques for textual information items, such as inverted indices. Evaluation of IR systems. Basic Tokenizing Indexing and Implementation of Vector-Space Retrieval - Simple Tokenizing –Stop-Word Removal and Stemming Inverted Indices - Efficient Processing with Sparse Vectors. Query Operations and Languages- Relevance Feedback -Query Expansion -Query Languages		7	15
FIRST INTERNAL TEST			
MODULE : 3 Data Mining: Types of Data –Data Mining Functionalities- Classification of Data Mining Systems-Data Mining Task Primitives- Major Issues in Data Mining **Data Warehouse and OLAP Technology for Data Mining**: Data warehouse, Data Warehouse and DBMS, Data marts, Metadata, Multidimensional data model, OLAP ,OLTP, Data cubes, Schemas for Multidimensional Database: Stars, Snowflakes and Fact constellations		8	15
MODULE 4 : Mining Frequent Patterns, Associations and Correlations – Mining Methods – Mining Various Kinds of Association Rules – Correlation Analysis – Constraint Based Association Mining Classification and Prediction - Basic Concepts - Decision Tree Induction		6	15
SECOND INTERNAL TEST			
MODULE : 5 - Bayesian Classification – Rule Based Classification – Classification by Back propagation Support Vector Machines –. Classification by Association Rule Analysis Learning from Neighbors- Prediction- Accuracy and Error measures-		10	20

Evaluating the accuracy of Predictor- Ensemble methods- Model Selection		
MODULE : 6 - Types of Data – Categorization of Major Clustering Methods K- means – Partitioning Methods – Hierarchical Methods - Density-Based Methods –Grid Based Methods Model-Based Clustering Methods – Clustering High Dimensional Data - Constraint – Based Cluster Analysis Outlier Analysis – Data Mining Applications. Advanced Techniques **:** -Web Mining, Spatial Mining, Text Mining Case Study: Perform various classification and clustering techniques using any one of data mining tools.	12	20
END SEMESTER EXAM		

COURSE NO.	COURSE TITLE	CREDITS	YEAR
04 CS 6112	VIRTUALIZING TECHNIQUES	3-0-0: 3	2015

Pre-requisites:

Course Objectives:

- To get used to the virtualization basics, and taxonomy of virtual machines.
- To have a clear idea about the application scenario, networking and its storage models.

Syllabus

Overview Of Virtualization, Storage Virtualization, Virtual Machine Basics – Taxonomy of Virtual machines - Process Virtual Machines – System Virtual Machines – Hypervisor - Key Concepts, Server Consolidation: Hardware Virtualization – Virtual Hardware Overview - Sever Virtualization, Types of Server Virtualization, Network Virtualization: Design of Scalable Enterprise Networks - Virtualizing the Campus WAN Design, Theory Network Device Virtualization Layer 2, Trunking Generic Routing Encapsulation, Routing Protocols, Virtualizing Storage, SAN backup and recovery techniques, storage models, Host based Architecture – Storage based architecture – Network based Architecture, Overview of Hypervisors : Xen Virtual machine monitors, Microsoft Virtual Server.

Course Outcome:

The student familiarizes with the different virtualizing techniques.

Text Books:

1. William von Hagen, Professional Xen Virtualization, Wrox Publications, January, 2008.
2. Chris Wolf, Erick M. Halter, and Virtualization: From the Desktop to the Enterprise, APress 2005

References:

1. Kumar Reddy, Victor Moreno, Network virtualization, Cisco Press, July, 2006.
2. James E. Smith, Ravi Nair, Virtual Machines: Versatile Platforms for Systems and Processes, Elsevier/Morgan Kaufmann, 2005.
3. David Marshall, Wade A. Reynolds, Advanced Server Virtualization: VMware and Microsoft Platform in the Virtual Data Center, Auerbach Publications, 2006.
4. Applied Virtualization Technology - Usage models for IT professionals and Software Developers (1st Ed): Sean Campbell Intel Press (2006)

COURSE PLAN

COURSE NO:	COURSE TITLE:	CREDITS	
04 CS 6112	VIRTUALIZING TECHNIQUES	3-0-0: 3	
MODULES		Contact hours	Sem. Exam Marks; %
MODULE: 1 Overview Of Virtualization: Basics of Virtualization - Virtualization Types – Desktop Virtualization – Network Virtualization – Server and Machine Virtualization Storage Virtualization – System-level or Operating Virtualization – Application Virtualization-Virtualization Advantages		7	15
MODULE: 2 – Virtual Machine Basics – Taxonomy of Virtual machines - Process Virtual Machines – System Virtual Machines **Overview of Hypervisors** : Hypervisor - Key Concepts -Xen Virtual machine monitors- Xen API – VMware – VMware products – Vmware Features – Microsoft Virtual Server – Features of Microsoft Virtual Server		7	15
FIRST INTERNAL TEST			
MODULE : 3 Server Consolidation: Hardware Virtualization – Virtual Hardware Overview - Sever Virtualization – Physical and Logical Partitioning Types of Server Virtualization – Business cases for Sever Virtualization – Uses of Virtual server Consolidation Planning for Development – Selecting server Virtualization Platform		7	15
MODULE 4 : Network Virtualization: Design of Scalable Enterprise Networks - Virtualizing the Campus WAN Design – WAN Architecture - WAN Virtualization - Virtual Enterprise Transport Virtualization–VLANs and Scalability Theory Network Device Virtualization Layer 2 - VLANs Layer 3 VRF Instances Layer 2 - VFIs Virtual Firewall Contexts Network Device Virtualization - Data- Path Virtualization Layer 2: 802.1q Trunking Generic Routing Encapsulation – Ipsec L2TPv3 Label Switched Paths - Control-Plane Virtualization–Routing Protocols- VRF - Aware Routing Multi-Topology Routing		7	15

SECOND INTERNAL TEST		
MODULE : 5 - Virtualizing Storage: SCSI- Speaking SCSI- Using SCSI buses – Fiber Channel – Fiber Channel Cables – Fiber Channel Hardware Devices – iSCSI Architecture – Securing iSCSI, SAN backup and recovery techniques – RAID – SNIA Shared Storage Model – Classical Storage Model – SNIA Shared Storage Model –. Host based Architecture – Storage based architecture – Network based Architecture – Fault tolerance to SAN – Performing Backups – Virtual tape libraries.	7	20
MODULE: 6 - **Virtualized computing:** Virtual machine based distributed computing, elastic cloud computing, clustering, cold and hot migration. Commercial examples. Challenges and future trends.	7	20
END SEMESTER EXAM		

COURSE NO.	COURSE TITLE	CREDITS	YEAR
04 CS 6114	WEB SECURITY	3-0-0: 3	2015

Pre-requisites:

Course Objectives:

- To apply the knowledge on web security by understanding various vulnerabilities, web application security, SQL Injection, blocking common attacks using ModSecurity, Web server hacking

Syllabus

Web application security- Key Problem factors – Core defence mechanisms- Handling user access, Discovering hidden content , Web Application Technologies - The HTTP Protocol, Bypassing Client-Side Controls- Transmitting data via the client – Hidden form fields – HTTP Cookies - URL Parameters - The Referer Header ,Opaque Data - The ASP.NET ViewState , Attacking authentication – design flaws in authentication mechanisms, Attacking access controls – Common vulnerabilities – Securing access controls, SQL Injection, Platform level defenses - Using run time protection - web application Firewalls - Using ModSecurity, Intercepting filters- Web server filters - application filters – securing the database,Cross-site scripting ,Directory traversal attacks ,Mod Security , Footprinting-Scanning-Enumeration,Web server Hacking ,Database Hacking ,Infrastructure Hacking.

Course Outcome:

The student gets knowledge about the security in web applications.

Text Books:

1. DafyddStuttard, Marcus Pinto, The Web Application Hacker's Handbook, 2nd Edition, Wiley Publishing, Inc.
2. Justin Clarke, SQL Injection Attacks and Defense, 2004 , Syngress Publication Inc.

