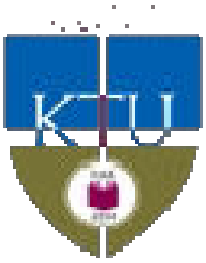
APJ ABDUL KALAM KERALA TECHNOLOGICAL UNIVERSITY



(KOLLAM CLUSTER- 02)

SCHEME AND SYLLABI

of

M.TECH

in

COMPUTER SCIENCE AND ENGINEERING

OFFERING DEPARTMENT

COMPUTER SCIENCE AND ENGINEERING

CLUSTER LEVELGRADUATE PROGRAMME COMMITTEE

NO	MEMBER
1	Dr.S. Mohan,Professor,IITMadras,Chennai
2	Principal,TKM College of Engineering, Kollam
3	Principal,Baselios Mathews II College of Engineering, Sasthamcotta,Kollam
4	Principal,College of Engineering,Karunagapally,Kollam
5	Principal,College of Engineering, Perumon, Kollam
6	Principal,Pinnacle School of Engineering and Technology, Anchal, Kollam
7	Principal,ShahulHameed Memorial Engineering College, Kadakkal, Kollam
8	Principal,TKM Institute of Technology, Ezhukone, Kollam
9	Principal,Travancore Engineering College, Parippally, Kollam
10	Principal,Younus College of Engineering and Technology, Pallimukku, Kollam

CERTIFICATE

Thisis to certify that

1. The scheme and syllabi are prepared in accordance with the regulations and guidelines issued by the KTU from time to time and also as per the decisions made in the CGPC meetings.

2. Thes uggestions/modifications suggested while presenting the scheme and syllabi before CGPC on 8.6.2015 have been incorporated.

3. There is no discrepancy among the soft copy in MS word format, PDF and hardcopy of the syllabi submitted to the CGPC.

4. The document has been verified by all the constituent colleges

Coordinator in charge of syllabus revision of the programme

Dr. Chithraprasad D

Professor and Head, Dept.of CSE

TKM College of Engineering

Karikkodu, Kollam

Dr.S Ayoob

Principal

TKM College of Engineering,Karikkodu, Kollam

Principals of the colleges in which the programme is offered

No	Nameofthecollege	Principal'sName	Signature
1	TKM College of Engineering Karikkodu, Kollam	Dr.S Ayoob	
2	Baselios Mathews II College of Engineering, Sasthamcotta	Dr.E. Vasudevan Nampoothiri	
3	Travancore Engineering College, Oyoor	Dr.P Balachandran	
4	Younus College of Engineering & Technology, Kollam	Dr.M Abdul Majeed	

Date:
Place:

Dr.S. Mohan,
Professor, IIT Madras
Chairman

Programme Educational Objective

1. Excel in academics, engineering design thinking and product development in Computer Science and Information Technology, so as to facilitate enhanced learning, research and entrepreneurship.
2. Exhibit critical thinking, decision-making and problem solving skills to unraveling real world engineering problems.
3. Present ideas and inferences effectively, while adhering to ethical values and above all maintaining professional and social responsibilities.

Programmeoutcome

Aftersuccessfulcompletion oftheprogrammethe student should be able to

1. Apply advanced knowledge acquired through the program to define, analyze and conceptualize computational problems, appraise possible alternatives ways of solving them and arrive at the most optimal solutions.
2. Analyze and interpret observations obtained by performing experiments and simulations using traditional as well as contemporary tools and techniques in Computer Science and Engineering, so as to contribute individually or in groups for the development of solutions for problems in multidisciplinary domains.
3. Engineer hardware or software systems and subsystems taking into account economic, environmental and ethical constraints, whereby upholding to the philosophies of Sustainable Engineering.
4. Liaise with peer-groups, clients and society as a whole and ably communicate the results of the work.
5. Acknowledge the need to engage oneself in lifelong learning through formal education, autodidacticism and research.

SchemeofM.TechProgramme inComputer Sceince andEngineering

SEMESTER 1(Credits23)

Exam Slot	CourseNo:	Name	L-T-P	Internal Marks	EndSemesterExam		Credits
					Marks	Duration (hrs)	
A	02CS6111	Mathematical Foundations of Computer Science	4-0-0	40	60	3	4
B	02CS6121	Advanced Data Structure and Algorithms	4-0-0	40	60	3	4
C	02CS6131	Advanced Software Engineering	4-0-0	40	60	3	4
D	02CS6141	Topics in Database Technology	3-0-0	40	60	3	3
E	02CS6151	Elective-1	3-0-0	40	60	3	3
	02CA6001	Research Methodology	1-1-0	100	0	0	2
	02CS6161	Seminar	0-0-2	100	0	0	2
	02CS6171	Algorithm Design Laboratory	0-0-2	100	0	0	1

L-LectureT-Tutorial P-Practical

ELECTIVE I

02CS6151.1 Information Security
02CS6151.2 Modern Computing Paradigms
02CS6151.3 Image Processing
02CS6151.4 Cyber Laws and Ethics
02CS6151.5 Advanced Computer Graphics

Note:8hours/week ismeantfordepartmentalassistancebystudents.

SchemeofM.TechProgramme inComputer Sceince andEngineering

SEMESTER 2(Credits19)

Exam Slot	CourseNo:	Name	L-T-P	Internal Marks	EndSemesterExam		Credits
					Marks	Duration (hrs)	
A	02CS6112	Advanced Data Mining	4-0-0	40	60	3	4
B	02CS6122	Advanced Computer Architecture	3-0-0	40	60	3	3
C	02CS6132	Advanced Operating System Design	3-0-0	40	60	3	3
D	02CS6142	Elective-2	3-0-0	40	60	3	3
E	02CS6152	Elective-3	3-0-0	40	60	3	3
	02CS6162	Mini Project	0-0-4	100	0	0	2
	02CS6172	OS & Networks LAB	0-0-2	100	0	0	1

L-Lecture T-Tutorial P-Practical

ELECTIVE 2

02CS6142.1 Advanced Computer Networks
02CS6142.2 Information Retrieval
02CS6142.3 Advanced Topics in Distributed Systems
02CS6142.4 Parallel Algorithms
02CS6142.5 Soft Computing

ELECTIVE 3

02CS6152.1Advanced Graph Theory
02CS6152.2Fuzzy Set Theory and Application
02CS6152.3 Network Security
02CS6152.4 Advanced Compiler Design
02CS6152.5 Decision Support Systems

Note: 8 hours/week ismeantfordepartmentalassistancebystudents.

SchemeofM.TechProgramme inComputer Sceince andEngineering

SEMESTER3 (Credits14)

Exam Slot	Course NO:	NAME	L-T-P	Internal mark	End semester Exam		Credits
					Marks	Duration (hrs)	
A	02CS7111	Elective-4	3-0-0	40	60	3	3
B	02CS7121	Elective-5	3-0-0	40	60	3	3
	02CS7131	Seminar	0-0-2	100	0	0	2
	02CS7141	Project(Phase-1)	0-0-8	50	0	0	6

L-Lecture T-Tutorial P-Practical

ELECTIVE 4

02CS7111.1 Cloud Computing
02CS7111.2 Machine Learning
02CS7111.3 Advanced Numerical Techniques
02CS7111.4 Ad hoc and Sensor Networks
02CS7111.5 Bioinformatics

ELECTIVE 5

02CS7121.1Software Quality Assurance and Testing
02CS7121.2 Data Compression
02CS7121.3 Computational Geometry
02CS7121.4 Biomedical Imaging
02CS7121.5 Big Data Analytics

Note:8hours/week ismeantfordepartmentalassistancebystudents.

SchemeofM.TechProgramme inComputer Sceince andEngineering

SEMESTER 4(Credits12)

Exam Slot	Coursecode	Name	L-T-P	Internal Marks	EndSemester Exam		Credits
					Marks	Duration (hrs)	
	02CS7112	Project Phase II	0-0-21	70	30	0	12

L-Lecture T-Tutorial P-Practical

Note:8hours/week ismeantfordepartmentalassistancebystudents.

Totalcreditsforallsemesters:68

SEMESTER1

CourseNo.	CourseName	L-T-P-Credits	YearofIntroduction
02CS 6111	MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE	4-0-0-4	2015

CourseObjectives

To understand the fundamental concepts in theorem proving, recurrence relations, counting and probability, probability distributions, special graphs and circuits and important algebraic structures

Syllabus

Techniques for theorem proving; Linear time temporal logic and branching time logic; Adequate sets of connectives; Principles of mathematical induction and complete induction; Recursive definitions; Generating functions; Solution methods for recurrence relations; Fundamental principles of counting; Probability theory; Mathematical expectation; Discrete distributions; Continuous distributions; Graphs; Euler's formula; Groups and sub groups; Rings; Quadratic residues; Reciprocity; Elliptic curve arithmetic.

CourseOutcome

Understanding of the descrete mathematical concepts and ability to apply them in practical situations.

References

1. J. P. Tremblay, R. Manohar, "Discrete Mathematical Structures with Application to Computer Science", Tata McGrawHill, 2000.
2. Kenneth H. Rosen, "Discrete Mathematics and its Applications", 7/e, McGraw Hill Inc, 2011.
3. Richard Johnson, "Probablity and Statistics for Engineers", 7/e, Prentice-Hall India Private Limited, 2005.
4. Robert V. Hogg, Elliot A. Tanis, Meda J. M. Rao, "Probability and Statistical Inference", 7/e,, Pearson Education India, 2006.
5. Michael Huth, Mark Ryan "Logic in Computer Science", 2/e, Cambridge University Press, 2004.
6. J. Truss, "Discrete Mathematics for Computer Scientists", 2/e, Addison Wesley, 1999.
7. Bernard Kolman, Robert C Busby,SharonKutler Ross, "Discrete Mathematical Structures", 2/e, Prentice-Hall India Private Limited, 1996.

COURSEPLAN

Module	Contents	Contact Hours	Sem.Exam Marks;%
I	Techniques for theorem proving: Direct Proof, Proof by Contra position, Proof by exhausting cases and proof by contradiction, Linear-time temporal logic and Branching-time logic-Syntax, Semantics, Practical patterns of specifications, Important equivalences, Adequate sets of connectives, Principle of mathematical induction, principle of complete induction.	8	15

II	Recursive definitions, Generating functions, function of sequences calculating coefficient of generating function, solving recurrence relation by substitution and generating functions Solution methods for linear, first-order recurrence relations with constant coefficient, characteristic roots.	8	15
FIRSTINTERNALEXAM			
III	Fundamental principles of counting, pigeonhole principle, countable and uncountable sets, principle of inclusion and exclusion – applications, derangements, permutation and combination, Pascal's triangles, binomial theorem.	7	15
IV	Probability theory – Properties of Probability, Methods of Enumeration, Conditional Probability, Independent Events, Bayes Theorem, Mathematical Expectation, Random variables Discrete Distribution, Binomial Distribution, Mean and variance The Poisson Distribution, Continuous Distribution, Uniform and Exponential Distributions, Normal Distribution.	8	15
SECONDINTERNALEXAM			
V	Graphs, Terminology, Euler tours, planar graphs, Hamiltonian graphs, Euler's formula (proof), four colour problem (without proof) and the chromatic number of a graph, five colour theorem, chromatic polynomials, Warshall's algorithm, Decision Trees, weighted trees.	8	20
VI	Groups and subgroups, homomorphism theorems, cosets and normal subgroups, Lagrange's theorem, rings , finite fields, polynomial arithmetic, quadratic residues, reciprocity, discrete logarithms, elliptic curve arithmetic.	11	20
ENDSEMESTEREXAM			

CourseNo.	CourseName	L-T-P-Credits	YearofIntroduction
02CS 6121	ADVANCED DATA STRUCTURES AND ALGORITHMS	4-0-0-4	2015

CourseObjectives

To understand about advanced data structures ,to understand how to analyze and establish correctness of algorithms and to understand theory behind various classes of algorithms.

Syllabus

Amortized analysis; Advanced data structures; Network flow algorithms and their analysis; Probabilistic algorithms; Monte-Carlo algorithms; Geometric algorithms; Convex hull algorithms; Finding closest pair of points; Number theoretic algorithms; Integer factorization; String matching; Overview of complexity classes; Complexity classes in randomized algorithms.

