KERALA TECHNOLOGICAL UNIVERSITY

Master of Technology

Curriculum, Syllabus and Course Plan

PALAKKAD CLUSTER - 08

SCHEME AND SYLLABI

FOR

M. Tech. DEGREE PROGRAMME

IN

COMPUTER SCIENCE AND ENGINEERING

(2015 ADMISSION ONWARDS)

VISION AND MISSION OF THE PROGRAMME

VISION

To become the frontiers of computer science and spearhead cost effective ICT solutions for the betterment of society.

MISSION

Impart quality education to the students in the domain of Computer Science and Engineering with a focus to create and disseminate the knowledge of problem solving using computers.

PROGRAM EDUCATIONAL OBJECTIVES (PEO)

1. To empower the graduates with a strong and in-depth foundation in theory of computer science.
2. To draw the attention of the graduates towards new technologies and induce urge for research and new learning methods.
3. To develop professional skills by enabling them to solve large real world and computational problems
4. To equip the graduates with soft skills and inculcate managerial skills in them.
5. To inculcate professional ethics in graduates and make them a good social human who can contribute to development of society through their professional activities.

PROGRAM OUTCOME (POs)

A. Graduates will demonstrate the ability to apply computer science principles and computational tools for problem solving
B. Graduates will possess knowledge in core research areas and contemporary issues of dynamically changing technology
C. Graduates will possess the ability to effectively communicate and present new technical ideas and disseminate knowledge
D. Graduates will be able to develop complex and efficient software and computational tools
E. Graduates will exhibit the ability to analyze emerging research problems and find effective and efficient solutions
F. Graduates will be able to identify new trends in emerging technologies and evaluate them
G. Graduates will possess the skill to work with professional ethics for sustainable development

SEMESTER 1

Examination Slot	Course Number	Name	L-T-P	Internal Marks	End Semester Examination		Credits
					Marks	Duration (hours)	
A	08 CS 6011	Operating System Design	4-0-0	40	60	3	4
B	08 CS 6021	Advanced Data Structures	3-0-0	40	60	3	3
C	08 CS 6031	Advanced Database Technology	3-0-0	40	60	3	3
D	08 CS 6041	Mathematical Foundations of Computer Science	3-0-0	40	60	3	3
E	08 CS 6051	Elective I	3-0-0	40	60	3	3
S	08 GN 6001	Research Methodology	0-2-0	100			2
T	08 CS 6071(P)	Seminar I	0-0-2	100			2
U	08 CS 6081(P)	Advanced Data Structures Lab	0-0-2	100			2
		TOTAL	**16-2-4**	**500**	**300**	**-**	**22**

Note: Remaining 8 hours / week is meant for departmental assistance by students

TOTAL CONTACT HOURS : 22
TOTAL CREDITS : 22

Elective I

08 CS 6051(A) Computational Intelligence
08 CS 6051(B) Advanced Network Technologies
08 CS 6051(C) Web Services

SEMESTER 2

Examination Slot	Course Number	Name	L-T-P	Internal Marks	End Semester Examination		Credits
					Marks	Duration (hours)	
A	08 CS 6012	Advanced Compiler Design	4-0-0	40	60	3	4
B	08 CS 6022	Information Retrieval	3-0-0	40	60	3	3
C	08 CS 6032	Evolutionary Computing	3-0-0	40	60	3	3
D	08 CS 6042	Elective II	3-0-0	40	60	3	3
E	08 CS 6052	Elective III	3-0-0	40	60	3	3
V	08 CS 6062(P)	Mini Project	0-0-4	100			2
U	08 CS 6072 (P)	Data mining and Analytics Lab	0-0-2	100			1
		TOTAL	**16-0-6**	**400**	**300**	**-**	**19**

Note: Remaining 8 hours / week is meant for departmental assistance by students

TOTAL CONTACT HOURS : 22
TOTAL CREDITS : 19

Elective II

08 CS 6042(A) Advanced Language Technologies
08 CS 6042(B) Big Data
08 CS 6042(C) Algorithms and Complexity
08 CS 6042(D) Software Architecture and Design

Elective III

08 CS 6052(A) Cloud Computing
08 CS 6052(B) Data Compression
08 CS 6052(C) Bioinformatics

SEMESTER 3

Examination Slot	Course Number	Name	L-T-P	Internal Marks	End Semester Examination		Credits
					Marks	Duration (hours)	
A	08 CS 7011	Elective IV	3-0-0	40	60	3	3
B	08 CS 7021	Elective V	3-0-0	40	60	3	3
T	08 CS 7031(P)	Seminar II	0-0-2	100			2
W	08 CS 7041(P)	Masters Research Project Phase 1	0-0-12	50			6
		TOTAL	**6-0-14**	**230**	**120**	**-**	**14**

Note: Remaining 10 hours / week is meant for departmental assistance by students

TOTAL CONTACT HOURS : 20
TOTAL CREDITS : 14

Elective IV

08 CS 7011(A) Unix Internals

08 CS 7011(B) Crypto Complexity

08 CS 7011(C) Ethical Hacking

Elective V

08 CS 7021(A) Theoretical Computer Science

08 CS 7021(B) Semantic Web

08 CS 7021(C) Advanced Architecture

SEMESTER 4

Examination Slot	Course Number	Name	L-T-P	Internal Marks	End Semester Examination		Credit
					Marks	Duration (hours)	
W	08 CS 7012(P)	Masters Research Project Phase 2	0-0-21	70	30		12
		TOTAL	**0-0-21**	**70**	**30**	**-**	**12**

TOTAL CONTACT HOURS : 23
TOTAL CREDITS : 12

TOTAL NUMBER OF CREDITS: 67

SEMESTER - I

Syllabus and Course Plan

Course No.	Course Name	L-T-P	Credits	Year of Introduction
08 CS 6011	Operating System Design	4-0-0	4	2015

Course Objectives

- To provide a design oriented approach towards operating systems;
- To understand the different functions of the operating system in detail;
- To perform case studies of some of the operating systems such as Windows NT and Linux.

Syllabus

Operating System design techniques, Implementing processes, Parallel systems, Interprocess communication patterns, Deadlocks, Memory management, Virtual memory, I/O devices , I/O subsystems, File systems, File system organization, Resource management and protection, case study in Windows NT and Linux.

Expected Outcome

- Students will have the ability to apply the design techniques of operating systems.
- Students will be able to compare the different operating systems available.

References

1. Charles Crowley, Operating systems- a design oriented approach, Tata Mcgraw-Hill edition, New Delhi, 1998.
2. Silberschatz and Galvin, Operating system concepts, 8th edition, Addison Wesley, 2008.
3. Tanenbaum Andrew S, Modern Operating system , 3rd edition, Eaglewood Cliffs, NJ: Prentice Hall, 2008
4. Gary J.Nutt, Operating systems- A modern perspective, 3rd edition, Addison Wesley, 2004.
5. Stallings William, Operating systems- Internals and design principles, 7th Edition, PHI, 2012

COURSE PLAN

Module	Contents	Hours Allotted	% of Marks in End-Semester Examination
I	Introduction- Introduction, Hardware interface, Operating system interface. Design problems, Operating System design techniques. Implementing processes – The system call interface, system initialization, process switching, system call interrupt handling, disk driver Subsystem, implementation of waiting.	9	15

II	Interprocess communication patterns- competing and co-operating, problems, race conditions and atomic actions, new message passing system calls, IPC pattern: mutual exclusion, signaling and rendezvous models, producer-consumer and client server models. Deadlocks- Conditions for deadlock, dealing with deadlocks, two-phase locking,	6	15
FIRST INTERNAL EXAM			
III	Memory management- levels of memory management, linking and loading process, memory management design, dynamic memory allocation, keeping track of blocks, memory management system calls. Virtual memory- Fragmentation and compaction, dealing with fragmentation- paging, swapping, Implementing Virtual memory, page replacement- global and local page replacement algorithms, thrashing and load control, Segmentation-Virtual memory with segmentation, sharing memory. Design techniques- examples of multiplexing and late binding.	10	15
IV	I/O devices - devices and controllers, terminal devices, communication devices, disk devices, disk controllers, SCSI interfaces, tape devices, CD devices. I/O subsystems- I/O system software, disk device driver access strategies, modeling disks, unification of files and device, generalized disk device drivers, disk caching.	10	15
SECOND INTERNAL EXAM			
V	File systems- File abstraction, naming, file system objects and operations.–File System Implementation-Data structures -organization and control flow,Case study in Windows NT and Unix. File system organization- organization, file descriptors, locating file blocks on disks .	10	20
VI	Design techniques- Caching, hierarchical names and naming of objects.Resource management and protection-resources in an OS, resource management issues, types of resources, integrated scheduling, queuing models of scheduling, protection of resources,user authentication, mechanism for protecting hardware resources, representation of protection information, mechanisms for software protection, – case study in Windows NT and Unix.	11	20
END SEMESTER EXAM			

Course No.	Course Name	L-T-P	Credits	Year of Introduction
08 CS 6021	Advanced Data Structures	3-0-0	4	2015

Course objectives

To give the Student :

- An introduction to advanced data structures
- Develop ability to select a suitable data structure to solve a computational problem.

Syllabus

Fundamental concepts and overview, Advanced search structures, Randomized structures, Structures for priority queue, Multi dimensional data structures.

Expected Outcome

Students who successfully complete this course will understand the fundamental concepts of advanced data structures; Students will be able to analyse the problem in terms of data operations and could select the data structure which makes the solution highly efficient.