References:

1. Magnus Mischel , ModSecurity 2.5, Packt Publishing

2. Stuart McClure Joel, ScambRay, George Kurtz, Hacking Exposed 7: Network Security Secrets and Solutions, Seventh Edition.2012, TheMcGraw-HillCompanies

COURSE PLAN

COURSE NO:	COURSE TITLE:	CREDITS
04 CS 6114	WEB SECURITY	3-0-0: 3

MODULES	Contact hours	Sem. Exam Marks; %
MODULE: 1 - Web application security- Key Problem factors – Core defence mechanisms- Handling user access- handling user input- Handling attackers – web spidering – Discovering hidden content Web Application Technologies - The HTTP Protocol, HTTP Requests, HTTP Responses , HTTP Methods, URLs , HTTP Headers , General Headers , Request Headers , Response Headers , Cookies , Status Codes, HTTPS, HTTP Proxies, HTTP Authentication.	7	15
MODULE: 2 – Bypassing Client-Side Controls- Transmitting data via the client – Hidden form fields – HTTP Cookies - URL Parameters - The Referer Header Opaque Data - The ASP.NET ViewState Handling client-side data securely - Transmitting Data via the Client - Validating Client-Generated Data - Logging and Alerting Attacking authentication – design flaws in authentication mechanisms – securing authentication Attacking access controls – Common vulnerabilities – Securing access controls	7	15
FIRST INTERNAL TEST		
MODULE : 3 SQL Injection - How it happens - Dynamic string building - Insecure Database Configuration - finding SQL injection – Exploiting SQL injection – Common techniques – identifying the database – UNION statements – Preventing SQL injection Platform level defenses - Using run time protection - web application Firewalls - Using ModSecurity Intercepting filters- Web server filters - application filters – securing the database – Locking down the application data – Locking down the Database server	7	15

MODULE 4 : Mod Security – Writing Rules-Blocking common attacks – HTTP finger printing – Blocking proxied requests Cross-site scripting – Cross-site request forgeries – Shell command execution attempts – Null byte attacks – Source code revelation Directory traversal attacks – Blog spam – Website defacement – Brute force attack- Directory indexing – Detecting the real IP address of an attacker	7	15
SECOND INTERNAL TEST		
MODULE : 5 - Footprinting-Scanning-Enumeration Infrastructure Hacking- Remote connectivity and VoIP Hacking-Network devices, Wireless Hacking	7	20
MODULE : 6 - Web server Hacking - Source code disclosure – Canonicalization attacks – Denial of service – Web application hacking – Web crawling Database Hacking – Database discovery – Database vulnerabilities	7	20
END SEMESTER EXAM		

COURSE NO.	COURSE TITLE	CREDITS	YEAR
04 CS 6116	AGENT BASED SYSTEMS	3-0-0: 3	2015

Pre-requisites:

Course Objectives:

- To apply the knowledge on searching technique, first-order logic, planning agents and agents under uncertainty into various real world problems.

Syllabus

Introduction, History - Intelligent Agents-Problem Solving-Searching – Uninformed Search strategies-Constraint Satisfaction Adversarial Search-Game playing. Agents and Uncertainty: Acting under uncertainty, Probability Notation, Inference in Bayesian networks, Time and Uncertainty-Temporal Models- Utility Theory - Decision Network. Knowledge Representation and Reasoning, Agent based on propositional logic- Unification-forward Chaining- Backward chaining- Resolution Strategies-Knowledge Representation. Planning Agents: State Space Search-Partial Order Planning- planning Graphs.

Course Outcome:

The student will familiarize the basic concepts of agent based approach.

Text Books:

1. Stuart Russell and Peter Norvig, “Artificial Intelligence - A Modern Approach”, 2nd Edition, Prentice Hall, 2002
2. Michael Wooldridge, “An Introduction to Multi Agent System”, John Wiley, 2002

References:

1. Patrick Henry Winston, Artificial Intelligence, III Edition, AW, 1999.
2. Nils.J.Nilsson, Principles of Artificial Intelligence, Narosa Publishing House, 1992

COURSE PLAN

COURSE NO:	COURSE TITLE:	CREDITS	
04 CS 6116	AGENT BASED SYSTEMS	3-0-0: 3	
MODULES		Contact hours	Sem. Exam Marks; %
MODULE: 1 - Introduction :Definitions - Foundations - History - Intelligent Agents-Problem Solving-Searching – Uninformed Search strategies-BFS,DFS- Heuristics – Greedy best- first, A*- Local search		5	15
MODULE: 2 – Constraint Satisfaction Problems – Backtracking search for CSPs , Local search for CSP- Adversarial Search-Game playing, Minmax algorithm, Alpha-Beta pruning		8	15
FIRST INTERNAL TEST			
MODULE : 3 Agents and Uncertainty: Acting under uncertainty Probability Notation-Bayes Rule and use –Semantics of Bayesian Networks- Inference in Bayesian networks		5	15
MODULE 4: Other Approaches-Time and Uncertainty-Temporal Models-Utility Theory - Decision Network.		8	15
SECOND INTERNAL TEST			
MODULE : 5 Knowledge Representation and Reasoning: Logical Agents – Reasoning pattern in propositional logic Agent based on propositional logic-First order logic- First Order Inference Unification-forward Chaining- Backward chaining- Resolution Strategies Knowledge Representation-Objects-Actions-Events		8	20
MODULE : 6 - Planning Agents: Planning Problem-State Space Search- Partial Order Planning- planning Graphs-planning and Acting in Nondeterministic Domains.		8	20
END SEMESTER EXAM			

COURSE NO.	COURSE TITLE	CREDITS	YEAR
04 CS 6118	BIOINFORMATICS	3-0-0: 3	2015

Pre-requisites:

Course Objectives:

- The course provides a fundamental background in bioinformatics and equips students with the necessary skills to develop methods and software tools for understanding biological data.

Syllabus

Basic Concepts of Molecular Biology-Central dogma of molecular biology, RNA classification coding and non coding RNA, Genomes and Genes - Genetic code, ORFs,Slicevarients,Protien structure and function, Transcription, Translation and Protein synthesis;Bio-databases –primary, secondary and ternary,DNA, RNA and protein databases; Data base searches; Sequence alignments ;Smith-Waterman algorithm, NeedlemanWunch algorithm; Scoring matrices-Matrices for nucleic acid and proteins sequences; Informational view of Genomic data- Gene expression;Analysis of gene expression microarrays Normalization; Principal Component Analysis, Clustering Gene Expression Profiles; Applications of Microarray Technology;Protein Structure Prediction and Visualization ; Protein Classification Approaches; Proteomics – Tools and Techniques in Proteomics, Methods of Gene Family Identification.

Course Outcome:

The student will demonstrate the ability to apply the various concepts and principles of bioinformatics into applications

Text Books:

1. S C Rastogi, N Mendiratta, P Rastogi, Bioinformatics Methods and Applications Genomics, Proteomics and Drug Discovery, Third Edition, PHI Learning Private Limited, 2011

References:

1. Setubal & Meidanis, “Introduction to Computational Molecular Biology”, Brooks/Cole Cengage Learning 2004 .
2. Vittal R Srinivas, Bioinformatics A modern Approach, PHI Learning Private Limited, 2004
3. Bryan Bergeron, Bioinformatics Computing PHI Learning Private Limited, 2010
4. Dan E Krane, Michael L Raymer, Fundamental Concepts of Bioinformatics, Pearson Education, 2003.