CourseOutcome

Attheendofthecourse the students are able to

- Explain the concepts of advanced data structures and their applications
- Compare various classes of algorithms.
- Design and analyze new algorithms

References

1. T. H. Cormen, C. E. Leiserson, R. L. Rivest and C. Stein, “Introduction to algorithms”, Prentice-hall of India Private Limited, New Delhi, 2010.
2. SartajSahni, “Data Structures, Algorithms, and Applications in C++”, Mc-GrawHill, 1999.
3. Gilles Brassard and Paul Bratley, “Fundamentals of algorithms”, Prentice-hall of India Private Limited, New Delhi, 2001.
4. R.C.T. Lee, S.S. Tesng, R.C. Cbang and Y.T. Tsai “Design and Analysis of Algorithms, A strategic Approach”, TMH, 2010
5. Rajeev Motwani, PrabhakarRaghavan, “Randomized Algorithms”, Cambridge University Press, 2000.
6. Dexter C. Kozen, “The Design and Analysis of Algorithms”, Springer.
7. Jon Kleinberg and Eva Tardos, “Algorithm Design”, Pearson Education, 2006.
8. M. H. Alsuwaiyal, “Algorithms Design Techniques and Analysis”, World Scientific Publishing Co. Beijing, 1999.
9. S. K. Basu, “Design Methods and Analysis of Algorithms”, Prentice Hall India, 2005.

COURSEPLAN			
Module	**Contents**	**ContactHours**	**Sem.ExamMarks;%**
I	Amortized Analysis – aggregate, accounting, potential methods- Case studies. Advanced data structures: binomial heap, Fibonacci heap, disjoint sets - applications.	7	15
II	Network flow algorithms: properties, Ford-Fulkerson method, maxflow-mincut theorem, Edmonds-Karp heuristics, push-relabel, relabel-to-front algorithms, maximum bipartite matching - analysis of associated algorithms - applications.	8	15
FIRSTINTERNALEXAM			
III	Probabilistic algorithms: Numerical algorithms, integration, counting, Monte-Carlo algorithms - verifying matrix multiplication, min-cut in a network. Las Vegas algorithms, selection, quicksort, Dixon's factorization	8	15
IV	Geometric Algorithms: Plane sweep technique, role of sweep- line - status and event-point-schedule, line segment intersection problem. Convex Hull: Graham's scan algorithm, Jarvismarch algorithm. Finding closest pair of points, proof of correctness.	9	15
SECONDINTERNALEXAM			
V	Number-Theoretic algorithms: GCD algorithm, primality testing, Miller-Rabin test, integer factorization - Pollard Rho heuristic, string matching: Rabin-Karp, Knuth-Morris-Pratt algorithms.	10	20
VI	Overview of Complexity classes – P, NP, Co-NP, NP-hard, NP complete, Space complexity. Complexity classes in randomized algorithms – RP, PP, ZPP, BPP.	8	20
ENDSEMESTEREXAM			

CourseNo.	CourseName	L-T-P-Credits	YearofIntroduction
02CS 6131	ADVANCED SOFTWARE ENGINEERING	4-0-0- 4	2015

CourseObjectives

To gain knowledge about the issues and approaches in modeling, analyzing and testing software systems.

Syllabus

Introduction to software engineering; Role of software engineer; Modelling the process and life cycle; Software process models; Agile methods; Tools and techniques for process modelling; Process models and project management; Project personnel and organization; Effort and schedule estimation; Risk management; Capturing, eliciting, modelling, and reviewing requirements; Software architectures and their evaluation; Software architecture documentation; Object oriented design; Types of testing; Reliability, availability, and maintainability; predictive accuracy; Test documentation; Maintaining the system.

CourseOutcome

- Students are able to use the principles of software engineering in modeling and testing.
- Students are able to explain different software architectures.

References

1. Shari Lawrence Pfleeger, Joanne M Atlee, "Software Engineering Theory and Practice", 4/e, Pearson Education, 2011.
2. Software Engineering: A Practitioner's Approach, Roger S Pressman, 7/e,. McGraw Hill Int.Ed., 2010.
3. Ian Somerville, "Software Engineering", 8/e, Addison-Wesley 2007
4. Carlo Ghezzi, Mehdi Jazayeri, Dino Mandrioli, "Fundamentals of Software Engineering", 2/e, PHI Learning Private Ltd., 2010
5. PankajJalote, "An Integrated Approach to Software Engineering", 3/e, Springer 2005.
6. K.K Aggarwal&Yogesh Singh, "Software Engineering", New Age International 2007.
7. Norman E Fenton, Shari Lawrence Pfleeger, "Software Metrics: A Rigorous and Practical Approach. 1998

COURSEPLAN

Module	Contents	Contact Hours	Sem.Exam Marks;%
I	Introduction: Role of Software Engineer- Quality of software process and product – Systems Approach to Software Engineering – An Engineering Approach to Software Engineering – How has Software Engineering Changed? Modeling the Process and Life Cycle – Software Process Models – Waterfall Model – V Model - Prototyping Model – Spiral Model – Agile methods.	8	15

II	Tools and Techniques for Process Modeling – Planning and Managing the Project - Tracking project progress - Project personnel and organization – Effort and schedule estimation – Risk Management – Process Models and Project Management .	8	15
FIRSTINTERNALEXAM			
III	Capturing the Requirement – Eliciting Requirements – Modelling requirements – Reviewing requirements to ensure quality – Documenting requirements – Designing the architecture – Views of Software Architecture – Common Architectural Patterns – Architecture Evaluation and Refinement Criteria for evaluating and comparing design alternatives - Software architecture documentation.	9	15
IV	Designing Modules – Design Methodology – Design Principles – Object Oriented (OO) design – Representing designs using UML – OO Design Patterns - OO Measurement - Design Documentation Programming Standards and Procedures – Programming Guidelines – Documentation.	9	15
SECONDINTERNALEXAM			
V	Testing the Programs - Principles of System Testing - Function Testing - Performance Testing – Reliability - Availability and Maintainability - Basics of reliability theory - The Software Reliability Problem - Parametric reliability growth models	8	20
VI	Predictive accuracy - The recalibration of software-reliability growth predictions - Acceptance Testing - Installation Testing – Automated System Testing - Test Documentation - Testing Safety Critical Systems - Maintaining the System – Evaluating Products, Processes, and Resources.	8	20
ENDSEMESTEREXAM			

CourseNo.	CourseName	L-T-P-Credits	YearofIntroduction
02CS 6141	TOPICS IN DATABASE TECHNOLOGY	3-0-0-3	2015

CourseObjectives

- *To understand the implementation and management aspects of databases.*
- *To understand the principles of distributed databases.*
- *To understand object based data models and their implementation.*
- *To understand the recent advances in database technology.*

Syllabus

Query processing algorithms; Transaction management; Concurrency control; Deadlocks; Database security and access control; Database system architectures; Parallel systems; IO parallelism; Distributed database; Distributed transactions; Distributed query processing; Concepts of object databases; Semi-structured data and XML databases; Temporal databases; Multimedia databases; Mobile data management..

CourseOutcome

- Discuss about various implementation issues in databases.
- Explain about distributed databases.
- Apply object based database concept in designing database systems.
- Discuss about recent technological trends in databases.

References

1. R. Elmasri, S.B. Navathe, "Fundamentals of Database Systems", 5/e, Pearson Education/Addison Wesley, 2011
2. Patrick O'Neil , Elizabeth O'Neil , "Database: Principles, Programming and Performance", 2/e, Morgan Kaufmann, 2011
3. Thomas Cannolly and Carolyn Begg, "Database Systems, A Practical Approach to Design, Implementation and Management", 3/e, Pearson Education, 2010.
4. Henry F Korth, Abraham Silberschatz, S. Sudharshan, "Database System Concepts", 5/e, Tata McGraw Hill, 2006.
5. C.J. Date, A.Kannan and S. Swamynathan,"An Introduction to Database Systems", 8/e, Pearson Education India, 2006.
6. Joe Fawcett, Danny Ayers , Liam R. E. Quin, Beginning XML, 5/e, John Wiley & Sons, 2012
7. Grigoris Antoniou. Frank van Harmelen, "A Semantic Web Primer", The MIT Press, Cambridge, Massachusetts, 2003
8. Jules J. Berman, "Principles of Big Data: Preparing, Sharing and Analyzing Complex Information", Morgan Kufmann, 2013.
9. Pete Warden, "Big Data Glossary", O'Reilly Media Inc, 2011

COURSEPLAN

Module	Contents	Contact Hours	Sem.Exam Marks;%
I	Query Processing Algorithms – Query Optimization Techniques – Transaction Management: Transaction Processing Concepts - Concurrency Control – Deadlocks – Recovery Techniques.	6	15

II	Database Security: threats to databases, control measures, database security and DBA, Discretionary access control, Mandatory access control (role-based only), SQL injection. Database System Architectures: Centralized and Client-Server Architectures – Server System Architectures.	7	15
FIRSTINTERNALEXAM			
III	Parallel Systems- Distributed Systems – Parallel Databases: I/O Parallelism – Inter and Intra Query Parallelism – Inter and Intra operation Parallelism – Distributed Database – Functions – Distributed RDB design- Transparency– Distributed Transactions - Commit Protocols – Concurrency Control –Deadlocks – Recovery - Distributed Query Processing.	7	15
IV	Concepts for Object Databases: Object Identity – Object structure – Type Constructors – Encapsulation of Operations – Methods – Persistence – Type and Class Hierarchies – Inheritance – Complex Objects, ODMG, ODL, OQL, basic OQL queries. Object Relational Systems – Case studies: Oracle and Informix.	7	15
SECONDINTERNALEXAM			
V	Semi-structured Data and XML Databases: XML Data Model – DTD – XPath and XQuery – Example Queries. Storing, RDF (Fundamental Concepts only). Temporal Databases – Time in Databases, Spatial and geographical data management: geographical data, representation, spatial queries, indexing spatial data, k-d trees, quad trees and R-trees	7	20
VI	Multimedia Databases: data formats, continuous media data, similarity-based retrieval, Mobile data management: Mobile computing architecture – data management issues - location-based services – peer-to-peer systems and applications – application platforms.	6	20
ENDSEMESTEREXAM			

CourseNo.	CourseName	L-T-P-Credits	YearofIntroduction
02CS 6151 .1	INFORMATION SECURITY	3-0-0-3	2015

CourseObjectives

To understand the requirement and fundamental principles of Information security.

Syllabus

OS security; DB security; Software vulnerabilities; Malware viruses, worms, and Trojans; Topological worms; Symmetric encryption principles; Public Key cryptography principles; SHA1; Discrete log Diffie Hellman; Digital signature; Digital certificates; Steganography and watermarking; Symmetric key distribution; One way and two way authentication; Needham Schroeder protocol; Kerberos; Network layer security; Transport layer security; Web security consideration; Law and ethics.

CourseOutcome

- Discuss about information security, its significance and the domain specific security issues.

References

1. Bernard Menezes, "Network security and Cryptography", Cengage Learning India, 2010.
2. Behrouz A. Forouzan, "Cryptography and Network Security", Special Indian Edition, Tata McGraw Hill, 2007
3. William Stallings, "Cryptography and Network Security: Principles and Practice", 6/e Pearson Education, 2013.
4. Dieter Gollmann. "Computer Security", John Wiley and Sons Ltd., 2006.
5. Whitman and Mattord, "Principles of Information Security", Cengage Learning, 2006.
6. D. Bainbridge, "Introduction to Computer Law", 5/e, Pearson Education, 2004.
7. C. Kaufman, R. Perlman and M. Speciner, "Network Security: Private Communication in a public World", 2/e, Prentice Hall, 2002.
8. W. Mao, "Modern Cryptography: Theory & Practice", Pearson Education, 2004.
9. H. Delfs and H. Knebl, "Introduction to Cryptography: Principles and Applications", Springer Verlag, 2002.