References

1. Thomas H.Cormen, Charles E. Leiserson, Ronald L Rivest, Clifford Stein, "Introduction to Algorithms", MIT Press, Massachusetts, 2009.
2. Sartaj.Sahni "Data structures, Algorithms and Applications in C++", University press (India) pvt ltd, 2nd edition, 2004.
3. Subrahmanian V S, "Principles of Multimedia Database Systems", Morgan Kaufman, USA, 1998.
4. Mark Allen Weiss, "Data structures and Algorithm Analysis in C++", 4th edition, 2014, Pearson Education, New Delhi.
5. Ellis Horowitz, SartajSahni, Dinesh P Mehta, "Fundamentals of Data Structures in C++",2nd edition, Universities Press (India) Pvt. Ltd, 2008.
6. Michael T.Goodrich, R.Tamassia and D.Mount,"Data structures and Algorithms in C++", Wiley student edition, John Wiley and Sons, 2nd edition, 2011.
7. R- Tree , http://www-db.deis.unibo.it/courses/SI-LS/papers/Gut84.pdf

COURSE PLAN

Module	Contents	Hours Allotted	% of Marks in End-Semester Examination
I	**Basic Concepts:** Abstract Data Types, Need of Different Data Structures, Applications of Data Structures, Case Study- Symbol Table, Binary Search Tree, Heap, Review of Complexity Notations.	6	15
II	**Search Structures:** AVL Trees, Red-Black Trees, B Trees, B+ Trees, Splay Trees.	6	15
	INTERNAL TEST I		

III	**Randomized Structures:** Skip Lists, Treaps, Dynamic Hash Tables, Universal Hash Functions, Amortized Analysis.	6	15
IV	**Structures For Priority Queues:** Min-Max Heap, Leftist Heaps, Skewed Heaps, Applications of each Structure	7	15
INTERNAL TEST II			
V	Binomial Heaps, Fibonacci Heaps, Applications, Dijkstra's Algorithm Using Fibonacci Heap.	9	20
VI	**Multi-Dimensional Structures:** Segment Trees, K-D Trees, Point Quad Trees, MX-Quad Trees, R-Trees, Applications of Multidimensional Structures.	9	20
END SEMESTER EXAM			

Course No.	Course Name	L-T-P	Credits	Year of Introduction
08 CS 6105	Advanced Database Technology	3-0-0	3	2015

Course objectives

- To study in detail the advanced technology design in database
- To understand parallel and distributed database technology
- To gain an insight into web database, graph and no sql databases

Syllabus

Overview of relational database and functional dependencies, parallel and distributed database design, storage and transaction processing, next gen databases, namely, web, No SQL and graph databases, emerging technologies in database – mobile database.

Expected Outcome

At the end of this course the student will be able to appreciate the various database designs and use the appropriate technolgy for the application. The student will be able to design a database with optimal representation for the problem.

References

1. R. Elmasri, S.B. Navathe, "Fundamentals of Database Systems", 5/e, Pearson Education/Addison Wesley, 2011
2. Thomas Cannolly and Carolyn Begg, "Database Systems, A Practical Approach to Design, Implementation and Management", 3/e, Pearson Education, 2010.
3. Henry F Korth, Abraham Silberschatz, S. Sudharshan, "Database System Concepts", 5/e, Tata McGraw Hill, 2006.
4. Raghu Ramakrishnan, Johannes Gehrke, "Database Management Systems", McGraw Hill, Third Edition, 2004.
5. Serge Abiteboul, IoanaManolescu, Philippe Rigaux, Marie -Christine Rousset, Pierre Senellart, Web Data Management, Cambridge University Press, 450 pages,2011. (also available online)

COURSE PLAN

Module	Contents	Hours Allotted	% of Marks in End-Semester Examination
I	Database Design Theory: Functional dependencies- Multivalued dependencies and fourth normal form-Join dependencies and fifth normal form- Algorithms for relational database schema design.Query Processing and Query optimization: Algorithms for query processing-Heuristics based Query optimization- Semantic query optimization.	6	15
II	Parallel and Distributed Databases: Database System Architectures: Centralized and Client-Server Architectures – Server System Architectures – Parallel Systems- Distributed Systems –Parallel Databases: I/O Parallelism – Inter and Intra Query Parallelism – Inter and Intra operation Parallelism.	9	15
	FIRST INTERNAL EXAM		
III	Distributed Database Concepts - Distributed Data Storage – Distributed Transactions – Commit Protocols – Concurrency Control – Distributed Query Processing –Three Tier Client Server Architecture- Case Studies.	9	15
IV	Next Generation Databases: Web databases – XML – Semi structured data model – Implementation issues for semi structured data – XPath and XQuery.	6	15
	SECOND INTERNAL EXAM		
V	NoSQL Databases – Key-value data stores – Column store –Case Study- Graph Databases – Basic concepts	6	20
VI	Emerging Technology: Mobile Databases: Location and Handoff Management - Effect of Mobility on Data Management - Location Dependent Data Distribution - Mobile Transaction Models - Concurrency Control - Transaction Commit Protocols - Mobile database Recovery: Log management in mobile database systems - Mobile database recovery	6	20

	schemes.		
END SEMESTER EXAM			

Course No.	Course Name	L-T-P	Credits	Year of Introduction
08 CS 6041	Mathematical Foundations of Computer Science	3-0-0	3	2015

Course objectives

To introduce the mathematical theory relevant to Computer Science

Syllabus

Linear Algebra- Matrix operations-Vector Algebra- Probability-Bayesian Networks-Markov Chains-Transition Probability –Classification-Continuous Time Markov Chains Finite state continuous time Markov chains- Simple Markovian Queues -Queueing Model

Expected Outcome

The student will be able to appreciate and understand the concepts relevant to the problems in computer science and apply the same for developing a mathematical model for the problem at hand.

References

1. E. Kreizig: Advanced Engineering Mathematics. Wiley, 10th edition, 2010.
2. S. M. Ross, Introduction to Probability Models, Harcourt Asia Pvt. Ltd. and Academic Press, 10th edition, 2010.
3. Oliver C. Ibe: Fundamentals of Applied Probability and Random Processes. Academic Press/Elsevier. 2007.
4. John B Thomas, An Introduction to Applied Probability and Random Processes, John Wiley & Sons.

COURSE PLAN

Module	Contents	Hours Allotted	% of Marks in End-Semester Examination
I	Linear Algebra: Matrix operations, Eigen values and Eigen vectors, LU decomposition, Singular Value decomposition, Review of Vector Algebra	6	15

II	Probability: Bayes' Theorem, Bayesian Networks, Bayesian Inference, some applications.	6	15
FIRST INTERNAL EXAM			
III	Markov Chains: Definition, Examples, Transition Probability Matrices of a Markov Chain, Classification of states and chains, Basic limit theorem, Limiting distribution of Markov chains.	7	15
IV	Continuous Time Markov Chains: General pure Birth processes and Poisson processes, Birth and death processes, Finite state continuous time Markov chains.	7	15
SECOND INTERNAL EXAM			
V	Queueing Theory: Simple Markovian Queues - Queue Model I [(M/M/1):(∞/FIFO)], Queue Model II [(M/M/s):(∞/FIFO)], Queue Model III [(M/M/1):(k/FIFO)], Queue Model IV [(M/M/s):(k/FIFO)].	8	20
VI	Non-Markovian Queues and Queue Networks: M/G/1 Queueing Model –M/G/1: Single-server queues with Poisson Input and General Service, Pollaczek-Khintchine Formula, Queue Networks: Series Queue with blocking, Two-Stage Tandem Queues.	8	20
END SEMESTER EXAM			

Course No.	Course Name	L-T-P	Credits	Year of Introduction
08 CS 6051(A)	Computational Intelligence	3-0-0	3	2015

Course Objectives

To provide the students with the concepts of intelligence in computing. Gives an overview of various styles of Representing Knowledge, Expert system learning, genetic algorithm and an introduction to AI programming languages like LISP and PROLOG.

Syllabus

Artificial Intelligence-History and Applications, Predicate Calculus, Prepositional calculus-Structures and Strategies for State Space Search-Heuristic Search, Production Systems Knowledge representation – Strong method problem Solving-Advanced Topics for problem Solving. Machine Learning- Symbol based, Connectionist, Social and Emergent models of learning, The Genetic Algorithm - Introduction to Natural Language Processing. Languages and Programming Techniques for AI - Introduction to PROLOG and LISP.

Expected Outcome

Student will be able to understand the adaptive mechanisms of Artificial Intelligence and can apply these concepts to solve Engineering related problems.

References

1. GEORGE.F.LUGER, Artificial Intelligence- Structures and Strategies for Complex Problem Solving, 4/e, 2002, Pearson Education.
2. E. RICH, K.KNIGHT, Artificial Intelligence, 2/e, Tata McGraw Hill
3. WINSTON. P. H, LISP, Addison Wesley
4. IVAN BRATKO, Prolog Programming for Artificial Intelligence, 3/e, Addison Wesley, 2000.

COURSE PLAN

Module	Contents	Hours Allotted	% Marks in End of Semester Examination
I	AI- History and Applications, Knowledge representation - Propositional calculus, Predicate Calculus, Structures and Strategies for state space search- Data driven and goal driven search, Depth First and Breadth First Search, DFS with Iterative Deepening	7	15
II	Heuristic Search- Best First Search, A* Algorithm, AO* Algorithm, Using heuristics in games- Minimax Search, Alpha Beta Procedure, Production Systems, AI Representational Schemes- Semantic Nets, Conceptual Dependency, Scripts, Frames,Introduction to Agent based problem solving.	7	15
FIRST INTERNAL EXAM			
III	Machine Learning- Symbol based and Connectionist- ID3 Decision Tree Induction Algorithm, Knowledge and learning, Unsupervised and Reinforcement learning, Perceptron learning, Back Propagation Learning, Competitive Learning, Hebbian Coincidence learning.	8	15
IV	Social and Emergent models of learning, The Genetic Algorithm, Genetic Programming,Theorem proving by Resolution, Answer Extraction.	7	15
SECOND INTERNAL EXAM			
V	Introduction to Natural Language Processing. Overview of Expert System Technology- Rule based Expert Systems	6	20

VI	Introduction to PROLOG and LISP, Introduction to PROLOG and LISP, Search strategies and Logic Programming in LISP, Production System examples in PROLOG.	7	20
END SEMESTER EXAM			

Course No.	Course Name	L-T-P	Credits	Year of Introduction
08 CS 6051(B)	Advanced Network Technologies	3-0-0	3	2015

Course Objectives

To give the Student:-

- In-depth knowledge in basic network design and technologies.
- Technical skills that will enable them independently or collectively do the project works that require the application of the theory they have studied

Syllabus

Building a network, Transport Layer, Network and Routing, VOIP, Ubiquitous Computing, VPN, Understanding Storage Networking, Network Troubleshooting, Components and OS.

Expected Outcome

Students who successfully complete this course will have the ability to design and experiment with computer networks; Students will be able to troubleshoot and appreciate computer networks and latest trends in networking.