COURSE PLAN

COURSE NO:	COURSE TITLE:	CREDITS	
04 CS 6118	BIOINFORMATICS	3-0-0: 3	
MODULES		**Contact hours**	**Sem. Exam Marks; %**
MODULE: 1 Basic Concepts of Molecular Biology: Central dogma of molecular biology, RNA classification – coding and noncoding RNA- mRNA, tRNA, miRNA and siRNA, RNAi, Genomes and Genes Genetic code, ORFs, Slicevarients, Protein structure and function, Transcription, Translation and Protein synthesis		8	15
MODULE: 2 – Bio-databases –primary, secondary and ternary. DNA, RNA and protein databases. Data base searches – text based and sequence based-BLAST and FASTA Algorithms		7	15
FIRST INTERNAL TEST			
MODULE : 3 Sequence alignments – local/global, pairwise/multiple Sequence alignment, Smith-Waterman algorithm, NeedlemanWunch algorithm		6	15
MODULE 4: Scoring matrices: basic concept of a scoring matrix, Matrices for nucleic acid and proteins sequences, PAM and BLOSUM, Phylogenetic Trees. Sequence polymorphisms, variations among human genomes, medical and pharmacological issues.		7	15
SECOND INTERNAL TEST			
MODULE : 5 - Informational view of Genomic data Gene expression, Microarrays-cDNAarrays,Oligo Arrays, Microarray experiment, Analysis of gene expression microarrays-Normalization Principal Component Analysis, Clustering Gene Expression Profiles. Applications of Microarray Technology, Gene regulation, Gene Ontology, metabolic pathways, and gene set enrichment analysis		7	20

MODULE : 6 - Protein Structure Prediction and Visualization - Polypepticcomposition,Protein folding problem, Protein Structure Visualization, Protein Structure Databases, Protein Structure Alignment, Protein Classification Approaches, Protein Identification and Characterization, Primary and Secondary Structure Analysis and Prediction, Patterns and Fingerprints Search, Methods of 2D Structure Prediction, Protein Prediction from a DNA Sequence **Proteomics** – Tools and Techniques in Proteomics, Protein-Protein Interactions, Methods of Gene Family Identification.	8	20
END SEMESTER EXAM		

COURSE NO.	COURSE TITLE	CREDITS	YEAR
04 CS 6122	DIGITAL IMAGE PROCESSING	3-0-0: 3	2015

Pre-requisites:

Course Objectives:

- To develop critical thinking about basic theory and algorithms that are widely used in digital image processing.
- To gain exposure to current technologies and issues that are specific to image processing systems
- To apply material by implementing and investigating image processing algorithms in Matlab.
- To utilize techniques that develop hands-on experience in using computers to process images

Syllabus

Digital Image Fundamentals, Image Model, Image Transforms, Image Enhancement , Image restoration and compression , Image Analysis and Computer Vision, Image Segmentation, Sensing 3D shape, Emerging IT applications

Course Outcome:

The students will be able to demonstrate how monochrome digital images are represented, manipulated, encoded and processed, with emphasis on algorithm design, implementation and performance evaluation methods of capturing and reproducing images in digital systems.

Text Books:

1. Gonzalez R. C. & Woods R. E., “Digital Image Processing”, 3rd ed, PHI Learning, 2008.

References:

1. Sonka M, Vaclav Hlavac, and Roger Boyle, “Image Processing, Analysis and Machine Vision”, Brooks Cole, 3rd ed, 2008.
2. Jain A K, “Fundamentals of Digital Image Processing”, Prentice-Hall India, 2007

COURSE PLAN

COURSE NO:	COURSE TITLE:	CREDITS
04 CS 6122	DIGITAL IMAGE PROCESSING	3-0-0: 3

MODULES	Contact hours	Sem. Exam Marks; %
MODULE: 1 - Digital Image Fundamentals: - Digital image Representation – Functional Units of an Image processing system. Visual perception Image Model - Image sampling and Quantization – grayscale resolution – pixel relationship.	8	15
MODULE: 2 – Image Transforms – Unitary Transform, Discrete Fourier Transform, Cosine Transform Sine Transform, Hadamard Transform, Slant and KL Transform	8	15
FIRST INTERNAL TEST		
MODULE : 3 Image Enhancement – Histogram processing – Spatial operations – Image smoothing – Image Sharpening Color Image Processing methods- Color Image Models.	8	15
MODULE 4 : Image restoration and compression Degradation Model – Discrete Formulation Circulant matrices – Constrained and Unconstrained restoration geometric transformations fundamentals Compression Models – Error Free Compression – Lossy Compression – International Image Compression Standards.	10	15
SECOND INTERNAL TEST		
MODULE : 5 - Image Analysis and Computer Vision: Spatial feature Extraction – Transform feature – Edge detection-Boundary Representation-Region Representation-Moment Representation Structure-Shape Features-Texture-Scene Matching and Detection Image Segmentation- Classification techniques-Morphology-Interpolation	10	20

MODULE: 6 - Sensing 3D shape: how the 3rd dimension changes the problem. Stereo 3D description, 3D model, matching, TINA Direct 3D sensing-structured light, range finders, range image segmentation Emerging IT applications: Recognition of characters, Fingerprints and faces-Image databases Case Study: Implement various feature selection techniques on image	10	20
END SEMESTER EXAM		

COURSE NO.	COURSE TITLE	CREDITS	YEAR
04 CS 6124	OPERATING SYSTEM DESIGN CONCEPTS	3-0-0: 3	2015

Pre-requisites:

Course Objectives:

- To understand the different functionalities of Operatingsystem through the detailed analysis of UNIX operating system.
- To understand the current trends and problems faced inoperating System Design.

Syllabus

Operating System design concepts, Kernel, Process- Threads- Files - Architecture of the UNIX operating system, File Subsystem, Design Techniques and problems, Interactive and Programming Interfaces, System call interface, implementation of simple OS, process, Design Techniques of Multiprocessor Operating System, Interprocess communication, Memory management design problems and solutions, Virtual memory Systems, Paging and Segmentation, Distributed UNIX Systems, Operating System Security

Course Outcome:

The student will demonstrate the ability to understand the basic concepts and implementation of operating system

Text Books:

1. Maurice J. Bach, "The Design of the Unix Operating System", FirstEdition, Prentice Hall of India, 1986.
2. Charles Crowley, “Operating Systems”, First Edition, TataMcGraw-Hill Edition, 1998.

References:

1. Andrew S. Tanenbaum, “Modern Operating System”, Third Edition, PHI learning private limited, 2011.
2. William Stallings, "Operating Systems",Fourth Edition, PearsonEducation, 2004
3. UreshVahalia, "Unix Internals - The new Frontiers", Pearson Education, 2006
4. B. Goodheart, J. Cox, "The Magic Garden Explained", Prentice Hallof India, 1986.
5. S. J. Leffler, M. K. Mckusick, M. J.Karels and J. S. Quarterman.,"The Design And Implementation of the 4.3 BSD Unix OperatingSystem", Addison Wesley, 1998

COURSE PLAN

COURSE NO:	COURSE TITLE:	CREDITS	
04 CS 6124	OPERATING SYSTEM DESIGN CONCEPTS	3-0-0: 3	
MODULES		Contact hours	Sem. Exam Marks; %
MODULE: 1 - Design Concepts - Characteristics of modern operating system Process- Threads- Files - Architecture of the UNIX operating system - Kernel datastructures - The Buffer Cache File Subsystem- Inode - Regular file -Super block– Inode assignment to a new file		10	15
MODULE: 2 – Design Techniques–Design Problem- Design Techniques- Two levelImplementation Two level Implementation - Interface Design- Connection in Protocols Interactive and Programming Interfaces - Decomposition Patterns.		10	15
FIRST INTERNAL TEST			
MODULE : 3 System call interface-Implementation of a simple OS- Process Implementation ProcessSwitching – System call Interrupt handling- Program Error Interrupts **Design Techniques**- -Multiprocessor Operating System- KernalmodeProcesses –Implementation of Mutual Exclusion		13	15
MODULE 4 : Interprocess communication- Process Tracing –System V IPC – Network Communication- Sockets – Linking and loading a Process Memory managementdesign problems and solutions – File Mapping		11	15
SECOND INTERNAL TEST			
MODULE : 5 - Virtual memory Systems- Page replacement algorithm- Local page replacement algorithm- Evaluation of paging algorithms Thrashing and load control- Recursive address spaces- Paging the operating system address space		12	20