COURSEPLAN			
Module	**Contents**	**Contact Hours**	**Sem.Exam Marks;%**
I	Security Models as basis for OS security, Introduction to DB Security, Software vulnerabilities, Buffer and stack overflow, Phishing. Malware Viruses, Worms and Trojans. Topological worms. Internet propagation models for worms. Symmetric Encryption Principles, Public-Key Cryptography Principles	7	15
II	Cryptography Topics: Introduction to Secure Hash Function and Digital Signature, Cryptographic hash SHA1, Discrete Log Diffie Hellman, Digital certificates. Steganography, watermarking. Symmetric Key Distribution Using Symmetric Encryption	7	15
FIRSTINTERNALEXAM			
III	Protocol topics: One way and two way authentication, Needham Schroeder protocol, Kerberos basics, Biometrics for authentication.	6	15
IV	Network security topics: Network layer security – IPSec – overview, IP and IPv6, AH, ESP. Transport layer security SSL. Attacks DoS, DDoS, ARP spoofing - firewalls.	7	15
SECONDINTERNALEXAM			
V	Web Security Consideration, Secure Sockets Layer (SSL) and Transport Layer Security (TLS), HTTPS, Secure Shell (SSH), Pretty Good Privacy (PGP), S/MIME	7	20
VI	Law and ethics: Intellectual property rights, computer software copyrights, security policy, ethical hacking, security tools.	6	20
ENDSEMESTEREXAM			

CourseNo.	CourseName	L-T-P-Credits	YearofIntroduction
02CS 6151.2	MODERN COMPUTING PARADIGM	3-0-0-3	2015

CourseObjectives

- *The ability to work with various computing revolutions like HPC, Cluster, Grid and Cloud computing.*
- *Ability to use virtualization techniques to implement computing approaches like cloud*

Syllabus

High performance computing; Programming models; Introduction to PVM and MPI; Cluster computing; Grid Computing – Fundamentals, Grid security, Grid architecture, Grid topologies; Cloud computing – Cloud architecture, Cloud storage, Cloud services, EUCALYPTUS, CloudSim; Virtualization types; Virtual machines.

CourseOutcome

- Use appropriate computing paradigms in real time business
- Discuss about various tools and methods to implement Grid and Cloud computing

References

1. RajkumarBuyya, High Performance Cluster Computing – Architecture and Systems, Pearson Education.
2. Bart Jacob, Michael Brown, et al, Introduction to Grid Computing, IBM Red Books
3. Kris Jamsa, Cloud Computing, Jones and Bartlett Learning, LLC
4. Michael Miller, Cloud Computing: Web-Based Applications that Change the Way You Work and Collaborate Online, Que Publishing.
5. William von Hagen, Professional Xen Virtualization, Wrox Publications, January, 2008.

COURSEPLAN

Module	Contents	Contact Hours	Sem.Exam Marks;%
I	High performance computing - cluster, grid, meta-computing, middleware. Programming models: shared memory, message passing, peer-to-peer, broker-based. Introduction to PVM and MPI.	7	15
II	Cluster Computing – Cluster Computing at a Glance – Cluster Setup and its Administration – Cluster Architectures – Detecting and Masking Faults – Recovering from Faults.	7	15

FIRSTINTERNALEXAM			
III	Grid Computing – Fundamentals – Benefits of Grid Computing – Grid Terms and Concepts – Grid Security – Grid Architecture Models – Grid Topologies.	6	15
IV	Cloud Computing – Cloud Architecture – Cloud Storage – Cloud Services. Types of Cloud Service Development. Software as a Service – Platform as a Service – Infrastructure as a Service, Identity as a Service – Data Storage in the Cloud – Collaboration in the Cloud – Securing the Cloud – Service Oriented Architecture	7	15
SECONDINTERNALEXAM			
V	Familiarization of EUCALYPTUS – an open source software framework for cloud computing. Familiarization of CloudSim: A Toolkit for Modeling and Simulation Cloud Computing Environments. Virtualization - Virtualization Types – Desktop Virtualization – Network Virtualization – Server and Machine Virtualization – Storage Virtualization	7	20
VI	Virtual Machine Basics – Hypervisor - Server Consolidation. Virtual machines products-Xen Virtual machine monitors- Xen API – VMware – VMware product-Vmware Features – Microsoft Virtual Server – Features of Microsoft Virtual Server Software framework for distributed computing - MapReduce - Hadoop.	7	20
ENDSEMESTEREXAM			

CourseNo.	CourseName	L-T-P-Credits	YearofIntroduction
02CS 6151.3	IMAGE PROCESSING	3-0-0-3	2015

CourseObjectives

- To impart understanding of the methodologies in digital image processing.
- To get knowledge about the principles, techniques and algorithms for digital image processing

Syllabus

Digital image representation; Fundamental steps in image processing; Elements of digital image processing systems; Sampling and quantization; Relationship between pixels; Image enhancement – Basic grey level transformations, Histogram equalization, Spatial filtering; Image transforms; Image enhancement in frequency domain; Image restoration; Point detection, line detection, and edge detection in images; Image segmentation; Image compression; Image reconstruction from projections.

CourseOutcome

- Explain digital image processing systems.
- Discuss about Image transforms, restoration, segmentation and compression techniques.

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References

1. Rafael C., Gonzalez & Woods R.E., "Digital Image Processing", Pearson Education.
2. Rosenfeld A. &Kak A.C., "Digital Picture Processing", Academic Press
3. Jain A.K, "Fundamentals of Digital Image Processing", Prentice Hall,Eaglewood Cliffs, NJ.
4. Schalkoff R. J., "Digital Image Processing and Computer Vision", John Wiley
5. Pratt W.K., "Digital Image Processing", John Wiley

COURSEPLAN

Module	Contents	Contact Hours	Sem.Exam Marks;%
I	Introduction digital image representation: fundamental steps in image processing, elements of digital image processing systems, digital image fundamentals, simple image model, sampling and quantization.	6	15
II	Relationship between pixels , image geometry, Image enhancement - Basic grey level transformation – Histogram equalization – Image subtraction – Image averaging – Spatial filtering – Smoothing and sharpening filters – Laplacian filters	7	15

FIRSTINTERNALEXAM			
III	Image transforms : Introduction to Fourier transform – discrete Fourier transform, properties of 2d-fourier transform (DFT), other separable image transforms, Hotelling transform	7	15
IV	Image enhancement in the frequency domain. Image restoration: degradation/restoration model, Noise models, inverse filtering, least mean square filtering.	7	15
SECONDINTERNALEXAM			
V	Point detection, line detection and edge detection in images. Image segmentation. Image compression: image compression, elements of information theory, error-free Compression, lossy compression, image compression standards.	7	20
VI	Image reconstruction from projections: basics of projection, parallel beam and fan beam projection, method of generating projections, Fourier slice theorem, filtered back projection algorithms	6	20
ENDSEMESTEREXAM			

CourseNo.	CourseName	L-T-P-Credits	YearofIntroduction
02CS 6151.4	CYBER LAWS AND ETHICS	3-0-0-3	2015

CourseObjectives

- To impart sufficient knowledge about the fundamental principles of IPR, various types of cyber-crimes and Indian and international cyber laws.

Syllabus

Intellectual property rights; Computer software copyrights; Copyrights in electronic publishing and databases; Laws of confidence; trademarks; product designs; patent laws; Computer contracts; Computer crimes; Cyber laws in India; International cyber laws and crimes; Ethical issues in computer security; Case studies.

CourseOutcome

Attheendofcourse,thestudentwillbeableto:

- Discuss about ethical issues, cyber-crimes and cyber laws.

References

1. D. Bainbridge, Introduction to Computer Law, 5/e, Pearson Education, 2004.
2. Harish Chander, Cyber Laws and IT Protection, PHI Learning Private Limited, 2012.
3. P. Duggal, Cyber law: the Indian Perspective, Saakshar Law Publications, Delhi, 2005.
4. C. P. Fleeger and S. L. Fleeger, Security in Computing, 3/e, Pearson Education, 2003.

COURSEPLAN

Module	Contents	Contact Hours	Sem.Exam Marks;%
I	Intellectual property rights, computer software copyrights, copyright in databases and electronic publishing, law of confidence, patent laws, trademarks, product designs, international law .	7	15
II	Computer contracts, liability for defective hardware and software, software contracts, web and hardware contracts, electronic contracts and torts, liabilities.	7	15
	FIRSTINTERNALEXAM		
III	Computer crime, computer fraud, hacking	6	15
IV	Unauthorized modification of information, piracy, computer pornography and harassment.	6	15
	SECONDINTERNALEXAM		
V	Cyber laws in India, IT Act 2000, Offences under IT act. Protection pf IPR in Cyber space in India.	7	20

VI	International cyber laws and crimes, COE convention of cyber crimes. data subjects' rights, ethical issues in computer security, case studies	7	20
ENDSEMESTEREXAM			

CourseNo.	CourseName	L-T-P-Credits	YearofIntroduction
02CS 6151.5	ADVANCED COMPUTER GRAPHICS	3-0-0-3	2015

CourseObjectives

- *To introduce geometric modelling and modelling transformations*
- *To learn different techniques for representing Solids*
- *To learn visible surface determination algorithms*
- *To learn concepts of global illumination modeling using advanced Ray tracing algorithms and Radiosity methods*

Syllabus

Geometric modelling - Modelling transformations, Hierarchical models, Interaction, Output features, Optimizing display of hierarchical models, SPHIGS; User interface software; Solid modelling – Regularized Boolean set of operations, Sweep representations, Boundary representations, Edge representations; Visible surface determination algorithms; Illumination and shading; Radiosity methods; Image manipulation and storage; Clipping polygons; Animation; Advanced raster graphics architecture; Multiprocessor rasterization architecture; Image parallel rasterization.

CourseOutcome

- apply appropriate mathematical models to solve computer graphics problems.

References

1. James D. Foley, Andries van Dam, Steven K. Feiner and F. Hughes John, "Computer Graphics, principles and Practice in C", 2/e, Pearson Education.
2. Donald Hearn and M. Pauline Baker, " Computer Graphics", Prentice Hall India
3. Alan Watt , " 3D Computer Graphics", Addison Wesley.

COURSEPLAN

Module	Contents	Contact Hours	Sem.Exam Marks;%
I	Geometric modelling :Hierarchy in Geometric models, relationship between model, application program and Graphical System, Defining and Displaying structures, Modelling Transformations, Hierarchical structure networks, Appearance attribute handling in hierarchy, Screen updating and rendering modes, Interaction, Output features, Implementation issues, Optimizing display of hierarchical models, Limitations of SPHIGS.	7	15

II	User Interface Software: Basic interaction handling models, Window management systems, Output handling in window systems, Input handling in window systems, User Interface Management systems. Solid Modelling: Regularized Boolean set of operations, Sweep representations, Boundary representations, Winged – Edged representations, Boolean Set Operations, Spatial Partitioning representations, Octrees, Constructive Solid Geometry, Comparisons of representations.	7	15
FIRSTINTERNALEXAM			
III	Visible surface determination algorithms: Scan line algorithm, Area subdivision algorithm, visible surface ray tracing. Algorithm for Octree, algorithm for curved surface.	6	15
IV	Illumination and shading: Illumination models, diffuse reflection and Specular reflection, illumination models, Shading models for polygons. Global illumination algorithms. Recursive ray tracing and distributed ray tracing. Radiosity methods, Combining radiosity and ray tracing.	7	15
SECONDINTERNALEXAM			
V	Image manipulation and storage : Geometric transformation of images, Filtering, Multipass transforms, Generation of transformed image with filtering, Image Compositing, Mechanism for image storage. Advanced geometric and raster transforms: Clippingclipping polygon against rectangles and other polygons. Animation: Conventional and computer assisted animation, Methods of controlling animation.	7	20
VI	Advanced Raster graphics architecture. Display processor system, Standard graphics pipeline, Multiprocessor Graphics System. Multi processorRasterization Architectures. Image parallel rasterization.	6	20
ENDSEMESTEREXAM			

CourseNo.	CourseName	L-T-P-Credits	YearofIntroduction
02CA6001	RESEARCH METHODOLOGY	1-1-0-2	2015

CourseObjectives

- *To formulate a viable research question*
- *To distinguish probabilistic from deterministic explanations*
- *To analyze the benefits and drawbacks of different methodologies*
- *To understand how to prepare and execute a feasible research project*

Syllabus

Introduction to research methodology; Objectives and types of research; Research formulation; Selecting a problem; Literature review; Research design and methods; Development of models and research plan; Data collection and analysis; Data processing and analysis strategies; Report and thesis writing; Presentation; Application of results of research outcome; Commercialization of the work; Ethics; Trade related aspects of Intellectual property rights.