Reference

1. John D. Sloan, ''Network Troubleshooting", Aug'2001 - O'Reilly.
2. Radic Perlman, "Interconnections: Bridges, Routers, Switches andInternetworking Protocols " ,Second Edition, Addison Wesley professional, 1999.
3. Andrew S. Tanenbaum, ''Modem operating system ", Pearson Education

COURSE PLAN

Module	Contents	Hours	% Marks in End-of-Semester Examination

I	**Building a network** – network edge and core – layering and protocols – Internet Architecture - networking devices – modems, routers, switches, gateways. Needs/Principles of Application layer Protocols – Web and HTTP – FTP – Electronic Mail (SMTP, POP3, IMAP, and MIME) – DNS – SNMP	7	15
II	**TRANSPORT LAYER:** Overview of Transport layer – UDP - TCP – Reliable byte stream – connection management – flow control – retransmission - Congestion control - congestion avoidance	6	15
FIRST INTERNAL EXAM			
III	**NETWORK AND ROUTING :** Circuit switching – packet switching – virtual circuit switching - Routing - IP – Global Address – Datagram Forwarding – Subnetting – CIDR - ARP – DHCP – RIP – OSPF - BGP - ICMP – IPv6 - Multicasting – PIM	7	15
IV	**VOIP**- Issues in VOIP — Distributed Computing and Embedded System — Ubiquitous Computing – VPN	6	15
SECOND INTERNAL EXAM			
V	**Understanding Storage Networking** - Storage Networking Architecture — The Storage in Storage Networking, The Network in Storage Networking, Basic Software for Storage Networking — SAN Implementation Strategies. Monitoring and Control — SNMP, V2, V3, RMON, RMON2.	8	20
VI	**Network Troubleshooting, Components and OS** Troubleshooting and Management — Host Configuration, Connectivity, Testing Path Characteristics, Packet Capture, Device Discovery and Mapping — Troubleshooting Strategies — Components — Bridges, Routers and Switches — Network OS — Novel Netware, Linux, Windows 2000 and Macintosh OS	8	20
END SEMESTER EXAM			

Course No.	Course Name	L-T-P	Credits	Year of Introduction
08 CS 6051(C)	Web Services	3-0-0	3	2015

Course Objectives

To provide fundamentals on SOA, SOAP UDDI and XML that lays foundations for the advanced studies in the area of web services

Syllabus

SOA (Service Oriented Architecture), Introduction to Services , Framework for SOA, Web Services Architecture, Interoperability, JSON, RESTLETS, Ruby on Rails, Java Server Faces, Hibernate, XML & Web Service Standards, SOAP, UDDI data Models, From Web Services To Semantic Web Services, Resource Description Framework (RDF), Ontology Basics, Web Ontology Language OWL, Case study.

Expected Outcome

At the end of the course students will be able to

- Understand the use of web services applications.
- Understand the design principles and application of SOAP based web services.
- Perform project in the area of XML

References

1. SanjivaWeerawarana, Francisco Curbera, Frank Leymann, Tony Storey, Donals F. Ferguson, "Web Services Platform Architecture: SOAP, WSDL, WS-Policy, WS-Addressing, WSBPEL, WS-Reliable Messaging and More", 2nd edition, Prentice Hall PRT, 2005.
2. Liyang Yu, "Introduction to the Semantic Web and Semantic Web Services", 1st edition, Chapman & Hall/CRC, 2007.
3. John Hebeler, Matthew Fisher, Ryan Blace, Andrew Perez-Lopez, Mike Dean, "Semantic web programming", 3rd edition, Wiley Publishing Inc, 2009.
4. Grigoris Antoniou and Frank van Harmelen, "A Semantic Web Primer", 2nd Ed., MIT Press, 2008.

COURSE PLAN

Module	Contents	Hours Allotted	% of Marks in End-Semester Examination
I	SOA: (Service Oriented Architecture) : Introduction to Services - Bind, Publish, Find - Framework for SOA – Web Services Architecture, Interoperability – RESTful (Representational State Transfer) Services, WS − Interoperability, JSON, RESTLETS, Ruby on Rails, Java Server Faces, Hibernate.	6	15
II	XML & Web Service Standards :Basics of XML –XML standards − SOAP − Messaging, Encoding, Faults, Data types, WSRouting, WSDL Specification − UDDI Business Registry − UDDI data Models, Types, Inquiry and Publisher APIs.	9	15
FIRST INTERNAL EXAM			

III	From Web Services To Semantic Web Services :Introduction to semantic web services −Resource Description Framework: RDF – Basic elements, Classes and Properties − RDF query, RDF tools, RDF − Semantics.	9	15
IV	Ontology Basics, Web Ontology Language :OWL, sub languages − OWL: Lite, DL, Full. Instance, Classes, Properties, DataType Properties, Object Properties, Operators	6	15
SECOND INTERNAL EXAM			
V	OWL-S: OWL-S: An upper ontology to describe web services, Building blocks, Validating OWL- S documents. Case Study, Swoogle, Architecture and usage of meta-data, FOAF(Friend Of A Friend), Semantic markup, RSS, feeds, semantic web search engines	6	20
VI	Real World Examples & Applications : Case Study, Swoogle, Architecture and usage of meta-data, FOAF(Friend Of A Friend), Semantic markup, RSS, feeds, semantic web search engines	7	20
END SEMESTER EXAM			

Course No.	Course Name	L-T-P	Credits	Year of Introduction
08GN6001	Research methodology	0-2-0	2	2015

Course Objectives

The main objective of the course is to provide a familiarization with research methodology and to induct the student into the overall research process and methodologies. This course addresses:
The scientific research process and the various steps involved formulation of research problem and research design, design of experiments, thesis preparation and presentation, research proposals, publications and ethics; Important research methods in engineering
As a tutorial type course, this course is expected to be more learner centric and active involvement from the learners are expected which encourages self-study and group discussions. The faculty mainly performs a facilitator's role

Syllabus

Overview of research methodology - research process - scientific methods - research problem and design - research design process - formulation of research task, literature review and web as a source - problem solving approaches - experimental research - ex post facto research. Thesis writing - reporting and presentation - interpretation and report writing - principles of thesis writing- format of reporting, oral presentation - seminars and conferences -Research proposals - research paper writing - publications and ethics - considerations in publishing, citation, plagiarism and intellectual property rights. Research methods – modelling and simulation - mathematical modeling – graphs - heuristic optimization - simulation modeling - measurement design – validity – reliability – scaling - sample design - data collection methods and data analysis.

Expected Outcome

At the end of course, the student will be able to:

- Discuss research methodology concepts, research problems, research designs, thesis preparations, publications and research methods.
- Analyze and evaluate research works and to formulate a research problem to pursue research
- Prepare a thesis or a technical paper, and present or publish them
- Apply the various research methods followed in engineering research for formulation and design of own research problems and to utilize them in their research project.

References

1. C. R. Kothari, Research Methodology, New Age International, 2004
2. Panneerselvam, Research Methodology, Prentice Hall of India, New Delhi, 2012.
3. K. N. Krishnaswamy, AppaIyerSivakumar, M. Mathirajan, (2006)) "Management ResearchMethodology, Integration of principles", Methods and Techniques, Pearson Education
4. Deepak Chawla, MeenaSondhi,(2011) "Research Methodology – concepts & cases", Vikas Publishing House
5. J.W Bames, "Statistical Analysis for Engineers and Scientists", McGraw Hill, New York
6. Schank Fr.,(2008) "Theories of Engineering Experiments", Tata Mc Graw Hill Publication
7. John W Best, James V Kahan, (2010) "Research in Education", PHI Learning
8. Sinha, S.C. and Dhiman, A.K. (2002), "Research Methodology", ESS Publications. (2 volumes)

COURSE PLAN

Module	Contents	Hours Allotted	% of Marks in End-Semester Examination
I	**Overview of Research Methodology:** Research concepts – meaning – objectives – motivation - types of research –research process – criteria for good research – problems encountered by Indian researchers - scientific method - research design process	5	15
II	**Research Problem and Design:** Formulation of research task – literature review –methods – primary and secondary sources – web as a source – browsing tools - formulation of research problems – exploration - hypothesis generation - problem solving approaches –Concepts of introduction To TRIZ-experimental research – principles – Laboratory experiment - experimental designs - ex post facto research- qualitative research	5	15
FIRST INTERNAL EXAM			

III	**Thesis writing, reporting and presentation:** significance of report writing-–– principles of thesis writing-different steps in report writing Interpretation in writing – techniques of interpretation – precautions in interpretation - format of reporting - – layout and mechanics of research report -references – tables – figures – conclusions – oral presentation – preparation – making presentation – use of visual aids - effective communication - preparation for and presentation in seminars and conferences	4	15
IV	**Research proposals, publications, ethics and IPR:** Research proposals - development and evaluation –research paper writing – layout of a research paper - journals in engineering – considerations in publishing –concept of impact factor–citations - open access publication - ethical issues -plagiarism – software for plagiarism checking intellectual property right- patenting case studies .	5	15
SECOND INTERNAL EXAM			
V	**Research methods – Modelling and Simulation** : Modelling and Simulation – concepts of modelling –mathematical modelling - composite modelling –modelling with – ordinary differential equations – partial differential equations – graphs-heuristics and heuristic optimization - simulation modeling	5	20
VI	**Research Methods – Measurement, sampling andData acquisition:** Measurement design – errors -validity and reliability in measurement - scaling and scale construction - sample design - sample size determination - sampling errors -data collection procedures - sources of data – data collection methods - data preparation and data analysis	4	20

Course No.	Course Name	L-T-P	Credits	Year of Introduction
08CS 6071 (P)	Seminar I	0-0-2	2	2015

Course Objectives

To assess the debating capability of the student to present a technical topic. Also to impart training to a student to face audience and present his/her ideas and thus creating self esteem and courage that are essential for an engineer. Each student is expected to present a seminar on a topic of current relevance in Computer Science and Engineering about 30 minutes. They are expected to refer current research and review papers from standard journals like ACM, IEEE, JPDC, IEE etc. - at least three cross references must be used - the seminar report must not be the reproduction of the original paper. A committee consisting of at least three faculty members shall assess the presentation of the seminar and award marks to the students based on merits of topic of presentation. Each student shall submit two copies of a write up of the seminar topic. One copy shall be returned to the student after duly certifying it by the chairman of the assessing committee and the other will be kept in the departmental library. Internal continuous assessment marks are awarded based on the relevance of the topic, presentation skill, quality of the report and participation.

Approach

Students shall make a presentation for 20-25 minutes based on the detailed study of the topic and submit a report based on the study.

Expected Outcome

Upon successful completion of the seminar, the student should be able to

1. Get good exposure in the current topics in the specific stream.
2. Improve the writing and presentation skills.
3. Explore domains of interest so as to pursue the course project.

Course No.	Course Name	L-T-P	Credits	Year of Introduction
08CS 6081(P)	Advanced Data Structure Lab	0-0-2	2	2015

Course Objectives

To give the Student:-

- The ability to design and implement algorithms for various operations on advanced data structures.

Course Outcome:

A student who completes this course will get hands on experience of working with advanced data structures.