Segmentation- Sharing memory- very large address spaces		
MODULE: 6 - Distributed **UNIX Systems** – Satellite Processors – The Newcastle Connection-Transparent Distributed File System. **Operating SystemSecurity**- Firewalls-Antivirus-Codesigning- jailing- Model based intrusion detection	8	20
END SEMESTER EXAM		

COURSE NO.	COURSE TITLE	CREDITS	YEAR
04 CS 6126	EMBEDDED SYSTEMS	3-0-0: 3	2015

Pre-requisites:

Course Objectives:

- To provide an overview and current statistics of embedded systems.
- To design, code, compile and test real time software.
- To integrate a fully functional system including hardware and software

Syllabus

Fundamental concepts of embedded systems; Design process in embedded system; Classification of embedded systems; Skills required for an embedded system designer;Devicesand communication buses for devices network; Serial bus communication protocols; Parallel bus device protocols; Device drivers and interrupts and service mechanism; Real-time operating systems; Introduction to embedded software development process and tools

Course Outcome:

Learning to design and program embedded systems is a critical skill that is necessary for many industry and scientific jobs. Students who successfully complete this course will have an ability to understand the fundamental concepts of embedded systems. In this course students will learn the basics of designing, interfacing, configuring, and programming embedded systems. It will help them to prepare for cutting edge careers in industry and research.

Text Books:

1. Raj Kamal, “Embedded Systems: Architecture, Programming, and Design” 2nd edition, Tata McGraw Hill-2013.

References:

1. Marilyn Wolf, “Computer as Components, Principles of Embedded Computing System Design” 3rd edition, Elsevier-2014.

2. Embedded Systems – Lyla, Pearson, 2013.

3. Introduction to Embedded Systems - Shibu K.V, McGraw Hill, 2004 .

4. Embedded System Design - Frank Vahid, Tony Givargis, John Wiley, 2001.

5. An Embedded Software Primer - David E. Simon, Pearson Education, 1999

COURSE PLAN

COURSE NO:	COURSE TITLE:	CREDITS	
04 CS 6126	EMBEDDED SYSTEMS	3-0-0: 3	
MODULES		**Contact hours**	**Sem. Exam Marks; %**
MODULE: 1 - Introduction to embedded systems: Embedded systems, Processor embedded into a system, Embedded hardware units and device in a system, Embedded software in a system, Examples of embedded systems, Design process in embedded system, Formalization of system design, Design process and design examples, Classification of embedded systems, skills required for an embedded system designer.		7	15
MODULE: 2 – Devices and communication buses for devices network :IO types and example, Serial communication devices, Parallel device ports, Sophisticated interfacing features in device ports, Wireless devices, Timer and counting devices, Watchdog timer, Real time clock, Networked embedded systems.		7	15
FIRST INTERNAL TEST			
MODULE : 3 Serial bus communication protocols, Parallel bus device protocols-parallel communication internet using ISA, PCI, PCI-X and advanced buses, Internet enabled systems network protocols, Wireless and mobile system protocols.		6	15
MODULE 4 : Device drivers and interrupts and service mechanism: Programming-I/O busy-wait approach without interrupt service mechanism, ISR concept, Interrupt sources, Interrupt servicing (Handling) Mechanism, Multiple interrupts, Context and the periods for context switching, interrupt latency and deadline, Classification of processors interrupt service mechanism from Context-saving angle, Direct memory access, Device driver programming.		8	15
SECOND INTERNAL TEST			
MODULE : 5 - Real-time operating systems: OS Services, Process management, Timer functions, Event functions, Memory management, Device, file and IO subsystems management, Interrupt routines in RTOS environment and handling of interrupt source calls, Real-time operating systems, Basic design using an RTOS		8	20

MODULE: 6 - RTOS task scheduling models, interrupt latency and response of the tasks as performance metrics, OS security issues. **Introduction to embedded software development process and tools**, Host and target machines, Linking and location software.	8	20
END SEMESTER EXAM		

COURSE CODE	COURSE NAME	L-T-P: C	YEAR
04 CS 6192	MINI PROJECT	0-0-4: 2	2015

COURSE CODE	COURSE NAME	L-T-P: C	YEAR
04 CS 6194	ADVANCED COMPUTING LAB	0-0-2: 1	2015

Pre-requisites:

Course Objectives:

- To acquire practical understanding of Parallel Programming, Data Analytics and Cyber Security

Syllabus

Introduction to parallel programming

1. Sending message from client to server through RPC in Java
2. Implement parallel programming MPI,OPENMP
3. Hadoop single node and multi node installation
4. HDFS commands
5. Map reduce programming
6. Usage of combiners and partitioner in Hadoop
7. Input formats in Hadoop
8. Deploying a cloud using OpenStack
9. Starting an instances
10. Creating and attaching a volume
11. Creating a snapshot
12. Adding floating point addresses
13. Controlling and deleting instances

Data Processing and Analysis.

14. Implement various feature selection techniques on image and text domain using any one of data mining tools
15. To perform classification like Decision tree and Naive Bayes etc on datasets any one of data mining tools
16. Perform various types of clustering using any one of data mining tools
17. Implement linear regression using any one of data mining tools

Information Security

18. Understanding of cryptographic algorithms and implementation of the same in C or C++ .
19. Using open ssl for web server - browser communication
20. Performance evaluation of various cryptographic algorithms

21 Using IP TABLES on Linux and setting the filtering rules

22. Understanding the buffer overflow and format string attacks

N.B: Any two topics should be selected

COURSE CODE	COURSE NAME	L-T-P:C	YEAR
04 CS 7101	CYBER FORENSICS	3-0-0: 3	2015

Course Objectives:

Student will be able to:-

- To introduce computer forensics concepts, as well as techniques for identifying, collecting, and preserving digital evidence consistent with industry standards and best practices
- To familiarize with the assorted hardware and software utilized by computer forensic practitioners
- Exposure to fundamental knowledge and skills utilized in entry-level information systems …and cyber security positions.

Syllabus

This syllabus introduces to computer forensics concepts, as well as applying scientific techniques to an investigative case. The technical core covers knowledge and skills in the data acquisition, processing, exploring tools, extraction, interpretation and documentation of computer evidence. This course is designed to teach about e-mail crimes and violations in cell phones and mobile devices. It also provides guidance on dealing with these constantly changing technologies. At the end, mid-level security practitioners emerge with how to engage all functional levels within the enterprise to deliver information system security.

Course Outcome:

The student will demonstrate the concepts of cyber forensic analysis and develop knowledge and skill in cyber forensics investigation concepts and tools.

Text Books:

1. Computer Forensics and Investigations- Bill Nelson, Amelia Phillips, Frank Enfinger, Christofer Steuart , Second Indian Reprint 2004 , Cengage Learning India Private Limited
2. Digital Evidence and Computer Crime – Eoghan Casey, Edition 3, Academic Press, 2011
   Computer Forensics and Cyber Crime: An Introduction – MarjieBritz, Edition 2, Prentice Hall,2008

References:

1. Practical guide to Computer Forensics- David Benton and Frank Grindstaff , 2006, Book Surge Publishing, 2006.
2. Computer Evidence: Collection & Preservation- Christopher L.T Brown Charles River Media publishing, Edition 1, 2005.
3. Computer Investigation (Forensics, the Science of crime-solving) – Elizabeth Bauchner, Mason Crest Publishers, 2005.
4. Real Digital Forensics- Keith J. Jones, Richard Bejtlich and Curtis W. Rose, Addison-Wesley publishers, 2005.
5. Forensic Computer Crime Investigation (International Forensic Science and Investigation)- Thomas A. Johnson, CRC Press, 2005.