CourseOutcome

- Students are exposed to the research concepts in terms of identifying the research problem, collecting relevant data pertaining to the problem, to carry out the research and writing research papers/thesis/dissertation.

References

1. C.R Kothari, Research Methodology, Sultan Chand & Sons, New Delhi,1990.
2. Panneerselvam, “Research Methodology”, Prentice Hall of India, New Delhi, 2012.
3. J.W Bames,” Statistical Analysis for Engineers and Scientists”, McGraw Hill, New York.
4. Donald Cooper, “Business Research Methods”, Tata McGraw Hill, New Delhi.
5. Leedy P D, "Practical Research: Planning and Design", MacMillan Publishing Co.
6. Day R A, *"How to Write and Publish a Scientific Paper"*, Cambridge University Press, 1989.
7. Manna, Chakraborti, “Values and Ethics in Business Profession”, Prentice Hall of India, New Delhi, 2012.
8. Sople,”Managing Intellectual Property: The Strategic Imperative”, Prentice Hall of India, New Delhi, 2012.

COURSEPLAN

Module	Contents	Contact Hours	Sem.Exam Marks;%
I	Introduction to Research Methodology - Objectives and types of research: Motivation towards research - Research methods *vs.* Methodology. Type of research: Descriptive *vs.* Analytical, Applied *vs.* Fundamental, Quantitative *vs.* Qualitative, and Conceptual *vs.* Empirical.	6	15

II	Research Formulation - Defining and formulating the research problem -Selecting the problem - Necessity of defining the problem - Importance of literature review in defining a problem. Literature review: Primary and secondary sources - reviews, treatise, monographs, patents. Web as a source: searching the web. Critical literature review - Identifying gap areas from literature review - Development of working hypothesis.	7	15
FIRSTINTERNALEXAM			
III	Research design and methods: Research design - Basic Principles- Need for research design — Features of a good design. Important concepts relating to research design: Observation and Facts, Laws and Theories, Prediction and explanation, Induction, Deduction. Development of Models and research plans: Exploration, Description, Diagnosis, Experimentation and sample designs.	7	15
IV	Data Collection and analysis: Execution of the research - Observation and Collection of data - Methods of data collection - Sampling Methods- Data Processing and Analysis strategies - Data Analysis with Statistical Packages - Hypothesis-Testing -Generalization and Interpretation.	6	15
V	Reporting and thesis writing - Structure and components of scientific reports -Types of report - Technical reports and thesis - Significance - Different steps in the preparation, Layout, structure and Language of typical reports, Illustrations and tables, Bibliography, referencing and footnotes. Presentation; Oral presentation - Planning - Preparation -Practice - Making presentation - Use of audio-visual aids - Importance of effective communication.	7	20
VI	Application of results of research outcome: Environmental impacts –Professional ethics – Ethical issues -ethical committees. Commercialization of the work - Copy right - royalty - Intellectual property rights and patent law - Trade Related aspects of Intellectual Property Rights - Reproduction of published material - Plagiarism - Citation and acknowledgement - Reproducibility and accountability.	6	20

CourseNo.	CourseName	L-T-P-Credits	YearofIntroduction
02CS 6161	SEMINAR	0-0-2-2	2015

Each student is required to select a topic on advanced technologies in Computer Science and allied subject domains and get it approved by the faculty-in-charge of seminar. He/she should give a presentation with good quality slides. An abstract of the seminar should be submitted to the faculty members well in advance before the date of seminar. He/she should also prepare a well documented report on the seminar in approved format and submit to the department

CourseNo.	CourseName	L-T-P-Credits	YearofIntroduction
02CS 6171	**ALGORITHM DESIGN LABORATORY**	**0-0-2-2**	**2015**

The experiments are based on, but need not be limited to, the topics covered in the course Advanced Data structures and Algorithms (02CS6121) and explore the use of the said algorithms and data structures in various application domains.

SEMESTER2

CourseNo.	CourseName	L-T-P-Credits	YearofIntroduction
02CS 6112	ADVANCED DATA MINING	4-0-0: 4	2015

CourseObjectives

To understand the fundamental and advanced concepts in Data Warehousing and Data Mining

Syllabus

Data warehousing; OLAP operations; Data warehousing architecture; Data warehousing to data mining; Data mining tasks; Data mining issues; Data pre-processing; Concept hierarchy generation; Introduction to DMQL; Similarity measures; Classification algorithms; Clustering algorithms; Association rules; Web mining; Spatial mining; Temporal mining.

CourseOutcome

Conceptual understanding of:

- Data cleaning, analysis and visualization
- Data mining techniques
- Web mining and Spatial mining

References

1. Margaret H Dunham, "Data Mining – Introductory and Advanced Topics", Pearson India, 2005.
2. Ian H. Witten, Eibe Frank, Mark A. Hall," Data Mining: Practical Machine Learning Tools and Techniques", 3/e, Morgan Kaufmann, 2011.
3. J. Han, M. Kamber, "Data Mining: Concepts and Techniques", 2/e, Morgan Kaufman, 2006.

COURSEPLAN

Module	Contents	Contact Hours	Sem.Exam Marks;%
I	Data warehousing – Multidimensional data model, OLAP operation, Warehouse schema, Data Warehousing architecture, warehouse server, Metadata, OLAP engine, Data warehouse Backend Process , Data Warehousing to Data Mining. Basic Data Mining Tasks, Data Mining Issues, Data Mining Metrics, Data Mining from a Database Perspective, Knowledge Discovery in Database Vs Data mining.	9	15
II	Data Preprocessing**:** Preprocessing, Cleaning, Integration, Transformation, Reduction, Discretization, Concept Hierarchy Generation, Introduction to DMQL	8	15
FIRSTINTERNALEXAM			

III	Similarity measures, Bayes Theorem, Classification - regression, Bayesian classification, Decision tree based algorithm- ID3, Neural network based algorithm- supervised learning, back propagation, gradient-descent algorithm, Rule based algorithm-IR, PRISM	9	15
IV	Clustering algorithm – Hierarchical algorithm – Dendrograms- Single link algorithm, Partitional algorithm-Minimum spanning tree, squared error, K-means, PAM algorithm.	8	15
SECONDINTERNALEXAM			
V	Association Rules : Apriori algorithm, Sampling algorithm, Partitioning algorithm, Parallel and distributed algorithms	8	20
VI	Web mining - web content mining, web structure mining, web usage mining, Spatial mining - spatial queries, spatial data structures, Generalization and specialization, spatial classification, spatial clustering, Introduction to temporal mining.	8	20
ENDSEMESTEREXAM			

CourseNo.	CourseName	L-T-P-Credits	YearofIntroduction
02CS 6122	ADVANCED COMPUTER ARCHITECTURE	3-0-0-3	2015

CourseObjectives

- *To understand issues and techniques in improving performance of processors*
- *To understand the concepts of pipelining.*
- *Familiarize with the properties of superscalar processors.*
- *To understand the multiprocessor systems and cache coherence.*

Syllabus

Classes of parallelism and parallel architecture; Computer architecture; Data dependencies and hazards; Instruction level parallelism; Dynamic scheduling; Data level parallelism; Vector architecture; Graphics Processing Unit; Multiprocessor system interconnects; Cache coherence.

CourseOutcome

In-depth knowledge in:

- Measuring performance of processors
- Instruction level parallelism
- Vector Architecture
- Multiprocessor systems and cache coherence.
- Interconnection networks

References

1. Hennessy J. L., D. Patterson, "Computer Architecture – A quantitative Approach", 5/e, Morgan Kauffman 2012.
2. DezsoSima, Terence Fountain, Peter Kacsuk, "Advanced Computer Architectures – A Design Space Approach", Pearson Education India, 2009.
3. Kai Hwang, "Advanced Computer Architecture Parallelism, Scalability, Programmability", Tata McGraw Hill, 2003.
4. John Paul Shen, MikkoLipasti, "Modern Processor Design – Fundamentals of Superscalar Processors", McGraw Hill International Edition, 2005.
5. The World Wide Web (WWW) Computer Architecture page. http://www.cs.wisc.edu/arch.

COURSEPLAN

Module	Contents	Contact Hours	Sem.Exam Marks;%
I	Classes of parallelism and parallel architecture, computer architecture- design issues, Performance measurements, quantitative principles of computer design	7	15

II	Instruction level parallelism – concepts and challenges, Data dependencies and hazards, Basic compiler techniques for exposing ILP.	6	15
FIRSTINTERNALEXAM			
III	Dynamic Scheduling - Tomasulo's approach, Hardware based speculation, ILP using multiple issueand static scheduling, ILP using dynamic scheduling, multiple issue and speculation, case study- Intel Core i7.	7	15
IV	Data level parallelism-Vector architecture-Vector instruction types, Vector-Access memory schemes , Graphic processing units	6	15
SECONDINTERNALEXAM			
V	Multiprocessor system interconnects-hierarchical bus system, Cross bar switch and multiport memory, multistage networks, Centralized shared memory architecture	7	20
VI	Multiprocessor cache coherence, Schemes for enforcing coherence - Snooping protocol, Limitations, Distributed shared memory and Directory based coherence.	7	20
ENDSEMESTEREXAM			

CourseNo.	CourseName	L-T-P-Credits	YearofIntroduction
02CS 6132	ADVANCED OPERATING SYSTEM DESIGN	3-0-0-3	2015

CourseObjectives

- *To understand the configuration and functions of a typical OS Kernel*

Syllabus

Introduction to Linux kernel; Linux versus Unix kernels; Process management; Process scheduling – Linux's process scheduler, Scheduling algorithms; System call handling and implementation; Interrupts and interrupt handlers; Kernel synchronization; Kernel synchronization methods; Timers and time management; Memory management; Virtual file system; Block IO layer; Process address space; Devices and modules.

CourseOutcome

- In-depth knowledge in Design and implementation of Kernel modules.

References:

1. Robert Love, "Linux Kernel Development", 3/e, Addison-Wesley, 2010.
2. Daniel Bovet, Marco Cesati, "Understanding the Linux Kernel", 3/e, OReilly Media Inc., 2005.
3. Reilly Christian Benvenuti, "Understanding Linux Network Internals", 1/e, OReilly Media Inc.,2005.
4. Jonathan Corbet, Alessandro Rubini, Greg Kroah-Hartman, "Linux Device Drivers", 3/e,
5. OReilly Media Inc., 2005.

COURSEPLAN

Module	Contents	Contact Hours	Sem.Exam Marks;%
I	Overview of basic concepts. Introduction to the Linux Kernel - History of Unix, Introduction to Linux, Overview of Operating Systems and Kernels, Linux Versus Classic Unix Kernels, Linux Kernel Versions.	6	15
II	Process Management - Process Descriptor and the Task Structure, Process Creation, The Linux Implementation of Threads, Process Termination. Process Scheduling - Linux's Process Scheduler, Policy, Linux Scheduling Algorithm, Preemption and Context Switching, Real-Time Scheduling Policies.System Calls - Communicating with the Kernel, Syscalls, System Call Handler, System Call Implementation.	7	15
FIRSTINTERNALEXAM			

III	Interrupts and Interrupt Handlers - Registering an Interrupt Handler, Writing an Interrupt Handler, Interrupt Context, Interrupt Control, Bottom Halves – Task Queues, Softirqs,Tasklets, Work Queues.	7	15
IV	Kernel Synchronization – Introduction, Critical Regions and Race Conditions, Locking, Deadlocks, Contention and Scalability. Kernel Synchronization Methods – Atomic Operations, Spin Locks, Semaphores, Mutexes, Completion Variables, BKL: The Big Kernel Lock, Sequential Locks, Preemption Disabling. Timers and Time Management - Kernel Notion of Time, Jiffies, Hardware Clocks and Timers, Using Timers, Delaying Execution.	7	15
SECONDINTERNALEXAM			
V	Memory Management - Pages and Zones, Slab Layer, Static Allocation on the Stack, High Memory Mappings, Per-CPU Allocations. The Virtual Filesystem - Filesystem Abstraction Layer, Unix Filesystems, VFS Objects and Data Structures, Superblock Object, Inode Object, Dentry Object, File Object.	6	20
VI	The Block I/O Layer - Buffers and Buffer Heads, Request Queues, I/O Schedulers. Process Address Space - Address Spaces, Memory Descriptor, Virtual Memory Areas, Page Tables. Devices and Modules - Device Types, Modules, Device Model.	7	20
ENDSEMESTEREXAM			

CourseNo.	CourseName	L-T-P-Credits	YearofIntroduction
02CS 6142.1	**ADVANCED COMPUTER NETWORKS**	**3-0-0-3**	**2015**

CourseObjectives

To impart a deeper understanding of

- *Networking design including media, protocols, quality control and congestion management*
- *Multimedia networking issues and approaches.*

Syllabus

General principles of network design; Network architecture and standardization; Network characteristics; High speed LANs; Switched LANs; Wireless transmission; Addressing in TCP/ IP networks; TCP/ IP protocol stack; Advanced features of IP routers; Wide Area Networks; IP WANs; Congestion and traffic management; Secure transport services; Multimedia networking.