08 CS 6081(P) – EXPERIMENTS	
Experiment No	**Description**
I	AVL Trees
II	Red Black Trees
III	Splay Trees
IV	Treap
V	Min-Max Heap
VI	Binomial heap
VII	Dijkstra's algorithm using Fibonacci heap
VIII	Skewed heap
IX	K-d trees

SEMESTER - II

Syllabus and Course Plan

Course No.	Course Name	L-T-P	Credits	Year of Introduction
08 CS 6012	Advanced Compiler Design	3-0-0	3	2015

Course Objectives

- To familiarize students of the basic structure of a typical modern compiler's back end.
- To give a clear understanding of the typical processes in compiler optimization

Syllabus

Syntax directed translation, automatic tools; Semantic analysis: symbol tables, Intermediate code generation: run-time environments, translation of language constructs; Code generation: flow graphs, register allocation, code generation algorithms; code optimization, instruction scheduling

Expected Outcome

Students who successfully complete this course will be able to

- Create lexical rules and grammars for a representative programming language.
- Design a compiler for a concise programming language or a small subset of it.
- Implement semantic rules into a parser that performs attribution while parsing.

References

1. *Compilers: Principles, Techniques and Tools* (2nd edition), Alfred V. Aho, Monica S. Lam, Ravi Sethi, and Jeffery D. Ullman., Addison Wesley, Boston, MA, 2006
2. *Compilers: Principles, Techniques and Tools*, Aho, A. V, Sethi, R. and Ullman, J. D. Pearson Education, 1986.
3. Modern Compiler Implementation in Java, Andrew. W. Appel, Cambridge University Press, 2000.
4. Advanced Compiler Design and Implementaiton, Steven S Muchnick, Morgan Kaufmann Publishers

COURSE PLAN			
Module	**Contents**	**Hours Allotted**	**% of Marks in End-Semester Examination**
I	**Syntax Directed Translation :** Syntax Directed Translation - Syntax directed definitions – Inherited and Synthesized attributes – Evaluating an SDD at the nodes of a parse tree Evaluation orders for SDDs – Dependency graphs – Ordering the evaluation of attributes – S-attributed definitions – L-attributed definitions – Semantic rules with controlled side effects - Applications of syntax directed translation Construction of syntax trees – The structure of a type – Syntax directed translation schemes – Postfix translation schemes – Parser-stack implementation of postfix SDTs – SDT's with action inside productions - Eliminating left recursion from SDTs – SDTs for L-attributed definitions. Implementing L-attributed SDDs – Translation during recursive-descent parsing – On-the-fly code generation – L-attributed SDDs and LL Parsing – Bottom up parsing of L-attributed SDDs	8	15
II	**Intermediate Code Generation :** Intermediate Code Generation - Intermediate Representations – Variants of syntax trees – Directed acyclic graphs for expressions – The value-number method for constructing DAGs – Three-address code – Addresses and instructions – Quadruples – Triples – Static Single-Assignment Form. Types and Declarations – Type Expressions – Type equivalence – Declarations – Storage layout for local names – Sequences of declarations – Fields in records and classes - Translation of expressions. Translation of expressions – Operations within expressions – Incremental translation – Addressing array elements – Translation of array references Control flow – Boolean expressions – Short-circuit code – flow-of-control statements – Control flow translation of Boolean expressions – Avoiding redundant Gotos – Boolean values and jumping code – Back patching - One-pass code generation using back patching – Back patching for Boolean expressions – Flow-of-control statements – Break, continue and Goto statements Translation of switch statements – syntax directed translation of switch statements - intermediate code for procedures	9	15
FIRST INTERNAL EXAM			

III	**Run-Time management :** Run-Time Environments - Storage organization – Static versus dynamic storage allocation – stack allocation of space – Activation trees – Activation records – Calling sequences – Variable length data on the stack Access to nonlocal data on the stack – Data access without nested procedures – Issues with nested procedures – Access links – Manipulating access links – Access links for procedure parameters – Displays Heap management – The memory manager – Locality in programs – Reducing fragmentation – Manual deallocation requests - Garbage collection – Design goals for Garbage collectors – Reference counting garbage collectors Introduction to trace-based collection – A basic mark-and-sweep collector – Basic abstraction – Optimizing mark-and-sweep – Mark-and-compact garbage collectors – Copying collectors.	9	15
IV	**Code Generation :** Code Generation - Issues in the design of a code generator – Instruction selection – Register allocation – Evaluation order - Target language – A simple target machine model – Program and instruction costs - Addresses in the target code – static allocation – stack allocation – run-time addresses for names Basic Blocks and Flow Graphs – Basic blocks – Next-use information – Flow graphs – Representation of flow graphs – Loops - Optimization of basic blocks – The DAG representation of basic blocks – Finding local common sub expressions – Dead code elimination – Use of algebraic identities – Representation of array references – Pointer assignments and procedure calls – Resembling basic blocks from DAGs. Simple code generator – Register and address descriptors – The code generation algorithm - Peephole optimization – Eliminating redundant loads and stores – Eliminating unreachable code – Flow-of-control optimizations – Algebraic simplification and reduction I strength – Use of machine identities Register allocation and assignment – Global register allocation – Usage counts – Register Assignment for outer loops – Register allocation for graph colouring - Instruction selection by tree rewriting – Tree-translation schemes – Code generation by tiling an input tree – Pattern matching by parsing – Routines for semantic checking – General tree matching - Optimal code generation for expressions – Ershove numbers – Generating code from Labelled Expression trees	8	15
	SECOND INTERNAL EXAM		
V	**Code Optimization :** Code optimization - Principal sources of optimization – causes of redundancy – Semantics-preserving transformations – Global common sub expressions – Copy propagation – Dead code elimination – Code motion Induction variables and reduction in strength – Introduction to data flow analysis –The data-flow abstraction – The data-flow analysis schema – Data-flow schemas on Basic blocks – Reaching definitions Live variable analysis – Available expressions Partial redundancy elimination – The sources of redundancy – The lazy-code- motion problem – Anticipation of expressions The lazy-code-motion algorithm - Loops in Flowgraphs – Dominators – Depth- first ordering – Edges in Depth-first spanning tree – Back edges and reducibility – Depth of a flow graph – Natural loops – Convergence of Iterative data-flow algorithms Region based analysis – Regions – Region hierarchies for reducible flow graphs – Algorithm for region based analysis – Handling non-reducible flow graphs	11	20

VI	**Code Scheduling :** Instruction scheduling - Instruction-level parallelism – instruction pipelines and branch delays – pipelined execution – multiple instruction issue Code scheduling constraints – data dependence - dependencies among memory accesses – Trade off between register usage and parallelism Phase ordering between register allocation and code scheduling – control dependence – speculative execution support Basic-Block Scheduling – Data dependence graphs – List scheduling of basic blocks – Prioritized topological orders Global Code Scheduling – Primitive code motion – Upward code motion – Downward code motion – Updating data dependencies Global scheduling algorithms – Advanced code motion techniques – Interaction with dynamic schedulers	11	20
END SEMESTER EXAM			

Course No.	Course Name	L-T-P	Credits	Year of Introduction
08 CS 6022	Information Retrieval	3-0-0	3	2015

Course Objectives

To give the Student:-

- To present the scientific underpinnings of the field of Information Search and Retrieval
- To learn important concepts, algorithms, and data/file structures those are necessary to design, and implement Information Retrieval (IR) systems.

Syllabus

Introduction to information retrieval, Evaluation measures, IR models, IR query, Web Search, Link analysis, Multimedia IR,Text Categorization,Text Clustering methods

Expected Outcome

Students who successfully complete this course will understand the need and importance of information retrieval systems. Students will be able to analyze various data mining problems in terms of information retrieval and could develop various solutions based on the studied IR models and methods.

References

1. Manning .C, Raghavan P, and Schutze.H," Introduction to Information Retrieval", Cambridge University Press, 2008.
2. Bruce Croft W, Donals Metzler, Trevor Strohman, "Search Engines: Information Retrieval in Practice" , Addison-Wesley, 2009
3. Ricardo Baeza-Yates and Berthier Ribeiro-Neto ,"Modern Information Retrieval",Addison Wesley,2nd edition.
4. Karen Sparck Jones and Peter Willett," Readings in Information Retrieval" ,Morgan Kaufmann Publisher, 1997.

COURSE PLAN			
Module	**Contents**	**Hours Allotted**	**% of Marks in End-Semester Examination**
I	Information versus Data Retrieval, Basic Concepts: The Retrieval Process, Logical View of Documents. Modelling: A Taxonomy of IR Models, Performance Evaluation of IR:Recall and Precision, Other Measures, Reference Collections	6	15
II	Boolean, Vector-Space & Probabilistic Retrieval Models, Inverted Index,Index Construction,Term Weighting, Text-Similarity Metrics,TF-IDF (Term Frequency/Inverse Document Frequency) Weighting, Cosine Similarity - Vector-Space Model, Probabilistic IR Model,Binary Independence Model.	6	15
FIRST INTERNAL EXAM			
III	Query Operations and Languages, Relevance Feedback, Query Expansion, Web Search Basics, Web Crawling and Indexing, Link Analysis, Page Rank Algorithm, Hubs and Authorities.	9	15
IV	XML Retrieval, Multimedia IR: Spatial Access Methods, Distance Function, Generic Multimedia Indexing Approach.	9	15
SECOND INTERNAL EXAM			
V	Naive Bayes, Decision Trees, and Nearest Neighbor. Practical Examples.	6	20
VI	Agglomerative Clustering, K-Means, Expectation Maximization (EM), Recommender Systems.	6	20
END SEMESTER EXAM			

Course No.	Course Name	L-T-P	Credits	Year of Introduction
08 CS 6032	Evolutionary Computing	3-0-0	3	2015

Course Objectives

To give the Student:-

- Knowledge of evolutionary computation techniques and methodologies set in the context of modern heuristic methods
- An idea of how to apply these techniques to optimisation problems and problems that require machine learning

Syllabus

Introduction to evolutionary computing, simulated annealing and hill climbing, genetic algorithm, ant colony optimization, particle swarm optimization, artificial bee colony optimization, case studies using various optimization problems

Expected Outcome

Students who successfully complete this course will gain knowledge in matching various evolutionary computing methods and algorithms for particular classes of computational problems.

References

1. Goldberg D E, "Genetic Algorithms in search", Optimization and machine learning, Addison-Wesley 2005.
2. Kenneth A DeJong, "Evolutionary Computation A Unified Approach", Prentice Hall of India, New Delhi, 2006.
3. Elaine Rich, Kevin Knight, " Artificial Intelligence" Tata McGraw Hill Education Private Limited, 2011.
4. Marco Dorigo and Thomas Stutzle, "Ant Colony optimization", Prentice Hall of India, New Delhi 2005.