COURSE PLAN

COURSE NO:	COURSE TITLE:	CREDITS	
04 CS 7101	Cyber Forensics	3-0-0:3	
MODULES		Contact hours	Sem. Exam Marks. %
MODULE : 1 **Introduction to Computer Forensics:** understanding computer forensics, preparing for computer investigations, maintaining professional conduct, Understanding Computer Investigations -Preparing a computer investigation, taking a systematic approach, procedures for corporate high tech investigations, understanding data recovery workstations and software, conducting an investigation, completing the case Requirements for forensic lab certification , determining the physical requirements for a computer forensics lab, selecting a basic forensic workstation, building a business case for developing a forensic lab		8	15
MODULE : 2 Data Acquisition - storage formats for digital evidence, determining the best acquisition method-Contingency planning for image acquisitions, using acquisition tools, validating data acquisitions, performing RAID data acquisitions, using remote network acquisition tools, using other forensic acquisition tools		10	15
FIRST INTERNAL TEST			
MODULE : 3 **Processing Crime and Incident Scene**: identifying digital evidence, collecting evidence in private sector incident scenes, processing law enforcement crime scenes, Preparing for a search, securing a computer incident or crime scene . Seizing digital evidence at the scene, storing digital evidence, obtaining a digital hash. Working with windows and DOS systems- file systems, exploring Microsoft file structures, examining NTFS disks, whole disk encryption, the windows registry, Microsoft and Ms-DOS start up tasks, virtual machines		8	15
MODULE : 4 **Evaluating Computer Forensic s Tool needs:** computer forensics software and hardware tools, validating and testing forensics software. the Macintosh file structure and boot process, examining UNIX and LINUX disk structures and boot processes Examining CD data structures, examining SCSI Disk, examining IDE/EIDE and SATA devices, Analysis and validation -determining what data to collect and analyze, validating forensic data, addressing data -hiding techniques, performing remote acquisitions.		10	15
SECOND INTERNAL TEST			
MODULE : 5 Recovering Graphics Files- Recognizing, locating and recovering graphic files, understanding data compression, copy rights issues with graphics, identifying unknown file formats, copyright issues with graphics **Network Forensics overview:** performing live acquisitions, developing standard procedures for network forensics, using network tools. Email Investigations-role of E-mail in investigations, exploring the roles of the client		8	20

and server, investigating e-mail crimes and violations, understanding E-mail servers, specialized E-mail forensic tools.		
MODULE : 6 Cell Phone and Mobile Device forensics- Mobile device forensics, acquisition procedures. Report writing for high tech investigations – importance of reports, guidelines for writing, generating report findings with forensics software tools. Expert Testimony in High Tech Investigations- Preparing for testimony, testifying in court, preparing for a deposition or hearing, preparing Forensic evidence for testimony. Ethics for the Expert Witness-applying ethics and codes to expert witnesses, organizations with codes of ethics, ethical difficulties in expert testimony.	10	20

COURSE CODE	COURSE NAME	L-T-P:C	YEAR
04 CS 7103	DISTRIBUTED COMPUTING SYSTEMS	3-0-0:3	2015

Pre-requisites:

Course Objectives:

- To apply knowledge on synchronous and asynchronous distributed computing system.

Syllabus

Introduction to model of synchronous distributed computing system, Leader election in a General Network - Algorithms in Synchronous Networks, Minimum Spanning Tree, Shortest Paths, Maximal Independent Set, LCR algorithm, HS algorithm, Time Slice Algorithm, Variable Speeds Algorithm, Lower Bound for Comparison-Based Algorithms, LubyMIS algorithm. Distributed Consensus with Link Failures and Process Failures – Basic, Introduction to model of asynchronous distributed computing system, Send/Receive systems, Broadcast systems, Multicast systems,Basic algorithms, Asynchronous System Model. Shared Memory Systems, Environment Model, Resource Allocation, Mutual exclusion and consensus, relationship between shared memory and network models, asynchronous networks with failures.

Course Outcome:

The students will identify various design problems in distributed systems and develop algorithms for distributed computing.

Text Books:

1. Nancy A. Lynch, Morgan," Distributed Algorithms", Kaufmann Publishers, Inc
2. Wolfgang Reisig, W. Reisig, "Elements Of Distributed Algorithms: Modeling And Analysis With Petri Nets", Springer-verlag

References:

1. Tel Gerard , "Introduction To Distributed Algorithms", 2nd Edition, Cambridge University Press
2. Sukumar Ghosh, "Distributed Systems: An Algorithmic Approach (Hardcover)", Chapman & Hall/crc
3. Valmir C. Barbosa,"An Introduction To Distributed Algorithms", Mit Press
4. Randy Chow, Theodore Johnson, "Distributed Opearating Systems and Algorithm Analysis, , Pearson Education
5. Santoro N., Nicola Santoro, "Design And Analysis Of Distributed Algorithms", Wiley-Interscience
6. FionnualaO'donnell, VdmVerlagDr. Muller, "A Simulated Framework For The Teaching Of Distributed Algorithms", Aktiengesellschaft& Co. Kg
7. Ajay D. Kshemkalyani, MukeshSinghal, "Distributed Computing - Principles, Algorithms, And Systems", Cambridge University Press

COURSE PLAN

COURSE CODE:	COURSE TITLE	CREDITS	
04 CS 7103	**DISTRIBUTED COMPUTING SYSTEMS**	**3-0-0:3**	
MODULES		**Contact Hours**	**Sem. Exam Marks (%)**
MODULE 1: Introduction to model of synchronous distributed computing system, Leader election in a General Network - Simple Flooding Algorithm, Basic Breadth-First Search Algorithm., Bellman-Ford algorithm		6	15
MODULE 2: Algorithms in Synchronous Networks, Minimum Spanning Tree, Leader Election in a Synchronous Ring, Shortest Paths, Maximal Independent Set		7	15
INTERNAL TEST 1 (MODULE 1 & 2)			
MODULE 3: LCR algorithm, HS algorithm, Time Slice Algorithm, Variable Speeds Algorithm, Lower Bound for Comparison-Based Algorithms, LubyMIS algorithm. Distributed Consensus with Link Failures and Process Failures – Basic		7	15
MODULE 4: Introduction to model of asynchronous distributed computing system, Send/Receive systems, Broadcast systems, Multicast systems,Basic algorithms, Peterson Leader-Election Algorithm, Local Synchronizer, Safe Synchronizer		8	15
INTERNAL TEST 2 (MODULE 3 & 4)			
MODULE 5: Asynchronous System Model. Shared Memory Systems, Environment Model, Shared Variable Types, Mutual Exclusion - Asynchronous Shared Memory Model, Dijkstra's Mutual Exclusion Algorithm		7	20
MODULE 6: Resource Allocation - Nonexistence of Symmetric Dining PhilosophersAlgorithms, Right-Left Dining Philosophers Algorithm Mutual exclusion and consensus, relationship between shared memory and network models, asynchronous networks with failures		7	20
END SEMESTER EXAM			

COURSE CODE	COURSE NAME	L-T-P:C	YEAR
04 CS 7105	WIRELESS SENSOR NETWORKS	3-0-0:3	2015

Pre-requisites:

Course Objectives:

- To gain knowledge on layered architecture of sensor network in WSN applications.
- To understand various protocols involved in WSN and perform simulation of WSN.