CourseOutcome

- The student becomes aware of the theoretical and practical issues in networking.

References

1. Natalia Olifer Victor Olifer," Computer Networks - Principles, Technologies and Protocols for Network Design", - Wiley India (P) ltd. 2006.
2. William Stallings, "High Speed Networks and Internets – Performance and Quality of Service", Pearson India 2005.
3. James F Kurose and Keith W Ross," Computer Networking- A Top Down Approach Featuring Internet", 2/e, Pearson Education.

COURSEPLAN

Module	Contents	Contact Hours	Sem.Exam Marks;%
I	General Principles of Network Design – Network Architecture and Standardization- Network Characteristics-High Speed LANs : Fast Ethernet, Gigabit Ethernet and FDDI	7	15
II	Switched LANs : Basics and Advanced Features- Wireless Transmission : Wireless Media, Wireless Systems, Spread Spectrum Technology, WLANs	6	15
	FIRSTINTERNALEXAM		
III	Addressing in TCP/IP Networks : Address Types, IP Address Format (IPV4 and IPV6), Address Assignment, ARP, DNS, DHCP - Internet Protocol - Packet Format, Routing, IPV6	6	15

IV	TCP/IP Protocol Stack : TCP and UDP , Routing Protocols, ICMP - Advanced Features of IP Routers : Filtering, IP QoS, NAT, Routers - Wide Area Networks : Virtual Circuit Techniques, X.25, Frame Relay Networks , ATM Technology – IP WANs : Pure IP WANs, IP over ATM, Multiprotocol Label Switching, Network Management	7	15
SECONDINTERNALEXAM			
V	Congestion and Traffic Management: Congestion Control in Data Networks and Internets, Link Level Flow and Error Control, TCP Traffic Control, Traffic and Congestion Control in ATM Network. Secure Transport Services: IPSec Protected Channel Service, VPN Service, MPLS VPN.	7	20
VI	Multimedia Networking : Audio and Video Compression Techniques (Entropy encoding, JPEG Image Compression, MPEG Video Compression), Streaming Stored Audio and Video, Protocol for Real time Interactive Application, Integrated Services, RSVP, Differentiated Services.	7	20
ENDSEMESTEREXAM			

CourseNo.	CourseName	L-T-P-Credits	YearofIntroduction
02CS 6142 .2	INFORMATION RETREIVAL	3-0-0-3	2015

CourseObjectives

- *To understand the principles and techniques of information retrieval*

Syllabus

Goals and history of IR; Impact of web on IR; Role of Artificial Intelligence in IR; Basic IR models; Basic tokenizing indexing; Implementation of vector space retrieval; Experimental evaluation of IR; Query operations and languages; Metadata and markup languages; Web search engines; Text categorization and clustering; Clustering algorithms; Applications to information filtering, organization, and relevance feedback; Recommender systems; Information extraction and integration.

CourseOutcome

- Students gain in-depth theoretical and practical knowledge of information retrieval techniques and ability to apply them in practical scenarios.

References

1. Manning, Raghavan, and Schutze, Introduction to Information Retrieval, Cambridge University Press, 2008.
2. R. Baeza-Yates, B. Ribeiro-Neto, "Modern Information Retrieval: The Concepts and Technology behind Search", Pearson Education India, 1/e, 2009.

COURSEPLAN

Module	Contents	Contact Hours	Sem.Exam Marks;%
I	Introduction: Goals and history of IR. The impact of the web on IR. The role of artificial intelligence (AI) in IR. Basic IR Models: Boolean and vector-space retrieval models; ranked retrieval; text-similarity metrics; TF-IDF (term frequency/inverse document frequency) weighting; cosine similarity.	7	15
II	Basic Tokenizing Indexing, and Implementation of Vector-Space Retrieval:Simple tokenizing, stop-word removal, and stemming; inverted indices; efficient processing with sparse vectors; python implementation.	7	15
FIRSTINTERNALEXAM			

III	Experimental Evaluation of IR: Performance metrics: recall, precision, and F-measure; Evaluations on benchmark text collections. Query Operations and Languages: Relevance feedback; Query expansion; Query languages.	6	15
IV	Text Representation: Word statistics; Zipf's law; Porter stemmer; morphology; index term selection; using thesauri. Metadata and markup languages (SGML, HTML, XML). Web Search, Search engines; spidering; metacrawlers; directed spidering; link analysis (e.g. hubs and authorities, Google PageRank); shopping agents..	7	15
SECONDINTERNALEXAM			
V	Text Categorization and Clustering: Categorization algorithms: naive Bayes; decision trees; and nearest neighbor. Clustering algorithms: agglomerative clustering; k-means; expectation maximization (EM).	6	20
VI	Applications to information filtering; organization; and relevance feedback. Recommender Systems: Collaborative filtering and content-based recommendation of documents and products. Information Extraction and Integration: Extracting data from text; XML; semantic web; collecting and integrating specialized information on the web.	7	20
ENDSEMESTEREXAM			

CourseNo.	CourseName	L-T-P-Credits	YearofIntroduction
02CS 6142 .3	ADVANCED TOPICS IN DISTRIBUTED SYSTEMS	3-0-0-3	2015

CourseObjectives

To impart deeper understanding in:

- *Architecture and issues of distributed systems*
- *Distributed algorithms*
- *Hadoopsystem*

Syllabus

Distributed system definition; Types of distributed systems; System architecture; Communication; Naming; Consistency and replication; Distributed object based systems; Distributed algorithms; Hadoop ; Scaling out; Hadoop distributed file system; Administering Hadoop.

CourseOutcome

- The student gains insight into conceptual and practical aspects of distributed systems.

References

1. Andrew S. Tanenbaum, Maarten Van Steen." Distributed Systems – Principles and Paradigms ", 2/e, PHI, 2004.
2. Randy Chow Theodore Johnson, "Distributed Operating Systems and Algorithm Analysis", Pearson Education, 2009.
3. Nancy A. Lynch, Morgan," Distributed Algorithms", Kaufmann Publishers, Inc, 1996.
4. Tom White, "Hadoop: The Definitive Guide", 1/e, O'reilly, 2012.

COURSEPLAN

Module	Contents	Contact Hours	Sem.Exam Marks;%
I	Definition of Distributed System, Goals, Types of Distributed Systems, System Architecture: Centralized, Decentralized & Hybrid Architecture. Processes: Threads, Virtualization, Clients, Servers, Code migration. Communication: Message Oriented, Stream Oriented and Multicast Communication. Naming**:** Names, Identifiers and Addresses, Flat Naming, Structured Naming and Attribute Based Naming. Consistency and Replication: Reasons for Replication, Data Centric and Client Centric Consistency Models, Replica Management, Consistency Protocols.	7	15
II	Distributed Object Based Systems: Architecture, Processes, Communication, Naming, Synchronization, Consistency and Replication, Fault Tolerance, Security.	6	15

FIRSTINTERNALEXAM			
III	Distributed Algorithms**:** Models of Distributed Computation, Preliminaries, Causality, Distributed Snapshots, Modeling a Distributed Computation, Failures in a Distributed System.	6	15
IV	Algorithms in General Synchronous Networks: Leader Election, Breadth First Search, Minimum Spanning Tree, Shortest Path, Maximal Independent Set.	7	15
SECONDINTERNALEXAM			
V	Hadoop: Introduction, Comparison with Other Systems. Analyzing Data with Hadoop- Map and Reduce, Scaling Out: Data Flow, Combiner Functions, Running a Distributed Map Reduce Job. Map Reduce Types and Formats, Features.	7	20
VI	HadoopDistibuted File System: Concepts and Basic Operations. Administering Hadoop	7	20
ENDSEMESTEREXAM			

CourseNo.	CourseName	L-T-P-Credits	YearofIntroduction
02CS 6142 .4	PARALLEL ALGORITHMS	3-0-0-3	2015

CourseObjectives

- *Understand the principles and applications of parallel algorithms*

Syllabus

Parallel computer; Analyzing algorithms; Searching a sorted sequence; Searching a random sequence; Sorting; Matrix transposition; Matrix operations; Linear array multiplication; Tree multiplication; Solving numerical problems; Solving systems of linear equations SIMD and MIMD algorithms; Numerical problems; Graph theoretical problems; Minimal Alpha Beta tree; MIMD Alpha Beta tree algorithms.

CourseOutcome

- Students gain in-depth theoretical and practical knowledge on parallel algorithms.

References

1. S.G.Akl, "Design and Analysis of parallel algorithms", PrenticeHall, Inc. 1989.
2. S.G.Akl, "Parallel Sorting algorithm", Academic Press, 1985
3. M.J.Quin, "Parallel computing – theory and Practice", McGrawHill, New York, 1994.
4. S. Lakshmivarahan and S.K.Dhall, "Analysis and design of Parallel Algorithms -Arithmetic & Matrix problems", McGrawHill, New York, 1990.
5. V. Kumar, A. Grama, A. Gupta, and G. Karypis, "Introduction to Parallel Computing", San Francisco: Benjamin Cummings / Addison Wesley, 2002.
6. B. Wilkinson, M. Allen, "Parallel Programming", 2/e, Pearson Education Inc, 2007.

COURSEPLAN

Module	Contents	Contact Hours	Sem.Exam Marks;%
I	Parallel computer. Need of parallel computers, models of computation, Analyzing algorithms, expressing algorithms. Broadcast, All sums and selection algorithms on SIMD.	9	15
II	Searching a sorted sequence – EREW, CREW SMSIMD algorithms. Searching a random sequence – SMSIMD, tree and Mesh interconnection super computers. Sorting – Sorting on a linear array, sorting on a mesh, sorting on EREW SIMD computer, MIMD enumeration sort, MIMD quick sort, sorting on other networks.	9	15
FIRSTINTERNALEXAM			

III	Matrix Transposition, Mesh transpose, shuffle transpose, EREW transpose. Matrix operations – matrix-by-matrix multiplications, mesh multiplications, cube multiplication, Matrix by vector multiplication.	8	15
IV	Linear array multiplication, tree multiplications. Solving numerical problems, solving systems of linear equations SIMD algorithms and MIMD algorithms.	8	15
SECONDINTERNALEXAM			
V	Numerical problems – finding roots of nonlinear equations – SIMD and MIMD algorithms, solving partial differential equations, computing eigen values.	8	20
VI	Graph theoretical problems – solving graph theoretical problems, computing connectivity matrix, finding connected components, all pairs shortest path, traversing combinatorial spaces, sequential tree traversals, Minimal Alpha-Beta tree, MIMD Alpha-Beta algorithms, parallel cutoff storage requirements, recent trends and developments..	8	20
ENDSEMESTEREXAM			

CourseNo.	CourseName	L-T-P-Credits	YearofIntroduction
02CS 6142 .5	SOFT COMPUTING	3-0-0-3	2015

CourseObjectives

- *To familiarize the salient approaches in soft computing based on artificial neural networks, fuzzy logic, and genetic algorithms.*
- *To introduce applications of soft computing to different research areas in Computer Science / Information Technology*

Syllabus

Artificial neural network based concept of soft computing; Architectures; Different learning methods; Models of neural network; Fuzzy sets and logic; Fuzzy versus crisp; Fuzzy relations; Crisp logic; Predicate logic; Genetic algorithm based concept; Travelling salesman problem; Graph coloring problem; Hybrid systems; Neuro fuzzy systems.