COURSE PLAN

Module	Contents	Hours Allotted	% of Marks in End-Semester Examination
I	Historical Development, Features, Classification and Components of Evolutionary Computing, Advantages, Applications	6	15
II	**Simulated Annealing:** Annealing Schedule, Parameter Selection, Applications **Hill Climbing:** Mathematical Description, Local and Global Maxima, Ridges, Plateau, Applications	6	15
	FIRST INTERNAL EXAM		
III	**Genetic Algorithms:** Biological Background, Schema, Theorem, GA Operators: Crossover, Mutation and Its Types-GA Algorithm, Variations Of GA: Adaptive GA and Real Coded GA	9	15

IV	**Ant Colony Optimization:** Ant Foraging Behavior, Theoretical Considerations, Convergence Proofs, ACO Algorithm, ACO And Model Based Search, Variations Of ACO: Elitist Ant System (EAS), Minmax Ant System (MMAS) And Rank Based Ant Colony System (RANKAS).	9	15
SECOND INTERNAL EXAM			
V	**Particle Swarm Optimization:** Principles of Bird Flocking and Fish Schooling , Evolution of PSO , Operating Principles , PSO Algorithm , Neighborhood Topologies , Convergence Criteria , Variations of PSO	6	20
VI	**Artificial Bee Colony (ABC) Optimization:** Behaviour Of Real Bees, ABC Algorithm, Variations of ABC: Abcgbest and Abcgbestdist **Case Study:** Travelling Salesman Problem, Knapsack Problem, N Queens	6	20
END SEMESTER EXAM			

Course No.	Course Name	L-T-P	Credits	Year of Introduction
08 CS 6042(A)	Advanced Language Technologies	3-0-0	3	2015

Course Objectives

Gives the students an introduction about natural language Understanding and processing along with multilinguality and speech processing. To discuss about concepts like machine translation, natural language generation etc.

Syllabus

Natural Language Processing, Parsing, Semantics, Ambiguity, Information Retrieval, Information Extraction. Categorization, Clustering, Summarization, Multilingual Information Retrieval, Machine Translation, Dialog and Conversational Agents – Surface Realization and Discourse Planning.

Expected Outcome

Student must be able to understand the role of information retrieval techniques in Text and Speech processing. It also make the student to apply the various techniques and algorithms exclusively used in the area of Natural Language Processing.

References

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.

COURSE PLAN

Module	Contents	Hours Allotted	% of Marks in End-Semester Examination
I	Natural Language Processing – Linguistic Background – Classification Finite State Methods Grammar For Natural Language Processing – Parsing – Semantic and Logic Form – Ambiguity Resolution – Semantic Interpretation.	6	15
II	Information Retrieval-Information Retrieval Architecture – Indexing– Storage – Compression Techniques – Document Processing – NLP Based Information Retrieval – Information Extraction. Categorization – Extraction Based Categorization	6	15
FIRST INTERNAL EXAM			
III	Clustering– Hierarchical Clustering– Document Classification and Routing– Finding and Organizing Answers From Text Search – Use Of Categories and Clusters For Organizing Retrieval Results – Text Categorization and Efficient Summarization Using Lexical Chains – Pattern Extraction.	9	15
IV	Multilinguality – Multilingual Information Retrieval and Speech Processing – Multimodality – Text and Images – Modality Integration.	9	15
SECOND INTERNAL EXAM			
V	Machine Translation – Transfer Metaphor – Interlingual and Statistical Approaches – Discourse Processing	6	20
VI	Dialog and Conversational Agents Natural Language Generation – Surface Realization and Discourse Planning.	6	20
END SEMESTER EXAM			

Course No.	Course Name	L-T-P	Credits	Year of Introduction
08 CS 6042(B)	Big Data Essentials	3-0-0	3	2015

Course Objectives

To give the Student:-
An understanding of problems and solutions related with Big Data domain. To familiarize with the latest data intensive computing systems which can handle the big data challenge.

Syllabus

Importance and features of Big Data, Data intensive computing using Hadoop and MapReduce, Distributed data storage systems, Data mining with big data ,recent advancements in big data analytics.

Expected Outcome

Students who successfully complete this course will understand the challenges faced by both scientific and business community due to arise of Big Data. Students will be able to analyze a data intensive problem and could select a suitable big data technology to find efficient solutions to such problems.

References

1. Runkler**,** Thomas A, "Data Analytics - Models and Algorithms for Intelligent Data Analysis", Springer, 2012.
2. Nathan Marz , "Big Data: Principles and best practices of scalable real-time data systems",Manning Publications, 2012Noreen Burlingame ,"Little Book of Big Data" Ed. 2012
3. Tom White " Hadoop: The Definitive Guide" Third Edition, O'reilly Media, 2012.
4. Jimmy Lin, Chris Dyer "Data-Intensive Text Processing with MapReduce" Morgan & Claypool Publishers, 2010.
5. R. Owens, Brian Femiano, and Jon Lentz "Hadoop Real World Solutions Cookbook Jonathan"
6. Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2012.
7. Xindong Wu ,Xingquan Zhu ,Gong-Qing Wu ,Wei Ding "Data Mining with Big Data" IEEE Transaction of Knowledge and Data Engineering Vol. 26, No. 1, January 2014 pp.97-107
8. Tomasz, K. , Przemyslaw, K. and Wojciech, I.(2014), ' Parallel processing of large graphs' . Future Generation Computer Systems,Elsevier Vol. 32, pp. 324–337.
9. Malewicz, G.,Austern, M.H., Bik, A.J.C., Dehnert, J.C., Horn, I., Leiser, N. and CzajkowskiG. (2010), Pregel: a system for large-scale graph processing'. Proceedings of the 2010 International Conference on Management of Data, SIGMOD '10, New York, USA, pp. 135-146
10. www.serendio.com/resources/smart-meter-analytics-platform-selection.pdf

COURSE PLAN			
Module	**Contents**	**Hours Allotted**	**% of Marks in End-Semester Examination**
I	**Big Data**: Characteristics, Importance, Use cases: Fraud detection patterns, Data Analytics Lifecycle, Role of Data Scientist, Big Data Sources.	6	15
II	**Hadoop & Mapreduce-** Hadoop architecture, Hadoop distributed file system, MapReduce framework, Hadoop Input/output formats, Setting up a Hadoop cluster.	7	15
FIRST INTERNAL EXAM			
III	**MapReduce Programming:** Mapreduce Algorithm Design, Data Flow In Map Reduce Pipeline, Partitioners and Combiners, Developing A Mapreduce Application.	8	15
IV	**Data Storage**: NoSQL Stores , Key-Value Stores , Columnar Stores , Document Stores ,Graph Databases ,Case Studies , HDFS, HBase, Hive, MongoDB, Neo4j	7	15
SECOND INTERNAL EXAM			
V	**Big Data Mining**: Data Mining with Big Data, Issues, Case Study, Clustering on Big Data, Limitations of Mapreduce Framework, Case Study-Graph Algorithms on Mapreduce.	7	20
VI	**Advanced Big Data Analytics**: Real time data analytics, Alternate models for big data analytics, In memory models, Bulk Synchronous Parallel-case study-apache Giraph.	7	20
END SEMESTER EXAM			

Course No.	Course Name	L-T-P	Credits	Year of Introduction
08 CS 6042(C)	Algorithms and Complexity	3-0-0	3	2015

Course Objectives

To provide an introduction to the different complex algorithms in computer programming such as graph algorithms, randomized algorithms etc and the complexity classes such as NP-Hard and NP- Complete problems.

Syllabus

Analysis of RAM model, Recurrence analysis, Advanced Data Structures, Graph Algorithms and complexity, Randomized Algorithms, Complexity classes, Approximation algorithms, Probabilistic Complexity Classes, Probabilistic Proof Theory and Certificates.

Expected Outcome

- Students will understand different complex algorithms in computer programming.
- Students will be able to identify the complexity classes.

References

1. Dexter Kozen, The Design and Analysis of Algorithms, Springer, 1992.
2. T. H. Cormen, C. E. Leiserson, R. L. Rivest, Introduction to Algorithms, Prentice Hall India, 1990.
3. S. Basse, Computer Algorithms: Introduction to Design and Analysis, Addison Wesley, 1998.
4. U. Manber, Introduction to Algorithms: A creative approach, Addison Wesley, 1989.
5. V. Aho, J. E. Hopcraft, J. D. Ullman, The design and Analysis of Computer Algorithms, Addison Wesley, 1974.
6. R. Motwani andP. Raghavan, Randomized Algorithms, Cambrdige University Press, 1995.
7. C. H. Papadimitriou, Computational Complexity, Addison Wesley, 1994
8. Leonard Adleman. Two theorems on random polynomial time. In Proceedings of the 19th IEEE Symposium on Foundations of Computer Science, pages 75–83, 1978.
9. J. Gill. Computational complexity of probabilistic Turing machines. SIAM Journal of Computing, 6:675–695, 1977.
10. C. Lautemann. BPP and the Polynomial Hierarchy. Information Processing Letters, 17:215–217, 1983.
11. M. Sipser. A complexity theoretic appraoch to randomness. In Proceedings of the 15th ACM Symposium on Theory of Computing, pages 330–335, 1983.
12. L.G. Valiant and V.V. Vazirani. NP is as easy as detecting unique solutions. Theoretical Computer Science, 47:85–93, 1986.

COURSE PLAN

Module	Contents	Hours Allotted	% of Marks in End-Semester Examination

I	Analysis: RAM model – Notations, Recurrence analysis - Master's theorem and its proof - Amortized analysis	6	15
II	Advanced Data Structures: B-Trees, Binomial Heaps, Fibonacci Heaps, Disjoint Sets, Union by Rank and Path Compression	7	15
FIRST INTERNAL EXAM			
III	Graph Algorithms and complexity: Matroid Theory, All-Pairs Shortest Paths, Maximum Flow and Bipartite Matching.	6	15
IV	Randomized Algorithms : Finger Printing, Pattern Matching, Graph Problems, Algebraic Methods, Probabilistic Primality Testing, De-Randomization	8	15
SECOND INTERNAL EXAM			
V	Complexity classes - NP-Hard and NP-complete Problems -Cook's theorem NP completeness reductions. Approximation algorithms – Polynomial Time and Fully Polynomial time Approximation Schemes.	8	20
VI	Probabilistic Complexity Classes, Probabilistic Proof Theory and Certificates.	7	20
END SEMESTER EXAM			

Course No.	Course Name	L-T-P	Credits	Year of Introduction
08 CS 6042(D)	Software Architecture and Design	3-0-0	3	2015

Course Objectives

To give the Student:-

- In-depth knowledge in basic architecture and design so as to enable the students to understand the subjects.