Syllabus

Network Architecture- Challenges for WSNs, Single node architecture. Energy consumption of sensor node, Sensor network scenarios. Optimization goals and figures of merit, Gateway concepts.Communication Protocols- Wireless channel and communication fundamentals , MAC protocols, Fundamentals of (wireless) MAC protocols, Link-layer protocols, Error control, Framing. Routing protocols, Gossiping and agent-based unicast forwarding. Energy-efficient unicast, Broadcast and multicast, Geographic routing, Mobile nodes, Data-centric routing, Data aggregation. Transport layer and quality of service, Congestion control and rate control, Advanced application support, Advanced in-network processing, Security considerations in wireless sensor networks, Application-specific support

Course Outcome:

The student will demonstrate the ability to apply suitable protocols and architecture in wireless sensor network applications**.**

Text Books:

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

References:

1. KazemSohraby, Daniel Minoli, &TaiebZnati, “Wireless Sensor Networks- Technology, Protocols, and Applications”, John Wiley, 2007.
2. Anna Hac, “Wireless Sensor Network Designs”, John Wiley, 2003

COURSE PLAN

COURSE CODE:	COURSE TITLE	CREDITS	
04 CS 7105	**WIRELESS SENSOR NETWORKS**	**3-0-0:3**	
MODULES		**Contact Hours**	**Sem. Exam Marks (%)**
MODULE 1:**Network Architecture** Introduction, The vision of Ambient Intelligence, Challenges for WSNs, Challenges for WSNs, Single node architecture		5	15
MODULE 2: Energy consumption of sensor node, Operating system and execution environment, example sensor node, Sensor network scenarios Optimization goals and figures of merit, Optimization goals and figures of merit, Service interfaces of WSNs, Gateway concepts.		8	15
INTERNAL TEST 1 (MODULE 1 & 2)			
MODULE 3:**Communication Protocols** Introduction , Wireless channel and communication fundamentalsPhysical layer and transceiver design considerations in WSNs.		5	15
MODULE 4:**MAC protocols** Fundamentals of (wireless) MAC protocols, Low duty cycle protocols and wakeup concepts, Contention-based protocols, Schedule-based protocols, The IEEE 802.15.4 MAC protocol **Link-layer protocols -** Error control, Framing.		8	15
INTERNAL TEST 2 (MODULE 3 & 4)			
MODULE 5:**Routing protocols** The many faces of forwarding and routing, Gossiping and agent-based unicast forwarding, Energy-efficient unicast, Broadcast and multicast, Geographic routing, Mobile nodes, Data-centric routing, Data aggregation		8	20
MODULE 6:**Transport layer and quality of service** Coverage and deployment, Reliable data transport, Single packet delivery, Block delivery, Congestion control and rate control **Advanced application support -** Advanced in-network processing, Security considerations in wireless sensor networks, Denial-of-service attacks, Application-specific support.		8	20
END SEMESTER EXAM			

COURSE CODE	COURSE NAME	L-T-P:C	YEAR
04 CS 7107	TEXT MINING AND LANGUAGE PROCESSING	3-0-0:3	2015

Pre-requisites:

Course Objectives:

- To understand the basics of Text mining and to apply the knowledge on language processing into various applications

Syllabus

Introduction to Natural Language Processing;Statistical Modelling and Classification Finite State methods Grammar for Natural Language Processing;Syntax Parsing;Context-Free Grammars for English;Sentence-level constructions; Text Mining: Named Entity Recognition, Categorization – Information Extraction ; Clustering- Hierarchical Clustering Document Classification and routing; Document Summarization; Sentiment Analysis; Opinion Mining, Basic Rules of Opinions and Compositional Semantics; Polysemy and synonymy, Word Sense Disambigution, Coreference resolution; handling sparsity, domain adaptation and representations; Markov logic and NLP; Generic Issues: Multilinguality, Multimodality, Text and Images – Modality Integration -: Machine Translation Discourse Processing; Case Study: Lemmatization, Stemming,Tokenization and Tagging using NLTK Tool Kit

Course Outcome:

The student will demonstrate the ability to apply the various text mining concepts and language processing principles**.**

Text Books:

1. Daniel Jurafsky and James H. martin, " Speech and Language Processing" ,2000.
2. Ron Cole, J.Mariani, et.al "Survey of the State of the Art in Human Language Technology", Cambridge University Press, 1997.
3. Michael W. Berry " Survey of Text Mining: Culstering, Classification and Retrieval", Springer Verlag, 2003.
4. Christopher D.Manning and HinrichSchutze, " Foundations of Statistical Natural
5. Language Processing ", MIT Press, 1999.

References:

8. James Allen " Natural Language Understanding ", Benjamin/ Cummings Publishing Co. 1995.
9. Sentiment Analysis and Opinion Mining, Bing Liu.Morgan&Claypool Publishers, May 2012.
10. Gerald J. Kowalski and Mark.T. Maybury, "Information Storage and Retrieval systems", Kluwer academic Publishers, 2000.
11. TomekStrzalkowski" Natural Language Information Retrieval ", Kluwer academic Publishers, 1999.
12. Christopher D.Manning and HinrichSchutze, "Foundations of Statistical Natural Language Processing ", MIT Press, 1999.
13. Natural Language Processing with Python, Steven Bird, Ewan Klein and Edward Loper O'Reilly Media, Inc., 1005 Gravenstein Highway North, Sebastopol, CA 95472.

COURSE PLAN

COURSE CODE:	COURSE TITLE	CREDITS	
04 CS 7107	**TEXT MINING AND LANGUAGE PROCESSING**	**3-0-0:3**	
MODULES		**Contact Hours**	**Sem. Exam Marks (%)**
MODULE 1: Introduction: Natural Language Processing – Linguistic Background- Spoken language input and output Technologies – Written language Input - Mathematical Methods. Statistical Modelling and Classification Finite State methods		6	15
MODULE 2: Grammar for Natural Language Processing – Parsing – Semantic and Logic Form – Ambiguity Resolution – Semantic Interpretation. Finite-State Morphological parsing The porter stammer Syntax Parsing: Document Collection, Tokenization, Generate Vectors, Term Frequencies-Inverse Document Frequencies (tf-idf),		6	15
INTERNAL TEST 1 (MODULE 1 & 2)			
MODULE 3: Word Classes and part-of-speech tagging: English word classes - Tagsets for English -Part-of-speech tagging, Context-Free Grammars for English: Constituency - Context-Free rules and trees, Sentence-level constructions - The noun phrase - The verb phase and sub categorization Finite-State and Context-Free grammars - Grammars and human processing. Parsing with Context-Free Grammars.			15
MODULE 4: Text Mining: Named Entity Recognition, Categorization – Information Extraction, Extraction based Categorization Decision trees, Naive Bayes, Support Vector Machines, Nearest Neighbour. ,Evaluation metrics Clustering- Hierarchical Clustering Document Classification and routing- finding and organizing answers from Text search – use of categories and clusters for organising retrieval results, Document Summarization using Lexical Chains – Pattern Extraction			15
INTERNAL TEST 2 (MODULE 3 & 4)			
MODULE 5: Sentiment Analysis- Sentiment Classification Using Supervised Learning and Unsupervised Learning, Sentiment Rating Prediction, Cross Domain Sentiment Classification Opinion Mining, Basic Rules of Opinions and Compositional Semantics, Aspect Extraction, Simultaneous Opinion Lexicon Expansion and Aspect Extraction, Grouping Aspects into Categories, Entity, Opinion Holder and Time Extraction.			20
MODULE 6: Word Sense Disambigution, Coreference resolution; handling sparsity, domain			20

adaptation and representations; combining logic and probability, Markov logic and NLP, ontology extension. Generic Issues: Multilinguality, Multimodality, Text and Images – Modality Integration -: Machine Translation –-Discourse Processing Case Study: Lemmatization, Stemming,Tokenization and Tagging using NLTK Tool Kit		
END SEMESTER EXAM		

COURSE CODE	COURSE NAME	L-T-P:C	YEAR
04 CS 7109	BIG DATA PROCESSING	3-0-0:3	2015

Pre-requisites:

Course Objectives:

- Students will be able to understand the Big Data concepts and will be able to apply the same in various engineering and technological applications

Syllabus

Big Data and Hadoop- - -Hadoop distributions-Developing enterprise applications. HDFS- HDFS Architecture-Applicability of HDFS- HBase-High Level HBase Architecture-HBase schema design. MapReduce- Processing data with MapReduce- Execution pipeline-Designing MapReduce implementations. Hive-Features - Hive architecture –Hive in the hadoopecosysytem — HiveQL – Data Definition-Data Manipulation-Queries,Pig- Comparison with Map-Reduce-Pig's Data Model-Introduction to Pig Latin-Input and output-Relational operations-User Defined Functions-Advanced Pig latin-Advanced Relational operations-Joining datasets-Join-Cogroup- Controlling Execution-Pig Latin Preprocessor, Oozie- Oozie Job Execution Model-Scheduling workflow using Oozie coordinator Spark-Spark Architecture-Spark Streaming-Streaming Operator-Spark SQL-Resilient Distribution Dataset(RDD).