CourseOutcome

- Understand advantages and disadvantages of soft computing.
- Students will be able to apply soft computing techniques to research problems.

References

1. S.N. Sivanandam, S.N. Deepa, "Principles of Soft Computing", 2/e, John Wiley India, 2012
2. Simon Haykin, "Neural Networks- A Comprehensive Foundation", 2/e, Pearson Education.
3. T.S. Rajasekaran, G.A. VijaylakshmiPai, "Neural Networks, Fuzzy Logic & Genetic Algorithms – Synthesis and Applications", Prentice-Hall India
4. Sanchez, Takanori, Zadeh, "Genetic Algorithm and Fuzzy Logic System", World Scientific
5. Goldberg David, "Genetic Algorithms", Pearson Education
6. Zimmermann H. J , "Fuzzy Set Theory & Its Applications", Allied Publishers Ltd.

COURSEPLAN			
Module	**Contents**	**Contact Hours**	**Sem.Exam Marks;%**
I	Artificial Neural Network Basic concept of Soft Computing; Basic concept of neural networks, Mathematical model, Properties of neural network, Typical architectures: single layer , multilayer, competitive layer	6	15
II	Different learning methods: Supervised, Unsupervised & reinforced; Common activation functions; Feed forward, Feedback & recurrent N.N; Application of N.N; Neuron.	6	15
FIRSTINTERNALEXAM			
III	Models Of Neural Network:Architecture, Algorithm & Application of – McCullo h-Pitts, Hebb Net, Perceptron (with limitations & Perceptron learning rule Convergence theorem), Back propagation NN, ADALINE, MADALINE, Discrete Hopfield net, BAM, Maxnet , Kohonen Self Organizing Maps, ART1,ART2.	7	15
IV	Fuzzy Sets & Logic : Fuzzy versus Crisp; Fuzzy sets—membership function, linguistic variable, basic operators, properties; Fuzzy relations—Cartesian product, Operations on relations; Crisp logic—Laws of propositional logic, Inference; Predicate logic—Interpretations, Inference; Fuzzy logic—Quantifiers, Inference; Fuzzy Rule based system; Defuzzification methods; FAM	7	15
SECONDINTERNALEXAM			
V	Genetic Algorithm Basic concept; role of GA in optimization, Fitness function, Selection of initial population, Cross over(different types), Mutation, Inversion, Deletion, Constraints Handling; Evolutionary Computation; Genetic Programming; Schema theorem; Multiobjective& Multimodal optimization in GA; Applications: Travelling Salesman Problem, Graph Coloring problem.	7	20

VI	Hybrid Systems: GA based BPNN (Weight determination, Application); Neuro Fuzzy Systems—Fuzzy BPNN--fuzzy Neuron, architecture, learning, application; Fuzzy Logic controlled G.A.	7	20
ENDSEMESTEREXAM			

CourseNo.	CourseName	L-T-P-Credits	YearofIntroduction
02CS 6152 .1	ADVANCED GRAPH THEORY	3-0-0-3	2015

CourseObjectives

- *To impart deeper understanding in advanced concepts in graph theory and their practical applications.*

Syllabus

Graphs – Paths and connectedness, Cutnodes and blocks, Graph classes and graph operations; Connectivity and edge connectivity; Hamiltonicity; Centers; Extremal distance problems; Distance sequences; Matrices; Convexity; Symmetry; Digraphs; Graph algorithms; Networks.

CourseOutcome

- Students become aware of the advanced concepts of graph theory and gain ability to apply those concepts in practical scenarios.

References

1. Fred Buckley and Frank Harary , "Distance in Graphs", Addison – Wesley, 1990.
2. C. R. Flouds: "Graph Theory Applications", Narosa Publishing House, 1994.
3. Harary F: "Graph Theory", Addison- Weslwy pub. 1972.
4. Deo N: "Graph Theory with Applications to Engineering and Computer Science", Prentice Hall Inc. 1974.

COURSEPLAN

Module	Contents	Contact Hours	Sem.Exam Marks;%
I	Graphs: Graphs as models- Paths and connectedness- Cutnodes and Blocks- Graph classes and graph operations. Connectivity: Connectivity and edge connectivity - Menger's theorem - Properties of n-connected graphs- Circulants	6	15
II	Hamiltonicity: Necessary or sufficient conditions- Connectivity and Hamiltonicity- Graph operations and Hamiltonicity - Generations of Hamiltonicity. Centers:The Center and Edge connectivity- Self Central Graphs - The Median – Central Paths- Other Generalized Centers	7	15
FIRSTINTERNALEXAM			

III	Extremal Distance Problems: Radius- Small Diameter- Diameter- Long paths and Long Cycles. Distance sequences: The Eccentric Sequence - Distance Sequences - Distribution - Path Sequence - Other Sequences.	7	15
IV	Matrices: The Adjacency Matrix - The incidence Matrix - The Distance Matrix. Convexity: Closure Invariants- Metrics on Graphs - Geodetic Graphs- Distance Heredity Graphs. Symmetry: Groups- Symmetric Graphs - Distance Symmetry	7	15
SECONDINTERNALEXAM			
V	Digraphs: Digraphs and connectedness - Acyclic Digraphs - Matrices and Eulerian Digraphs- Long paths in Digraphs- Tournaments. Graph Algorithms: Polynomial Algorithms and NP completeness - Path Algorithms and Spanning Trees - Centers - Maximum Matchings - Two NP-Complete Problems.	7	20
VI	Networks: The Max- Flow Min-Cut Theorem - Minimum Spanning Trees - Traveling Salesman Problem - Shortest Paths -Centers - Critical Path Method.	6	20
END SEMESTER EXAM			

CourseNo.	CourseName	L-T-P-Credits	YearofIntroduction
02CS 6152 .2	FUZZY SET THEORY AND APPLICATIONS	3-0-0-3	2015

CourseObjectives

- *To understand Fuzzy Set Theory and the basis of fuzzy logic and fuzzy logic applications such as fuzzy control and fuzzy decision making.*

Syllabus

Crisp sets overview; Basic concepts of fuzzy sets; Fuzzy logic; Operations on fuzzy sets; Crisp and fuzzy relations; Compatibility or tolerance relations; Membership functions; Defuzzification methods; Fuzzy rule based systems; Fuzzy pattern recognition; Fuzzy control systems.

CourseOutcome

The students who succeeded in this course should be able to:

- Examine the Set Theory problems.
- Interpret the systems which include fuzziness within the scope of fuzzy set theory.
- Combine the information of decision theory and the information of fuzzy set theory.
- Improve the proof techniques of Fuzzy Set Theory.
- Solve problems that include uncertainty with using Fuzzy Set Theory.

References

1. George J Klir and Tina A Folger, “Fuzzy Sets, Uncertainty and Information”, Prentice Hall of India, 1998.
2. H.J. Zimmerman, “Fuzzy Set Theory and its Applications”, 4/e, Kluwer Academic Publishers, 2001.
3. George Klir and Bo Yuan, “Fuzzy Sets and Fuzzy Logic: Theory and Applications”, Prentice Hall of India, 1997.
4. Timothy J Ross, “Fuzzy Logic with Engineering Applications”, McGraw Hill International Editions, 1997.
5. Hung Nguyen and Elbert Walker, “A First Course in Fuzzy Logic, 2/e,, Chapman and Hall/CRC, 1999.
6. Jerry M Mendel, “Uncertain Rule-based Fuzzy Logic Systems: Introduction and New Directions, PH PTR, 2000.
7. John Yen and Reza Lengari, “Fuzzy Logic: Intelligence, Control and Information”, Pearson Education, 1999.

COURSEPLAN			
Module	**Contents**	**Contact Hours**	**Sem.Exam Marks;%**
I	Introduction – crisp sets an overview – the notion of fuzzy sets – Basic concepts of fuzzy sets– classical logic an overview – Fuzzy logic. Operations on fuzzy sets - fuzzy complement –fuzzy union – fuzzy intersection	7	15
II	Combinations of operations – general aggregationoperations Crisp and fuzzy relations – binary relations – binary relations on a single set–equivalence and similarity relations.	6	15
FIRSTINTERNALEXAM			
III	Compatibility or tolerance relations– orderings – Membership functions – methods of generation – defuzzification methods.	6	15
IV	General discussion – belief and plausibility measures – probability measures– possibility and necessity measures – relationship among classes of fuzzy measures.	7	15
SECONDINTERNALEXAM			
V	Classical logic: An overview – fuzzy logic – fuzzy rule based systems – fuzzy decision making	7	20
VI	Fuzzy logic in database and information systems – fuzzy pattern recognition – fuzzy control systems.	7	20
ENDSEMESTEREXAM			

CourseNo.	CourseName	L-T-P-Credits	YearofIntroduction
02CS 6152 .3	NETWORK SECURITY	3-0-0-3	2015

CourseObjectives

- *To impart understanding of various hardware and software aspects of security in networks.*

Syllabus

Security trends, security attacks and security mechanisms; Network security model; Review of intrusion detection systems; Review of cryptographic algorithms and protocols; Kerberos v4; Kerberos v5; PKI; Real time communication security; IPSec; Email security; PEM & S/ MIME; PGP; Web security; SSL/ TLS; Secure electronic transaction; Network management security; Wireless security; Firewalls.

CourseOutcome

- The student gains knowledge in problems and approaches related to secure network management.

References

1. C. Kaufman, R. Perlman and M. Speciner, "Network Security: Private communication in a
1. public World", 2/e, PHI, 2002.
2. W. Stallings, "Cryptography and Network Security Principles and practice", 3/e, Pearson Education Asia, 2003.
3. William Stallings, "Network Security Essentials", 2e, Prentice Hall, 2003.
4. Schiller J., "Mobile Communications", Pearson Education Asia,2/e, 2009.
5. Roberta Bragg et. al., "Network Security: The Complete Reference", TMH, 2008.

COURSEPLAN

Module	Contents	Contact Hours	Sem.Exam Marks;%
I	Introduction: Security trends, security attacks, security mechanisms, Network Security model, Review of intrusion detection systems. Review of cryptographic algorithms and protocols: cryptanalysis, Message authentication, secure hash functions, Digital signatures.	6	15
II	Standards: Kerberos v4 – configuration, authentication, encryption, message formats. Kerberos v5 – cryptographic algorithms, message formats. PKI – trust models, revocation. Real-time communication security, IPSec overview, AH, ESP, IKE – phases.	7	15
FIRSTINTERNALEXAM			

III	Email security, Security services for Email, establishing keys, privacy, authentication, message integrity. PEM & S/MIME – structure of messages, encryption, source authentication and integrity protection, message formats. PGP encoding, anomalies, object formats.	7	15
IV	Web security: Web security considerations, SSL/TLS – attacks, exportability, encoding. Secure electronic transaction.	6	15
SECONDINTERNALEXAM			
V	Network management security: SNMP, Basic concepts of SNMPv1, SNMPv3. Wireless security: Wireless LAN Specifications, Wireless network security stack, WEP.	7	20
VI	Firewalls: Firewall design principles, trusted systems, packet filters, application level gateways, encrypted tunnels.	7	20
ENDSEMESTEREXAM			

CourseNo.	CourseName	L-T-P-Credits	YearofIntroduction
02CS 6152 .4	ADVANCED COMPILER DESIGN	3-0-0-3	2015

CourseObjectives

- *To understand various compiler optimization techniques.*
- *To understand back end design of compilers.*

Syllabus

Introduction to advanced topics; Review of compiler phases; Intermediate representations; Control flow analysis; Data flow analysis; Review of optimizations; Redundancy elimination; Value numbering; Loop optimization; Procedure optimization; Machine dependent tasks; Local and global instruction scheduling; Code scheduling; Low level optimizations; Inter procedural analysis and scheduling; Machine code generation.

CourseOutcome

- Conceptual understanding of theory behind compiler design.
- Ability to build a complete compiler.