Syllabus

Introduction; Middleware Architectures; Software Architectural Process and Documentation; Aspect Oriented Architecture and MDA; Web Services; Architectural Patterns.

Expected Outcome

Students who successfully complete this course will have the ability to design and experiment with software prototypes; Students will be able to create and document the overall design for a system and document this design using UML and other methodologies and notations.

References

1. Ian Gorton, "Essential Software Architecture", Springer, 2011.
2. Frank Buschmann,Regine Muiner, Hans Rohnert, Peter Sommerlad, Michael Stal, "Pattern Oriented Software Architecture", Volume 1, John Wiley, 2001
3. George Fairbanks, "Just enough Software Architecture", Marshall and Bainerd, 2010.
4. Simon Brown, "Software Architecture for Developers", Lean Publiahing, 2013.
5. Mahesh P Matha "Object Oriented Analysis & Design Using Uml An Introduction To Unified Process & Design Patterns", Prentice-hall Of India Pvt Ltd, 2010

COURSE PLAN			
Module	**Contents**	**Hours Allotted**	**% of Marks in End-Semester Examination**
I	Introduction Definition – architecture for non-functional requirements – role of Software architect – Technologies – Software Quality attributes	9	15
II	**MIDDLEWARE ARCHITECTURES** – Classification – distributed objects – Message oriented middleware – application servers – Enterprise java Beans Architecture. Service Oriented Architecture– Service Oriented Systems .	9	15
FIRST INTERNAL EXAM			
III	**SOFTWARE ARCHITECTURAL PROCESS AND DOCUMENTATION**: Process – Requirements, design, validation- Documentation - UML 2.0, Architectural views, component diagrams, templates.	9	15
IV	**ASPECT ORIENTED ARCHITECTURE AND MDA**: Aspect Oriented Architecture-Aspects, AOP, example- architecture, Aspects and middleware, Tools, Model Driven Architecture-need, tools, MDA and Software Architecture- requirements, transformation	9	15
SECOND INTERNAL EXAM			
V	**Web Services** – components – Restful Web Services- Advanced middleware architectures –Business Process Orchestration, Integrating Architecture issues, ESB - Message brokers	10	20

VI	**Architectural Patterns**-Patterns in Software Architecture – layers, pipes and filters, blackboard, broker, MVC, Presentation-abstraction-control, Adaptable systems	10	20
END SEMESTER EXAM			

Course No.	Course Name	L-T-P	Credits	Year of Introduction
08 CS 6052(A)	Cloud Computing	3-0-0	3	2015

Course Objectives

- To understand the concept of cloud and utility computing
- To understand the various issues in cloud computing
- To familiarise themselves with the lead players in cloud
- To appreciate the emergence of cloud as the next generation computing paradigm

Syllabus

Evolution of cloud computing and its architecture, basics of virtualization and its types, cloud infrastucture, programming model, security in cloud

Expected Outcome

At the end of this course the student will be able to appreciate the new computing model called cloud computing and why it is creating such a hype in the 21st century. He/She will be able to use the open source cloud services. Understand that one of the major issues in usage of public cloud is security. The student will have the knowledge to deploy a private cloud and understand the issues currently prevailing.

References

1. Distributed and Cloud Computing, From Parallel Processing to the Internet of by Kai Hwang, Geoffrey C Fox, Jack G Dongarra, Morgan Kaufmann Publishers, 2012.
2. Cloud Computing: Implementation, Management, and Security by John W.Rittinghouse and James F.Ransome : CRC Press 2010
3. Cloud Computing, A Practical Approach by Toby Velte, Anthony Velte, Robert Elsenpeter: TMH, 2009
4. Cloud Application Architectures: Building Applications and Infrastructure in the Cloud: Transactional Systems for EC2 and Beyond (Theory in Practice (O'Reilly)) by George Reese: O'Reilly
5. James E. Smith, Ravi Nair, Virtual Machines: Versatile Platforms for Systems and Processes, Elsevier/Morgan Kaufmann, 2005.
6. Katarina Stanoevska-Slabeva, Thomas Wozniak, Santi Ristol, "Grid and Cloud Computing – A Business Perspective on Technology and Applications", Springer.

COURSE PLAN

Module	Contents	Hours Allotted	% of Marks in End-Semester Examination
I	**Evolution of Cloud Computing** Evolution of Cloud Computing –System Models for Distributed and Cloud Computing – NIST Cloud Computing Reference Architecture -IaaS – On-demand provisioning – Elasticity in cloud – Egs of IaaS providers - PaaS – Egs. Of PaaS providers - SaaS – Egs. Of SaaS providers – Public , Private and Hybrid clouds.)	6	15
II	**Virtualization:** Basics of virtualization – Types of Virtualization - Implementation Levels of Virtualization - Virtualization Structures/ Tools and Mechanisms – Virtualization of CPU, Memory, I/O Devices - Desktop virtualization – Server Virtualization.	9	15
	FIRST INTERNAL EXAM		
III	**Cloud Infrastructure:** Architectural Design of Compute and Storage Clouds – Layered Cloud Architecture Development – Design Challenges - Inter Cloud Resource Management – Resource Provisioning and Platform Deployment – Global Exchange of Cloud Resources.	9	15

IV	**Programming Model:** Parallel and Distributed programming Paradigms – MapReduce , Twister and Iterative MapReduce – Hadoop Library from Apache – Mapping Applications	6	15
SECOND INTERNAL EXAM			
V	Programming Support - Google App Engine, Amazon AWS - Cloud Software Environments - Eucalyptus, Open nebula, OpenStack.	6	20
VI	**Security in Cloud:** Security Overview – Cloud Security Challenges – Software-as-a-Service Security – Security Governance – Risk Management – Security Monitoring – Security Architecture Design – Data Security – Application Security – Virtual Machine Security	6	20
END SEMESTER EXAM			

Course No.	Course Name	L-T-P	Credits	Year of Introduction
08 CS 6052(B)	Data Compression	2-1-0	3	2015

Course Objectives

To familiarize the students with the different data compression techniques for image compression, audio compression, video compression etc. It helps to analyze different compression algorithms and their implementation.

Syllabus

Overview of basic techniques, compression algorithms, transformation methods, video compression, audio compression and their implementation

Expected Outcome

Students are able to implement various compression techniques on text, images and video. They can evaluate the perfomance comparison of different compression algorithms based on number of inputs given .

References

1. . David Solomon, Data compression: the complete reference, 2nd edition, Springerverlag, New York. 2000.

2. Stephen Welstead, Fractal and wavelet Image Compression techniques, PHI,NewDelhi-1, 1999.
3. Khalid Sayood, Introduction to data compression, Morgan Kaufmann Publishers,2003 reprint.

COURSE PLAN

Module	Contents	Hours Allotted	% of Marks in End-Semester Examination
I	Introduction, Basic Techniques :- Intuitive Compression – RLE – RLE Text Compression – RLE Image Compression – Move-to-Front Coding, Statistical Methods: – The Golomb Code – Shannon-Fano Coding - Huffman Coding - Adaptive Huffman Coding.	6	15
II	Dictionary Methods: – String Compression – Simple Dictionary Compression – LZ77 – LZSS – LZ78 – LZW – LZWM – LZAP – LZP – RAR and WinRAR – Deflate: Zip and Gzip.	9	15
	FIRST INTERNAL EXAM		
III	Transform based techniques: Image Transforms – Orthogonal Transforms – DCT Transform – JPEG – JPEG-LS, Wavelet Methods-Fourier transform – Fourier Image Compression – CWT and its Inverse – The Haar Transform –The DWT.	9	15
IV	Video compression: Analog Video – Composite and Components Video – Digital Video – Video Compression - MPEG –MPEG-4 – H.261	6	15
	SECOND INTERNAL EXAM		
V	Audio Compression: Sound - Digital Audio - The Human Auditory System - μ-Law and A-Law Companding - ADPCM Audio Compression - MLP Audio – Speech Compression – Shorten – MPEG-4 Audio Lossless Coding.	6	20
VI	Comparison of compression algorithms, Implementation of compression algorithms.	6	20
	END SEMESTER EXAM		

Course No.	Course Name	L-T-P	Credits	Year of Introduction
08 CS 6052(C)	Bio-Informatics	3-0-0	3	2015

Course Objectives

To provide an overview of algorithms used in Bioinformatics.

Syllabus

Algorithms and Complexity, Molecular Biology Primer, Exhaustive Search, Greedy Algorithms, Dynamic Programming Algorithms, Divide-and-Conquer Algorithms, Graph Algorithms, Combinatorial PatternMatching, Clustering and Trees, HiddenMarkovModels, Randomized Algorithms.

Expected Outcome

At the end of the course students will be able to

References

1. Neil C. Jones and Pavel A. Pevzner, An Introduction to BioinformaticsAlgorithms, MIT Press, First Indian Reprint 2005.
2. Gary Benson Roderic page (Eds), Algorithms in Bioinformatics, Springer International Edition, First Indian Reprint 2004.
3. Gusfields G, Algorithms on strings, trees and sequences- Computer Science and Computational Biology, Cambridge University Press 1997.
4. T. K. Attwood and D. J. Parry-Smith, Introduction to Bioinformatics, Pearson Education, 2003.

COURSE PLAN

Module	Contents	Hours Allotted	% of Marks in End-Semester Examination
I	Algorithms and Complexity- Biological algorithms versus computer algorithms – The change problem –Correct versus Incorrect Algorithms – Recursive Algorithms – Iterative versus Recursive Algorithms – Big-O Notations – Algorithm Design Techniques.	8	15
II	Molecular Biology Primer –Structure of DNA–Proteins - Analyzing DNA – Species - Exhaustive Search – Mapping Algorithms – Motif-Search Trees – Finding Motifs – Finding a Median String .	7	15
FIRST INTERNAL EXAM			

III	Greedy Algorithms– Genome Rearrangements – Sorting by Reversals – Approximation Algorithms – A Greedy Approach to Motif Finding - DNA Sequence comparison – Manhattan Tourist Problem – Edit Distance and Alignments – Longest Commons Subsequences– Global Sequence Alignment – Scoring Alignment – Local Sequence Alignment – Alignment with Gap Penalties – Multiple Alignment-Gene Predictions – Approaches to Gene Prediction - Spiced Alignment	8	15
IV	Divide and Conquer Algorithms - Graphs – Graphs and Genetics – DNA Sequencing – Shortest Superstring Problem – DNA arrays as an alternative sequencing techniques – Sequencing by Hybridization – Path Problems – Fragment assembly in DNA Sequencing – Protein Sequencing and Identification – The Peptide Sequencing Problem – Spectrum Graphs – Spectral Convolution and Alignment – Combinatorial Pattern matching..	7	15
SECOND INTERNAL EXAM			
V	Clustering and trees – Gene expression analysis – Hierarchical clustering-k-means clustering – Clustering and corrupted Cliques – Evolutionary Trees – Distance-based tree reconstruction – Reconstruction trees from additive matrices – Evolutionary trees and hierarchical clustering – Character-based tree reconstruction – Small and large Parsimony Problem.	7	20
VI	Hidden MarkovModels-CG-Islands and the "Fair Bet Casino" - The Fair Bet Casino and Hidden Markov Models - Decoding Algorithm - HMM Parameter Estimation - Profile HMM Alignment - Randomized Algorithms - Gibbs Sampling - Random Projections.	6	20
END SEMESTER EXAM			

Course No.	Course Name	L-T-P	Credits	Year of Introduction
08CS6062(P)	Mini Project	0-0-4	2	2015

Course Objectives

To make students design and develop a system or application in the area of their specialization.