Course Outcome:

The student will be thorough with the concept of Big data that can be used to develop Enterprise applications.

Text Books:

1. Boris Lublinsky Kevin T. Smith Alexey Yakubovich ,PROFESSIONAL Hadoop® Solutions
2. Alan Gates, "Programming Pig", O'Reilly Media; 1st Edition, October, 2011.

References:

14. Snehalatha, Scheduling Workflows using Oozie Coordinator, DeveloperIQ Magazine, August 28, http://developeriq.in/articles/2013/aug/28/scheduling-workflows-using-oozie-coordinator/
15. Spark Streaming, Data-Intensive systems: Real-Time Stream Processing, Duke University Department of Computer Science 2012 at http://www.cs.duke.edu/~kmoses/cps516/dstream.html
16. Edward Capriolo ,Dean Wampler ,Jason Rutherglen, "Programming Hive", O'Reilly Media; 1 edition , October, 2012
17. Tom White ,"Hadoop: The Definitive Guide", O'Reilly Media 3rd Edition,May6, 2012
18. Chuck Lam , "Hadoop in Action" ,Manning Publications; 1st Edition ,December, 2010
19. Donald Miner, Adam Shook, "MapReduce Design Patterns", O'Reilly Media ,November 22, 2012

COURSE PLAN

COURSE CODE:	COURSE TITLE	CREDITS	
04 CS 7109	**BIG DATA PROCESSING**	**3-0-0:3**	
MODULES		**Contact Hours**	**Sem. Exam Marks (%)**
MODULE 1: **Big Data and Hadoop**- Hadoop Ecosystem- Core components-Hadoop distributions-Developing enterprise applications. HDFS- HDFS Architecture-Applicability of HDFS-Using HDFS files-Hadoop specific file types-HDFS federation and high availability. HBase-High Level HBase Architecture-HBase schema design-New HBase Features-Managing metadata with HCATALOG.		7	15
MODULE 2: **MapReduce-** Processing data with MapReduce- Execution pipeline-Designing MapReduce implementations-Using MapReduce as a framework for parallel processing-Face Recognition Example-Simple Data Processing with MapReduce-Inverted Indexes Example-Building joins with MapReduce-Road Enrichment Example-Link Elevation Example-Building iterative MapReduce Applications-Solving Linear Equation Example-To MapReduce or not to MapReduce?-Common MapReduce Design Gotchas.		6	15
INTERNAL TEST 1 (MODULE 1 & 2)			
MODULE 3: **Hive-**Features - Hive architecture –Hive in the hadoopecosysytem – Datatypes and file formats –primitive and collection datatypes – HiveQL – Data Definition-Data Manipulation-Queries.		6	15
MODULE 4: **Pig-**Features and uses- Comparison with Map-Reduce-Pig's Data Model-Introduction to Pig Latin-Input and output-Relational operations-User Defined Functions-Advanced Pig latin-Advanced Relational operations-Joining datasets-Join-Cogroup- Controlling Execution-Pig Latin Preprocessor		6	15
INTERNAL TEST 2 (MODULE 3 & 4)			
MODULE 5: **Oozie**-Functional Components-Oozie Job Execution Model-Scheduling workflow using Oozie coordinator-Oozie coordinator components and variables-Oozie coordinator lifecycle operation.		9	20
MODULE 6: **Spark-**Spark Architecture-Spark Streaming-Streaming Operator-Spark SQL-Resilient Distribution Dataset(RDD).		8	20
END SEMESTER EXAM			

COURSE CODE	COURSE NAME	L-T-P:C	YEAR
04 CS 7111	COMPUTER VISION	3-0-0:3	2015

Pre-requisites:

Course Objectives:

- To understand the basics of Digital image and to apply the knowledge on Image enhancement and image analysis on emerging applications

Syllabus

Digital image Representation- Functional Units of an Image processing system ;Image sampling and Quantization – grayscale resolution – pixel relationship; Image Transforms – Unitary Transform, Discrete Fourier Transform, Cosine Transform, Sine Transform, Hadamard Transform, Slant and KL Transform;Image Enhancement – Histogram processing – Spatial operations – Image smoothing;Color Image Processing; Image restoration and compression Degradation Model ; Compression Models – Error Free Compression – Lossy Compression – International Image Compression Standards; Spatial feature Extraction Transform feature ; Boundary Representation-Region Representation-Moment Representation; Image Segmentation;Sensing 3D shape; Emerging IT applications

Course Outcome:

The student will demonstrate the ability to apply the various image processing concepts and principles into applications.

Text Books:

1. Fundamentals of Digital Image Processing-A. K. Jain ,Prentice Hall
2. Image Processing and machine vision-Milan Sonka,VaclavHlavae, Roger Boyle

References:

1. Pattern Recognition Principles-J.T. Tou and R. C. Gonzalez
2. Syntactic Pattern Recognition and applications. King Sun Fun
3. Computer vision-Fairhurst (PHI).

COURSE PLAN

COURSE CODE:	COURSE TITLE	CREDITS	
04 CS 7111	**COMPUTER VISION**	**3-0-0:3**	
MODULES		**Contact Hours**	**Sem. Exam Marks (%)**
MODULE 1: Digital image Representation – Functional Units of an Image processing system. Visual perception – Image Model _ Image sampling and Quantization – grayscale resolution – pixel relationship		7	15
MODULE 2: Image Transforms – Unitary Transform, Discrete Fourier Transform, Cosine Transform, Sine Transform, Hadamard Transform, Slant and KL Transform		7	15
INTERNAL TEST 1 (MODULE 1 & 2)			
MODULE 3: Image Enhancement – Histogram processing – Spatial operations – Image smoothing – Image Sharpening – Color Image Processing methods- Color Image Models.		6	15
MODULE 4: Image restoration and compression Degradation Model – Discrete Formulation – Circulant matrices – Constrained and Unconstrained restoration geometric transformations fundamentals . Compression Models – Error Free Compression – Lossy Compression – International Image Compression Standards		7	15
INTERNAL TEST 2 (MODULE 3 & 4)			
MODULE 5: Image Analysis and Computer Vision: Spatial feature Extraction – Transform feature – Edge detection-Boundary Representation-Region Representation-Moment Representation- Structure-Shape Features-Texture-Scene Matching and detection- Image Segmentation- Classification techniques-Morphology-Interpolation		7	20
MODULE 6: Sensing 3D shape: how the 3rd dimension changes the problem. Stereo 3D description, 3D model, matching, TINA, Direct 3D sensing-structured light, range finders, range image segmentation - Emerging IT applications: Recognition of characters, Fingerprints and faces-Image databases		8	20
END SEMESTER EXAM			

COURSE CODE	COURSE NAME	L-T-P:C	YEAR
04 CS 7113	COMPILER DESIGN	3-0-0:3	2015

Pre-requisites:

Course Objectives:

- To understand the basics of compiler design and to apply the optimization techniques.

Syllabus

Principles Of Compiler-Compiler Structure; Optimization-importance of Code optimization – Structure of Optimizing compilers; Introduction and Overview – Symbol table structure – Local and Global Symbol table management; Intermediate representations; Run-time support – Register usage – local stack frame; Optimization – Early optimization – Constant folding; Procedure optimization – in-line expansion – leaf routine optimization and shrink wrapping; Register allocation and assignment – graph coloring – control flow and low level optimizations; Code Scheduling – Instruction scheduling – Speculative scheduling; Case Studies – Sun Compilers for SPARC – IBM XL Compilers – Alpha compilers – PA –RISC assembly language – COOL – (Classroom Object oriented language) ; Compiler testing tools – SPIM

Course Outcome:

The student will be thorough with the compiler structure and the concept of optimization of code to make the best utilization of the underlying hardware resources.