References

1. Steven S. Muchnick, "Advanced Compiler Design and Implementation", Morgan Kauffmann, 1997.
2. Alfred V. Aho, Monica S. Lam, Ravi Sethi and Jeffrey D. Ullman, "Compilers: Principles, Techniques and Tools", Pearson Education, 2009.
3. Keith D. Cooper, Linda Torczon, "Engineering a Compiler", 2/e, Morgan Kauffmann, 2011.
4. Andrew W. Appel, "Modern Compiler Implementation in Java", Cambridge University Press, 2009.

COURSEPLAN

Module	Contents	Contact Hours	Sem.Exam Marks;%
I	Introduction to Advanced Topics Review of compiler phases, Informal Compiler Algorithm Notation, Symbol Table Structure – local and global symbol tables, Intermediate Representations – HIR, MIR and LIR. Run Time Issues.	7	15
II	Control Flow Analysis – basic blocks, DFS, dominators and postdominators, loops, dominator tree, dominance frontier.	6	15
FIRSTINTERNALEXAM			

III	Data Flow Analysis – reaching definitions, available expressions, live variable information. Dependency analysis, Alias analysis.	6	15
IV	Review of Optimizations – constant folding, constant and copy propagation, dead code elimination. Redundancy Elimination – common sub expression elimination, loop invariant code motion, partial redundancy elimination. Value numbering. Loop Optimizations – induction variable elimination. Procedure Optimization, Static Single Assignment (SSA) form.	7	15
SECONDINTERNALEXAM			
V	Machine Dependent tasks: Register Allocation - graph coloring, coalescing.	7	20
VI	Local and Global Instruction Scheduling, Advanced Topics in Code Scheduling, Low Level Optimizations, Introduction to inter-procedural analysis and scheduling, Machine code generation.	7	20
ENDSEMESTEREXAM			

CourseNo.	CourseName	L-T-P-Credits	YearofIntroduction
02CS 6152 .5	DECISION SUPPORT SYSTEMS	3-0-0-3	2015

CourseObjectives

- *To understand the theory and applications of various types of DSS*

Syllabus

Concepts of data, information, information systems, and end users; Systems concepts; Building information system; Systems development cycle; Prototyping evolution of information systems; Decision making; Making decisions in groups; Knowledge management systems; Knowledge representation techniques; Business Intelligence; Data warehousing concepts; Data mining concepts; Business Analytics.

CourseOutcome

- The student should have conceptual strength in DSS and should be able apply it identify the most apt DSS in a practical scenario.

References

1. Turban, Efrain, "Decision Support & Business Intelligent Systems", 8/e, Pearson Education
2. Marakas, George.M, "Decision Support Systems in the 21st Century", Pearson Education
3. Mallach, Efrem G., " Decision Support & Data Warehouse Systems", Tata McGraw-Hill
4. Keen,Peter G.W, "Decision Support System and Organizational Perspective", Addison-Wesley
5. Theierauff, Robert J., "Decision Support System for Effective Planning", Prentice Hall, 1982.
6. Krober,Donald W., and Hugh J. Watson, "Computer Based Information System", New York,1984.
7. Andrew P. Sage, "Decision Support System Engineering", John Wiley & Sons, New York,1991.
8. Leod. Raymond Me JR, "Management Information Systems", 5/e, Macmillian Publishing Company, 1993.

COURSEPLAN			
Module	**Contents**	**Contact Hours**	**Sem.Exam Marks;%**
I	Introduction to – Concepts of Data, Information, Information Systems & End Users. Systems Concepts: Open System, Closed System; Information Systems and Systems Concept. Building Information System: System Analysis and Design – Systems Development Cycle (Identification of Requirements, Feasibility Study, System Analysis, Design And Implementation), Prototyping Evolution of Information Systems: PS, OAS, MIS, DSS, EIS, ES.	7	15
II	Decision Making: Introduction and Definitions, Simons Decision Making Model, How Decisions are Supported, DSS Configurations, DSS Characteristics and Capabilities. Components of DSS, DSS Classifications DSS Modeling-Static and Dynamic Models, Certainty, Uncertainty, and Risk, Sensitivity Analysis, What-IF, and Goal Seeking.	7	15
FIRSTINTERNALEXAM			
III	Making Decisions in Groups: Group Decision Support System (GDSS),Characteristics, Process, Benefits, and Dysfunctions, Supporting Group work with Computerized Systems, Tools for Indirect and Indirect Support of Decision Making, From GDSS to GSS	7	15
IV	Knowledge Management System: Definition and types of Knowledge, Frame work for Knowledge Management Knowledge Representation Techniques: Rules, Frames, Semantic Networks.	6	15
SECONDINTERNALEXAM			
V	Introduction to Business Intelligence: Origins and Drivers of Business Intelligence, General Process of Intelligence Creation and Use, Characteristics of Business Intelligence, Towards Competitive Intelligence, Successful BI Implementation, Structure and Components of BI, Future trends	7	20

VI	Data Warehousing Definitions and Concepts, Types of Data warehouse. Business Analytics - Online Analytical Processing (OLAP), Reporting and Queries, Multidimensionality Knowledge Discovery in Databases (KDD), framework of KDD.	6	20
ENDSEMESTEREXAM			

CourseNo.	CourseName	L-T-P-Credits	YearofIntroduction
02CS 7111 .1	CLOUD COMPUTING	3-0-0-3	2015

CourseObjectives

- *Understanding cloud computing, and compare with existing technologies.*
- *Understand how to develop a cloud service*

Syllabus

Cloud computing; Cloud architecture; Cloud storage; Advantages and disadvantages of cloud computing; Cloud service development; Centralizing email communications; Cloud computing for the corporation; Schedules and task management; Collaborating on event management, project management, and contact management; Collaborating on databases; Collaborating on web-based communication tools; Evaluation of web conference tools; Collaborating via blogs and wikis.

CourseOutcome

- Design and develop cloud services for everyone.
- Use Cloud Service and collaborate it with various applications and taking it online.

References

1. Dan C. Marinescu , Cloud computing: Theory and Practice, Morgan Kaufmann, 2013
2. Kai Hwang, Geoffrey C. Fox, Jack J. Dongarra, Distributed and Cloud Computing,: From Parallel Processing to the Internet of Things, 1/e, Morgan Kaufmann , 2011
3. Michael Miller, Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online, Que Publishing, 2008.
4. Haley Beard, Cloud Computing Best Practices for Managing and Measuring Processes forOn demand Computing, Applications and Data Centers in the Cloud with SLAs, Emereo Pty Limited, 2008.

COURSEPLAN

Module	Contents	Contact Hours	Sem.Exam Marks;%
I	Cloud Computing – History of Cloud Computing – Cloud Architecture – Cloud Storage – Why Cloud Computing Matters – Advantages of Cloud Computing – Disadvantages of Cloud Computing – Companies in the Cloud Today	6	15
II	Cloud Services Web-Based Application – Pros and Cons of Cloud Service Development – Types of Cloud Service Development – Software as a Service – Platform as a Service – Web Services – On-Demand Computing – Discovering Cloud Services Development Services and Tools – Amazon Ec2 – Google App Engine – IBM Clouds.	7	15

FIRSTINTERNALEXAM			
III	Centralizing Email Communications – Collaborating on Schedules – Collaborating on To-Do Lists – Collaborating Contact Lists – Cloud Computing for the Community – Collaborating on Group Projects and Events – Cloud Computing for the Corporation.	7	15
IV	Collaborating on Calendars, Schedules and Task Management – Exploring Online Scheduling Applications – Exploring Online Planning and Task Management	6	15
SECONDINTERNALEXAM			
V	Collaborating on Event Management – Collaborating on Contact Management – Collaborating on Project Management – Collaborating on Word Processing - Collaborating on Databases – Storing and Sharing Files.	7	20
VI	Collaborating via Web-Based Communication Tools – Evaluating Web Mail Services – Evaluating Web Conference Tools – Collaborating via Social Networks and Groupware – Collaborating via Blogs and Wikis.	7	20
ENDSEMESTEREXAM			

CourseNo.	CourseName	L-T-P-Credits	YearofIntroduction
02CS 7111 .2	MACHINE LEARNING	3-0-0-3	2015

CourseObjectives

To impart a deeper understanding of machine language techniques, tools and applications.

Syllabus

Introduction to learning; Types of learning; Why machine learning; Types of problems in machine learning; Machine learning as a classifier; Machine learning applications; Neural networks; Artificial Neural Networks; Association learning; Statistical learning; Hidden Markov Models; Decision trees; Bayesian networks; Supervised learning; Support vector machines; Case Base Reasoning; Fuzzy network; Unsupervised network; Clustering; Markov decision problem; Q-learning algorithms; On-Policy and Off-Policy learning; Learning automata.

CourseOutcome

- Students gain understanding of conceptual and practical aspects of machine learning and ability to apply the techniques in real-world scenarios.

References

1. Anderson J.A., "An Introduction to Neural Networks", Prentice Hall India, 1999.
2. Hertz J. Krogh, R.G. Palmer, "Introduction to the Theory of Neural Computation", AddisonWesley,, 1991.
3. Stephen Marsland Machine Learning: An Algorithmic Perspective, CRC Press, 2009
4. Vojislav Kecman, "Learning and Soft Computing", 1/e, Peason Education, 2004.
5. Stuart Russell and Peter Norvig "Artificial Intelligence: A Modern Approach, 3/e, Peason Education., 2011.
6. Shakhnarovish, Darrell, and Indyk,, "Nearest-Neighbor Methods in Learning and Vision". MIT Press, 2005.

COURSEPLAN

Module	Contents	Contact Hours	Sem.Exam Marks;%
I	Introduction to learning. Types of Learning, Rote learning, Learning by parameter adjustment, Learning by general problem solving, Concept learning, Learning by analogy. Introduction to machine learning, Why machine learning. Types of problems in machine learning, History of machine learning, Aspects of inputs to training, Learning systems, Machine learning as a classifier, Intelligent agents, Machine learning applications.	7	15

II	Evaluation of machine learning algorithms. Neural Networks. Artificial Neural Nets, ANN Basics, ANN - Learning Process , Types of Networks, Perceptron, Multilayer Perceptron, Error back Propagation Algorithm, RBF Networks.	6	15
FIRSTINTERNALEXAM			
III	Association Learning, Basics of Association, Apriori Algorithm, Eclat Algorithm, FP Growth Algorithm, Tertius Algorithm. Statistical Learning, Stochastic Processes, Markov Process, Hidden Markov Models, Three Basic Problems for HMMs, Forward – Backward Procedure , Viterbi Algorithm, Baum-Welch Algorithm	6	15
IV	Linear Classifiers , Quadratic Classifiers, Decision Trees, C 4.5 Algorithm, ID3 Algorithm, Random Forest, Bayesian Networks, Bayesian Networks Learning, Limitation of Bayesian Networks, Expectation Maximization (EM), EM Algorithm, Self Organising Maps, Learning Process of SOM, Adaptive Resonance Theory, Important ART Networks, ART Architecture, ART Algorithms	7	15
SECONDINTERNALEXAM			
V	Supervised Learning, Support Vector Machines, Inductive Logic Programming, Generic ILP Algorithm, Principal Approaches to ILP, Characteristics of ILP System, Case Base Reasoning, How CBR Works?, Case Representation, CBR Issues, Ensemble Classifiers, AdaBoost algorithm, Bayes Optimal Classifier , Nearest Neighborhood techniques, Fuzzy Network, Fuzzy Systems, Info Fuzzy Networks, Fuzzy Neural Systems. Unsupervised learning.	7	20
VI	Clustering, K-Means Clustering , Fuzzy Clustering, Hierarchical Clustering ,Agglomerative and Divisive Clustering, Hierarchical Agglomerative Clustering, Cluster Similarity, Reinforcement Learning, Markov Decision Problem, Q-learning, Q-Learning Algorithms, Temporal Difference Learning, On-Policy and Off-Policy Learning, Advantages of TD Prediction Methods, Learning Automata.	7	20
ENDSEMESTEREXAM			

CourseNo.	CourseName	L-T-P-Credits	YearofIntroduction
02CS 7111.3	ADVANCED NUMERICAL TECHNIQUES	3-0-0-3	2015

CourseObjectives

- *To impart a deeper understanding of various advanced numerical techniques.*

Syllabus

Linear Algebra, Approximation of functions, Nonlinear system of differential equations, Boundary Value Problems, and Partial Differential Equations.