Approach

In this practical course, each student is expected to design and develop a moderately complex computer / information system with practical/research applications; Students can take up any application level/system level project pertaining to a relevant domain, preferably based on papers from IEEE/ACM journals. Projects can be chosen either from the list provided by the faculty or in the field of interest of the student. A committee consisting of minimum three faculty members specialised in computer science and engineering will perform assessment of the mini project.. Marks will be awarded based on the report and their performance during presentations and demonstrations. Publishing the work in Conference Proceedings/Journals with National/International status with the consent of the guide will carry an additional weightage in the evaluation process.

Expected Outcome

Upon successful completion of the miniproject, the student should be able to

1. Identify and solve various problems associated with designing and implementing a system or application.
2. Test the designed system or application.

Course No.	Course Name	L-T-P	Credits	Year of Introduction
08CS6072(P)	Data Mining and Analytics Lab	0-0-2	1	2015

Syllabus

Experiments are based on topics covered in Data Mining

To give the Student:-

- The ability to design and implement various algorithms related to information retrieval.
- Hands on experience with latest data storage and analytic infrastructure like Hadoop and R

08CS6072(P) **- Experiments**

Experiment No	Description
I	Study of WEKA / R Tool
II	Building an inverted index
III	Implementation of text classification techniques
IV	Implementation of text clustering techniques
V	Implementation of Page Rank Algorithm
VI	Setting up a Hadoop Cluster
VII	Developing a MapReduce Application
VIII	Working with a distributed data storage(Any NoSQL model)

SEMESTER - III

Syllabus and Course Plan

Course No.	Course Name	L-T-P	Credits	Year of Introduction
08 CS 7011(A)	Unix Internals	3-0-0	3	2015

Course Objectives

To give the Student:-

- An understanding of internal working of unix operating system

Syllabus

Architecture of Unix Operating System, Kernel and Buffer, Internal representation of files in a Unix operating system, the system call interface, process management in Unix system, memory management and input/output in Unix

Expected Outcome

A student who completes this course will get knowledge on the data structures, their relationships and the major algorithms used to manage System, processes, system calls, interrupts and exceptions, virtual memory and file systems.

References

1 Maurice J Bach, "The Design of the UNIX Operating Systems"- Prentice Hall of India/ Pearson Education, New Delhi, 2004.

2 UreshVahalia, "UNIX Internals: The New Frontiers"- Prentice Hall of India / Pearson Education, New Delhi, 2002.

3 Richard Stevens, "UNIX Network Programming"- Volume I- Prentice Hall of India / Pearson Education, New Delhi, 2006.

COURSE PLAN

Module	Contents	Hours Allotted	% of Marks in End-Semester Examination
I	**Unix System Structures:** Architecture of Unix Operating System, Introduction to System Concepts , Kernel , Kernel Data Structures, Buffer Cache, Buffer Headers , Structure of Buffer Pool , Retrieval of Buffer, Reading and Writing disk blocks	8	15

II	**Internal Representation of Files:** I-node, Structure of a regular file, Directories, Conversion of a path names to an I-node , Superblock , I-node assignment to a file ,Allocation of disk blocks.	7	15
FIRST INTERNAL EXAM			
III	Open, Read, Write, File and Record Locking, Lseek, Close. File creation: Creation of special files, Changing Directory And Root, Changing Owner and mode. Pipes, Mounting and unmounting file system, Link, Unlink.	7	15
IV	**Structure of the Processes:** Process States And Transitions, Layout of System Memory ,Context of a Process, Saving The Context of the Process, Manipulation of the Process Address Space ,Process Creation ,Signals ,Process Termination, Invoking other programs , Changing the size of a process, System boot and init process, Process Scheduling	7	15
SECOND INTERNAL EXAM			
V	**Memory Management:** Swapping, Application of swap space, File swap, Demand Paging, Data structures for demand paging, Swap process in and out, page stealing , Page aging and page fault.	7	20
VI	**I/O Device Subsystem** : Driver Interface ,Disk Drivers ,Terminal Drivers ,Case Study : Linux System	6	20
END SEMESTER EXAM			

Course No.	Course Name	L-T-P	Credits	Year of Introduction
08 CS 7011(B)	Crypto Complexity	3-0-0	3	2015

Course Objectives

- To provide the students with the concepts of cryptology and complexity theory.
- Discusses the different protocols like Diffie Hellman, Elgamaletc and randomized algorithms and complexity classes.

Syllabus

Review of Relevant Mathematics, Complexity Theory, Foundations of Cryptology, Hierarchies based on NP, Randomized algorithms and Complexity classes, probabilistic Polynomial time classes, Quantifiers, Graph Isomorphism and lowness, RSA Cryptosystem, Primality Tests, Factoring Methods, Diffie Hellman's, ElGamal's and other protocols, Arthur Merlin Games and Zero knowledge.

Expected Outcome

At the end of the course student will be able to

- Select and apply cryptographic primitives appropriately for security applications.
- Design and analyze securely usable information systems

References

1. Jorg Roth, Complexity Theory and Cryptology – An introduction to cryptocomplexity, Springer, 2005.
2. 2.H. Anton, Elementary Linear algebra, John Wiley and Sons, New York, eighth edition, 2000.
3. G. Brassard. A note on the complexity of cryptography, IEEE Transactions on Information Theory, 25(2):232-233, 1979

COURSE PLAN

Module	Contents	Hours Allotted	% of Marks in End-Semester Examination
I	Review of Relevant Mathematics, Complexity Theory.	7	15
II	Foundations of Cryptology, Hierarchies based on NP.	7	15
	FIRST INTERNAL EXAM		
III	Randomized algorithms and Complexity classes, probabilistic Polynomial time classes,	7	15
IV	Quantifiers, Graph Isomorphism and lowness.	7	15
	SECOND INTERNAL EXAM		

V	RSA Cryptosystem, primality and factoring, Primality Tests, Factoring Methods, Security of RSA.	7	20
VI	Diffie Hellman's, ElGamal's and other protocols, Arthur Merlin Games and Zero knowledge.	7	20
END SEMESTER EXAM			

Course No.	Course Name	L-T-P	Credits	Year of Introduction
08 CS 7011(C)	Ethical Hacking	3-0-0	3	2015

Course Objectives

- To understand various hacking techniques and attacks
- To study how to protect information from attacks
- To evaluate and study the vulnerability of networks

Syllabus

Fundametals of computer fraud, Security in TCP/IP networks, Hacking windows, Security in Web and Intrusion Detection, Forensics

Expected Outcome

At the end of this course the student will be able to defend the system and networks against various attacks. He/she will also be able to practise and use safe techniques on the network.

References

1. Kenneth C.Brancik "Insider Computer Fraud" Auerbach Publications Taylor & Francis Group–2008.
2. Ankit Fadia " Ethical Hacking" second edition Macmillan India Ltd, 2006

COURSE PLAN

Module	Contents	Hours Allotted	% of Marks in End-Semester Examination
I	**Basics** Fundamentals of Computer Fraud – Threat concepts – Framework for predicting inside attacks – Managing the threat – Strategic Planning Process.	6	15
II	**Security in Networks** TCP / IP – Checksums – IP Spoofing port scanning, DNS Spoofing. Dos attacks – SYN attacks, Smurf attacks, UDP flooding, DDOS – Models. Firewalls	6	15
	FIRST INTERNAL EXAM		
III	Packet filter firewalls, Packet Inspection firewalls – Application Proxy Firewalls. Batch File Programming.	6	15
IV	Hacking windows – Network hacking – Web hacking – Password hacking. A study on various attacks – Input validation attacks – SQL injection attacks – Buffer overflow attacks – Privacy attacks.	8	15
	SECOND INTERNAL EXAM		
V	**Web Services and Intrusion Detection** Architecture strategies for computer fraud prevention – Protection of Web sites – Intrusion detection system – NIDS, HIDS – Penetrating testing process – Web Services– Reducing transaction risks.	8	20
VI	**Forensics:** Forensics – Computer Forensics – Journaling and it requirements – Standardized logging criteria – Journal risk and control matrix – Neural networks – Misuse detection and Novelty detection.	8	20
	END SEMESTER EXAM		

Course No.	Course Name	L-T-P	Credits	Year of Introduction
08 CS 7021(A)	Theoretical Computer Science	3-0-0	3	2015

Course Objectives

To give the Student:-

1. Introduction to the mathematical foundations of computer science which includes automata theory, the theory of formal languages, the notions of algorithm, decidability, complexity, and computability.
2. Ability to understand and conduct mathematical proofs for computation and algorithms

Syllabus

Language and Automata Theory, Turing Machines, Church's works on computability, turing computability, complexity theory, Different classes of problems and its applications.

Expected Outcome

Students who successfully complete this course will understand the fundamental concepts of automata, computability and complexity theory. Students will be able to analyze real world computational problems with practical importance in terms of computability and complexity.

