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.

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.

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

	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.

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

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

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.

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.

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