Text Books:

1. Steven S Muchnik, “Advanced Compiler Design and Implementation”, Morgan Kaufmann
2. Keith D Cooper and Linda Torczon, “Engineering a Compiler”, Elsevier Science, India.

References:

1. Sivarama P. Dandamudi, “Introduction to Assembly language programming: for Pentium and RISC processors”.
2. Allen Holub “Compiler Design in C”, Prentice Hall of India, 1990.
3. Alfred Aho, Ravi Sethi V., Jeffery Ullman D., “Compilers Principles, Techniques and Tools” Addison Wesley, 1988.
4. Charles N. Fischer, Richard J. Leblanc, “Crafting a compiler with C”, Benjamin-Cummings Publishing Co., Inc. Redwood City, CA, USA

COURSE PLAN

COURSE CODE:	COURSE TITLE	CREDITS	
04 CS 7113	**COMPILER DESIGN**	**3-0-0:3**	
MODULES		**Contact Hours**	**Sem. Exam Marks (%)**
MODULE 1: Principles Of Compiler – Compiler Structure – Properties of a Compiler – Optimization – Importance of Code optimization – Structure of Optimizing compilers – placement of optimizations in optimizing compilers – ICAN		9	15
MODULE 2: Introduction and Overview – Symbol table structure – Local and Global Symbol table management. Intermediate representation – Issues High level, medium level, low level intermediate languages – MIR, HIR, LIR – ICAN for Intermediate code		9	15
INTERNAL TEST 1 (MODULE 1 & 2)			
MODULE 3: Run-time support – Register usage – local stack frame – run-time stack – Code sharing – position– independent code – Symbolic and polymorphic language support		8	15
MODULE 4: Optimization – Early optimization – Constant folding – scalar replacement of aggregates Simplification – value numbering – constant propagation – redundancy elimination – loop optimization. Procedure optimization – in-line expansion – leaf routine optimization and shrink wrapping		9	15
INTERNAL TEST 2 (MODULE 3 & 4)			
MODULE 5: Register allocation and assignment – graph coloring – control flow and low level optimizations - Inter-procedural analysis and optimization – call graph – data flow analysis – constant propagation – alias analysis – register allocation – global		10	20
MODULE 6: Code Scheduling – Instruction scheduling – Speculative scheduling – Software pipelining – trace scheduling – percolation scheduling- Case Studies – Sun Compilers for SPARC – IBM XL Compilers – Alpha compilers – PA –RISC assembly language – COOL – (Classroom Object oriented language) - Compiler testing tools – SPIM		11	20
END SEMESTER EXAM			

COURSE CODE	COURSE NAME	L-T-P:C	YEAR
04 CS 7115	PARALLEL ALGORITHMS	3-0-0:3	2015

Pre-requisites:

Course Objectives:

- To understand the various concepts of parallel algorithms used in processor level to application level.

Syllabus

PRAM Model - PRAM Algorithms – Parallel Reduction – Prefix Sums; List Ranking; Classifying MIMD Algorithms - Hypercube SIMD Model – Shuffle Exchange SIMD Model; Matrix Multiplication on 2-D Mesh, Hypercube and Shuffle Exchange SIMD Models ; Enumeration Sort -Lower Bound on Parallel Sorting – Odd-Even-Transposition Sort; OpenMP- Introduction, The OpenMP for Pragma- Dijkstra Shortest-Path Algorithm with Parallel for Loops; P-Depth Search - Breadth Death Search – Breadth First Search –Connected Components; Minimum Cost Spanning Tree .– Sollin's Algorithm – Kruskal's Algorithm.

Course Outcome:

The student will demonstrate the ability to apply principles of parallel algorithms in programming level and solving classical problems.

Text Books:

5. Michael J. Quinn, Parallel Computing : Theory & Practice, Tata McGraw Hill,Second Edition,

References:

1. AnanthGrame, George Karpis, Vipin Kumar and Anshul Gupta,
2. Introduction to Parallel Computing, 2nd Edition, Addison Wesley, 2003
3. Norm Matloff, Programming on Parallel Machines, University of California, Davis 2012

COURSE PLAN

COURSE CODE:	COURSE TITLE	CREDITS	
04 CS 7115	PARALLEL ALGORITHMS	3-0-0:3	
MODULES		Contact Hours	Sem. Exam Marks (%)
MODULE 1: PRAM Model - PRAM Algorithms – Parallel Reduction – Prefix Sums -List Ranking – Preorder Tree Traversal – Merging Two Sorted Lists – Graph Coloring – Reducing Number of Processors		7	15
MODULE 2: Classifying MIMD Algorithms - Hypercube SIMD Model – Shuffle Exchange SIMD Model – 2D Mesh SIMD Model – UMA Multiprocessor Model – Broadcase – Prefix Sums.		7	15
INTERNAL TEST 1 (MODULE 1 & 2)			
MODULE 3: Matrix Multiplication on 2-D Mesh, Hypercube and Shuffle Exchange SIMD Models – Algorithms for Multiprocessors – Algorithms for Multicomputers.		7	15
MODULE 4: OpenMP- Introduction, The OpenMP for Pragma- Dijkstra Shortest-Path Algorithm with Parallel for Loops, Task Directive- Quicksort, OpenMP Synchronization Issues		7	15
INTERNAL TEST 2 (MODULE 3 & 4)			
MODULE 5: Enumeration Sort -Lower Bound on Parallel Sorting – Odd-Even, Transposition Sort – Bitonic Merge –Complexity of Parallel Search –Searching on multiprocessors – Ellis's Algorithm – Manber and Ladner's Algorithm.		7	20
MODULE 6: P-Depth Search- Breadth Death Search – Breadth First Search –Connected Components – All pair Shortest Path – Single Source Shortest Path- Minimum Cost Spanning Tree-Sollin's Algorithm – Kruskal's Algorithm		7	20
END SEMESTER EXAM			

COURSE CODE	COURSE NAME	L-T-P:C	YEAR
04 CS 7193	PROJECT PHASE - I	0-0-12: 6	2015

Course Objectives:

The project work aims to develop the work practice in students to apply theoretical and practical tools/techniques to solve real-life problems related to industry and current research.

The project work can be a design project/experimental project and/or computer simulation project on any of the topics related to the stream of specialisation. The project work is chosen/allotted individually on different topics. Work of each student shall be supervised by one or more faculty members of the department. The students shall be encouraged to do their project work in the parent institute itself. If found essential, they may be permitted to carry out their main project outside the parent institute, subject to the conditions specified in the M. Tech regulations of the APJ Abdul Kalam Technological University. Students are encouraged to take up industry problems in consultation with the respective supervisors.

The student is required to undertake the main project phase-1 during the third semester and the same is continued in the 4th semester (Phase 2). Phase-1 consist of preliminary work, two reviews of the work and the submission of a preliminary report. First review would highlight the topic, objectives, methodology and expected results. Second review evaluates the progress of the work, preliminary report and scope of the work which is to be completed in the 4th semester.

COURSE CODE	COURSE NAME	L-T-P: C	YEAR
04 CS 7194	PROJECT PHASE - II	0-0-21: 12	2015

Main project phase II is a continuation of project phase-I started in the third semester. There would be two reviews in the fourth semester, first in the middle of the semester and the second at the end of the semester. First review is to evaluate the progress of the work, presentation and discussion. Second review would be a pre -submission presentation before the evaluation committee to assess the quality and quantum of the work done. It is encouraged to prepare at least one technical paper for possible publication in journals or conferences. The project report (and the technical paper(s)) shall be prepared without any plagiarised content and with adequate citations, in the standard format specified by the Department /University.