References

1.Hopcroft J.E, Motwani R & Ullman J. D. "Introduction to Automata Theory, Languages and Computation" , Pearson Education

2. Michael Sipser, "Introduction to Theory of Computation", Cengage Learning.

COURSE PLAN

Module	Contents	Hours Allotted	% of Marks in End-Semester Examination
I	**Language & Automata Theory :** Finite State Machines & Regular Grammar-Minimization of DFA, Pumping Lemma of Regular Languages, Push Down Automata & Context Free Grammars-Non Deterministic PDA, CYK Algorithm, Linear Bound Automata and Context Sensitive Language. Chomsky Hierarchy of Grammars and the corresponding acceptors.	9	15
II	**Turing Machine:** Turing Machines, variants of TMs, programming techniques for TMs, Non Deterministic TMs, TMs and Computers, Recursive and Recursively Enumerable Languages	6	15
	FIRST INTERNAL EXAM		
III	**Church's Computability :** Hilbert's problem, Primitive Recursive Functions, Computable Functions with examples, The Recursion Theorem,lambda calculus.	6	15

IV	**Turing Decidability:** Decidable Languages, Universal Turing Machines, Undecidablity –un decidability of Halting Problem, Rice Theorem, Post Correspondence Problem, Reducibility, Church-Turing thesis.	6	15
SECOND INTERNAL EXAM			
V	**Complexity theory:** Tractable and Intractable problems, time and space complexity of tractable problems, Classes P, NP, NP-complete and NP-Hard with examples, P=NP question	6	20
VI	**Complex Problems:** Boolean satisfiability problem, polynomial time reductions, NP-completeness of SAT, Node Cover Problem, Hamiltonian Circuit problem and TSP(with proof),PSPACE, and PSPACE-complete,polynomial hierarchy, randomized computation, parallel computation.	9	20
END SEMESTER EXAM			

Course No.	Course Name	L-T-P	Credits	Year of Introduction
08CS 7021(B)	Semantic Web	3-1-0	3	2015

Course Objectives

To introduce the advanced concepts in emerging trends in Web architecture.

Syllabus

Introduction to semantic web technology - Resource Description Framework -Web ontology language-Semantic web services and applications -Concept of OWL-S-Real world examples and applications.

Expected Outcome

At the end of the course student will be able to

1. Understand the concept structure of the semantic web technology and how this technology revolutionizes the World Wide Web and its uses.
2. Understand the concepts of metadata, semantics of knowledge and resource, ontology, and their descriptions in XML-based syntax and web ontology language (OWL).

References

1. Grigoris Antoniou, Frank van Harmelen, ―A Semantic Web Primer (Cooperative Information Systems)‖ , The MIT Press, 2009
2. Liyang Yu, Introduction to the Semantic Web and Semantic Web Services, Chapman & hall/CRC, 2007
3. Dean Allemang, James Hendler, ―Semantic Web for the Working Ontologist: Effective Modeling in RDFS and OWL‖ , Morgan Kaufmann, 2008
4. Asuncion Gomez-Perez, Oscar Corcho, Mariano Fernandez-Lopez ―Ontological Engineering: with examples from the areas of Knowledge Management, e- Commerce and the Semantic Web‖ , Springer, 2004
5. John Davies, Dieter Fensel, Frank Van Harmelen, ―Towards the Semantic Web: Ontology – Driven Knowledge Management‖ , John Wiley & Sons Ltd., 2003.
6. John Davies, Rudi Studer, Paul Warren, ―Semantic Web Technologies: Trends and Research in Ontology-based ystems‖ ,Wiley Publications, 2006.
7. Steffen Staab, Rudi Studer, ―Handbook on Ontologies (International Handbooks on Information Systems)‖ , 1/e, Springer, 2004
8. Steffen Staab, Rudi Studer, ―Handbook on Ontologies (International Handbooks on Information Systems)‖ , 1/e, Springer, 2004

COURSE PLAN

Module	Contents	Hours Allotted	% of Marks in End-Semester Examination
I	Introduction to semantic web technology : Traditional web to semantic web – meta data- search engines .	4	15
II	Resource Description Framework –elements -rules of RDF – tools- RDFS core elements-Taxonomy and ontology concepts .	2	15
	FIRST INTERNAL EXAM		
III	Web ontology language: OWL: define classes- set operators – enumerations- defining properties – Validating OWL ontology.	3	15
IV	Semantic web services and applications :Web services – web services standards – web services to semantic web services- UDDI	4	15
	SECOND INTERNAL EXAM		

V	Concept of OWL-S – building blocks of OWL-S- mapping OWL-S to UDDI- WSDL	4	20
VI	Real world examples and applications :Swoogle- architecture and usage of meta data; FOAF – vocabulary – creating documents – overview of semantic markup – semantic web search engines.	4	20
END SEMESTER EXAM			

Course No.	Course Name	L-T-P	Credits	Year of Introduction
08 CS 7021(C)	Advanced Computer Architecture	3-0-0	3	2015

Course Objectives

To focus towards the various design options in the area of architecture that lays platform to develop and analyse high performance applications.

Syllabus

Control Unit Design - Data path implementation, Register Transfer Notation (RTN), Abstract RTN, Concrete RTN, Control sequence for Simple RISC computer (SRC), Memory Module Design - Conceptual view of memory cell, Memory address map, Cache memory, Instruction and Thread level parallelism, Multi-Core and Multithreading Concepts, Multi-Core Programming.

Expected Outcome

The At the end of the course the student will be able to

- Identify the need for multi-core architecture for specific applications by developing a suitable complexity measure.
- Identify needs for homogeneous or heterogeneous multi-core architectures for a given application.

References

1. John L. Hennessy and David A. Patterson "Quantitative Approach –Computer Architecture" 5th edition, Morgan Kaufmann, 2011.
2. Shameem Akhter and Jason Roberts, "Multi-Core Programming", 1st edition, Intel Press, 2006.
3. Vincent P. Heuring, Harry F. Jordan "Computer System design and Architecture" 2nd edition, Pearson, 2003.
4. David B. Kirk , Wen-mei W. Hwu, "Programming Massively Parallel Processors: A Handson Approach (Applications of GPU Computing Series)", 1st edition, Morgan Kaufmann, 2010.
5. Apman, Gabriele Jost, Ruud van van der Pas, "Using OpenMP: Portable Shared Memory Parallel Programming (Scientific and Engineering Computation)", 1st edition, MIT Press, 2007

COURSE PLAN

Module	Contents	Hours Allotted	% of Marks in End-Semester Examination
I	Control Unit Design : Overview of IAS Computer, Data path implementation, Register Transfer Notation (RTN), Abstract RTN, Concrete RTN, Control sequence for Simple RISC computer (SRC); Control unit Design, Hardwired control unit Design and Micro programmed control unit Design using control Sequences.	8	15
II	Memory Module Design : Conceptual view of memory cell, Memory address map, Memory connections to CPU, Cache memory − Cache memory management techniques, Types of cache's : Look through, look aside, write through , write around, unified Vs Split, multilevel, cache levels, Cache Misses, performance issues: Mean memory access time, Execution time, Cache Coherence Protocols, Snoopy, MSI, MESI, and MOESI.	7	15
FIRST INTERNAL EXAM			
III	Instruction and Thread level parallelism : Instruction level parallelism (ILP): Concepts - Dynamic scheduling and data hazards – Exploiting ILP using static/dynamic scheduling and speculation -Advanced techniques for instruction delivery and speculation. Thread level parallelism: Shared memory architectures centralized, distributed Synchronisation in memory, Models for memory consistency.	7	15

IV	Multi-Core Concept: Multi-processor architecture and its limitations, Need for multi-core architectures, Architecting with multi-cores, Homogenous and heterogeneous cores, Shared recourses, shared busses, and optimal resource sharing strategies Evolution of Multi-Core Technology.	8	15
SECOND INTERNAL EXAM			
V	Multithreading Concept : Basic concepts of threading and parallel computing, Concurrency, Parallelism, threading design concepts for developing an application, Correctness Concepts, Performance Concepts: Simple Speedup, Computing Speedup, Efficiency , Granularity , Load Balance, Tools Foundation – Intel® Compiler and Intel® VTune™ Performance Analyzer.	7	20
VI	Multi-Core Programming : Introduction to OpenMP, OpenMP Directives, Parallel constructs, Work-sharing constructs, Data environment constructs, Synchronization constructs, Extensive API library for finer control, benchmarking multi-core architecture: Bench marking of processors. Comparison of processor performance for specific application domains.	5	20
END SEMESTER EXAM			

Course No.	Course Name	L-T-P	Credits	Year of Introduction
08 CS 7031(P)	Seminar II	0-0-2	2	2015

Course Objectives

To assess the debating capability of the student to present a technical topic. Also to impart training to a student to face audience and present his/her ideas and thus creating self esteem and courage that are essential for an engineer.

Approach

Each student is expected to present a seminar on a topic of current relevance in Computer Science and Engineering about 30 minutes. They are expected to refer current research and review papers from standard journals like ACM, IEEE, JPDC, IEE etc. - at least three cross references must be used - the seminar report must not be the reproduction of the original paper. A committee consisting of at least three faculty members shall assess the presentation of the seminar and award marks to the students based on merits of topic of presentation. Each student shall submit two copies of a write up of the seminar topic. One copy shall be returned to the student after duly certifying it by the chairman of the assessing committee and the other will be kept in the departmental library.

Expected Outcome

Upon successful completion of the seminar, the student should be able to

1.Get good exposure in the current topics in the specific stream.
2. Improve the writing and presentation skills.
3. Explore domains of interest so as to pursue the course project.

Course No.	Course Name	L-T-P	Credits	Year of Introduction
01CS7041(P)	Project (Phase I)	0-0-12	6	2015

Course Objectives

To make students

1. Do an original and independent study on the area of specialization.
2. Explore in depth a subject of his/her own choice.
3. Start the preliminary background studies towards the project by conducting literature survey in the relevant field.
4. Broadly identify the area of the project work, familiarize with the tools required for the design and analysis of the project.
5. Plan the experimental platform, if any, required for project work.

Approach

The student has to present two seminars and submit an interim Project report. The first seminar would highlight the topic, objectives, methodology and expected results. The first seminar shall be conducted in the first half of this semester. The second seminar is the presentation of the interim project report of the work completed and scope of the work which has to be accomplished in the fourth semester.

Expected Outcome

Upon successful completion of the project phase 1, the student should be able to

1. Identify the topic, objectives and methodology to carry out the project.
2. Finalize the project plan for their course project.

SEMESTER - IV

Syllabus and Course Plan

Course No.	Course Name	L-T-P	Credits	Year of Introduction
08 CS 7012(P)	Project (Phase II)	0-0-21	12	2015

Course Objectives

To improve the professional competency and research aptitude by touching the areas which otherwise not covered by theory or laboratory classes. 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.

Approach

There shall be two seminars (a mid term evaluation on the progress of the work and pre submission seminar to assess the quality and quantum of the work). At least one technical paper has to be prepared for possible publication in journals / conferences based on their project work.

Expected Outcome

Upon successful completion of the project phase II, the student should be able to

1. Get a good exposure to a domain of interest.
2. Get a good domain and experience to pursue future research activities.