CourseOutcome

- Students are able to use the concepts of linear algebra, approximation of functions and partial differential equations in solving real life problems.

References

1. Gene H. Golub and James M. Ortega.. Scientific Computing and Differential Equations, Academic Press NewYork.
2. M. K. Jain..Numerical Solution of Differential Equations, John Wiley & Son.
3. M. G. Ancona ..Computational Methods for Applied Science and Engineering. Rinton Press..
4. Kendall E. Atkinson, An Introduction to Numerical Analysis, John Wiley & Son. Press, 2005.

COURSEPLAN

Module	Contents	Contact Hours	Sem.Exam Marks;%
I	Linear Algebra: Matrices: Matrix norm. Spectral decomposition, Singular value decomposition, convergence and perturbation theorem.	7	15
II	Matrix eigen-value problem, Gerschgorin's theorem, Perron's theorem, Collatz theorem, Eigen-value by iteration, Tridiagonalization, Q-R Factorization, Generalized inverse of matrices.	7	15
	FIRSTINTERNALEXAM		
III	Approximation of functions: General function spaces, Least square approximation, Minimax approximation, orthogonal polynomials, approximation with rational functions, Pade's approximation.	7	15
IV	Differential equations: Nonlinear system of differential equations- method of successive approximations, Use of Pade's approximation	7	15

SECONDINTERNALEXAM			
V	Boundary Value Problems: Method of undetermined coefficients, Difference scheme based on quadrature formulas, solution of tridiagonal system, moving boundary conditions, boundary conditions at infinity, Non-linear boundary value problems, convergence of difference schemes, linear eigen value problems..	6	20
VI	Partial Differential Equations: Parabolic, Elliptic and Hyperbolic differential equations subject to Dirichlet's, Neumann (or flux) and mixed (or Robin or Radiation) conditions, Stefan problem .	6	20
ENDSEMESTEREXAM			

CourseNo.	CourseName	L-T-P-Credits	YearofIntroduction
02CS 7111.4	ADHOC AND SENSOR NETWORKS	3-0-0-3	2015

CourseObjectives

- *The primary objective of this course is to introduce to the area of wireless sensor networks and learn the concepts and principles behind WSN.*
- *To learn WSN network design, sensor node embedded system design and implementation.*
- *On WSN network management, the focus is mainly on wireless network security which is a very important issue in WSN.*

Syllabus

Fundamentals of wireless communication technology; Introduction to ad hoc/ sensor networks; Advantages of ad hoc/ sensor networks; Issues in ad hoc wireless networks; Issues in the design of sensor networks; Sensor network architecture; MAC protocols; Routing Protocols; QoS and energy management

CourseOutcome

- After passing the course, a student comprehends the Wireless Sensor Networks (WSN) as a new technology area in research and industry.
- A student is familiar with the main standards and specifications of WSNs and identifies the key building blocks for them.
- A student can define and explain the essential challenges of resource constrained WSN design and implementation, including applications, interfaces, energy-efficient protocols and platform functionalities.
- A student can apply both theoretical and practical tools for WSN design and utilization and design potential application scenarios for WSNs.

References

1. C. Siva Ram Murthy, B. S. Manoj, "AdHoc Wireless Networks ", Pearson Education, 2008.
2. Feng Zhao, LeonidesGuibas, "Wireless Sensor Networks ", Elsevier, 2004.
3. Jochen Schiller, "Mobile Communications ", 2/e, Pearson Education, 2003.
4. William Stallings, "Wireless Communications and Networks ", Pearson Education, 2004.

COURSEPLAN

Module	Contents	Contact Hours	Sem.Exam Marks;%
I	Introduction: Fundamentals of wireless communication technology, the electromagnetic spectrum radio propagation, characteristics of wireless channels, modulation techniques, multiple access techniques, wireless LANs, PANs, WANs, and MANs, Wireless Internet.	7	15

II	Introduction to adhoc/sensor networks: Key definitions of adhoc/ sensor networks, unique constraints and challenges, advantages of ad-hoc/sensor network, driving applications, issues in adhocwirelesss networks, issues in design of sensor network, sensor network architecture, data dissemination and gathering.	7	15
FIRSTINTERNALEXAM			
III	MAC Protocols: Issues in designing MAC protocols for adhoc wireless networks, design goals, classification of MAC protocols, MAC protocols for sensor network, location discovery, quality, other issues, S-MAC, IEEE 802.15.4.	7	15
IV	Routing Protocols: Issues in designing a routing protocol, classification of routing protocols, table-driven, on-demand, hybrid, flooding, hierarchical, and power aware routing protocols.	7	15
SECONDINTERNALEXAM			
V	QoS and Energy Management : Issues and Challenges in providing QoS, classifications, MAC, network layer solutions	6	20
VI	QoS frameworks, need for energy management, classification, battery, transmission power, and system power management schemes.	6	20
ENDSEMESTEREXAM			

CourseNo.	CourseName	L-T-P-Credits	YearofIntroduction
02CS7111.5	BIOINFORMATICS	3-0-0-3	2015

CourseObjectives

- *To give the students an introduction to bio-informatics and various concepts related to bio-informatics such as search engines, data visualization, pattern matching etc.*
- *To build efficient solutions to problems like sequence alignment and to introduce the process of drug discovery.*

Syllabus

Introduction to Molecular biology, Gene structure and information content, Molecular biology tools, Algorithms for sequence alignment, Sequence databases and tools. Molecular Phylogenetics, Phylogenetic trees, Algorithms for Phylogenetic tree construction, Introduction to Perl programming for Bioinformatics. Introduction to Protein structure, Algorithms for Protein structure prediction, Gene expression analysis, Micro Arrays, Pathway analysis. Pattern Matching algorithms, Bio-data analysis, Data Mining in Bioinformatics, Algorithms and data structures for efficient analysis of biological data, Drug Discovery.

CourseOutcome

- Empowers students with problem analysis skills
- Imbibes an interest in investigation of bioinformatics problems
- Students also gain expertise in programming to solve bioinformatics problems.

References

1. Bryan Bergeron, Bio Informatics Computing, Second Edition, Pearson Education, 2003.
2. D. E. Krane and M. L. Raymer, Fundamental Concepts of Bioinformatics, Pearson Education, 2003.
3. T. K. Attwood and D. J. Parry-Smith, Introduction to Bioinformatics, Pearson Education, 2003.
4. J. H. Zar, Biostatistical Analysis, 4/e, Pearson Education, 1999.

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COURSEPLAN

Module	Contents	Contact Hours	Sem.Exam Marks;%
I	Introduction to molecular biology, Gene structure and information content, Molecular biology tools, Algorithms for sequence alignment, Sequence databases and tools.	7	15
II	Phylogenetic trees (6 hours), Molecular Phylogenetics, Phylogenetic trees, Algorithms for Phylogenetic tree construction.	7	15
FIRSTINTERNALEXAM			

III	Randomized algorithms (6 hours), Introduction to Perl programming for Bioinformatics, Introduction to Protein structure, Algorithms for Protein structure prediction	7	15
IV	Micro Arrays Gene expression analysis, Micro Arrays, Pathway analysis.,Pattern Matching algorithms	6	15
SECONDINTERNALEXAM			
V	Bio-data analysis, Data Mining in Bioinformatics, Algorithms and data structures for efficient analysis of biological data.	6	20
VI	Drug Discovery – components, Perspectives, Numeric considerations, Algorithms, Heuristic methods, Systems Biology Tools	7	20
ENDSEMESTEREXAM			

CourseNo.	CourseName	L-T-P-Credits	YearofIntroduction
02CS 7121 .1	SOFTWARE QUALITY ASSURANCE AND TESTING	3-0-0-3	2015

CourseObjectives

- *Understand the theoretical aspects of software testing*
- *Demonstrate the knowledge of the existing testing methods*
- *Demonstrate the knowledge of static and dynamic analysis methods*
- *Demonstrate the knowledge of applying testing and analysis methods in software development and maintenance*

Syllabus

Software quality assurance framework; Standards SQA framework; Components of software quality assurance; Software quality assurance plan; Quality standards; Software quality metrics; Software testing strategy; Environment establishing testing policy; Database; Exception; Gray box; Histograms; Inspections; JADs; Pareto analysis; Prototyping; Software testing tools; Taxonomy of testing tools; JAVA testing tools; JUNIT and Cactus.

CourseOutcome

- Students get in-depth skill to quantitatively assess the quality of software; they also understand the fundamental principles and tools for software-testing and quality assurance.

References

1. William E. Perry, “Effective Methods for Software Testing”, 2/e, Wiley
2. Mordechai Ben Menachem, Garry S. Marliss, “Software Quality”, Thomson Learning

COURSEPLAN

Module	Contents	Contact Hours	Sem.Exam Marks;%
I	Software Quality Assurance Framework and Standards SQA Framework: Software Quality Assurance, Components of Software Quality Assurance Software Quality Assurance Plan: Steps to develop and implement a Software Quality Assurance Plan a€“ Quality Standards: ISO 9000 and Companion ISO Standards, CMM, CMMI, PCMM, MalcomBalridge, 3 Sigma, 6 Sigma	7	15

II	Software Quality Metrics: Product Quality metrics, In-process Quality Metrics, Metrics for Software Maintenance, Examples of Metric Programs Software Quality metrics methodology: establishing quality requirements, Identifying Software quality metrics, Implement the software quality metrics, analyze software metrics results, validate the software quality metrics Software quality indicators, Fundamentals in Measurement theory.	7	15
FIRSTINTERNALEXAM			
III	Software Testing Strategy and Environment Establishing testing policy, structured approach to testing, test factors, Economics of System Development Life Cycle (SDLC) Testing Software Testing Methodology Defects hard to find, verification and validation, functional and structural testing, workbench concept, eight considerations in developing testing methodologies, testing tactics checklist, Software Testing Techniques Black Box, Boundary value, Bottom up, Branch coverage, Cause Effect graphing, CRUD	7	15
IV	Database, Exception, Gray Box, Histograms, Inspections, JADs, Pareto Analysis, Prototyping, Random Testing, Risk based Testing, Regression Testing, Structured Walkthroughs, Thread Testing, Performance Testing, White Box Testing	6	15
SECONDINTERNALEXAM			
V	Software Testing Tools Taxonomy of Testing tools, Methodology to evaluate automated testing tools, Load Runner, Win runner and Rational Testing Tools, Java Testing Tools, JMetra, JUNIT and Cactus.	6	20
VI	Testing Process Eleven Step Testing Process: Assess Project Management Development Estimate and Status, Develop Test Plan, Requirements Phase Testing, Design Phase Testing, Program Phase Testing, Execute Test and Record Results, Acceptance Test, Report test results, testing software installation, Test software changes, Evaluate Test Effectiveness. Testing Specialized Systems and Applications Testing Client/Server Web applications, Testing off the Shelf Components, Testing Security, Testing a Data Warehouse	7	20
ENDSEMESTEREXAM			

CourseNo.	CourseName	L-T-P-Credits	YearofIntroduction
02CS 7121.2	DATA COMPRESSION	3-0-0-3	2015

CourseObjectives

- *Develop theoretical foundations of data compression, concepts and algorithms for lossy and lossless data compression, signal modeling and its extension to compression with applications to speech, image and video processing.*

Syllabus

Compression techniques; lossy and lossless compression; Huffman coding; Adaptive coding; Arithmetic coding; Dictionary based compression; Sliding window compression; LZ77, LZ78, LZW compression; Predictive coding; Speech compression and synthesis; Image compression; Image standards; Video compression; Comparison of compression algorithms; Implementation of compression algorithms.

CourseOutcome

- Awareness about various data compression techniques and their practical significance.

References

1. David Solomon, Data compression: the complete reference, 2/e, Springer-verlag, New York. 2000.
2. Stephen Welstead, Fractal and wavelet Image Compression techniques , PHI, 1999.
3. Khalid Sayood, Introduction to data compression, Morgan Kaufmann Publishers, 2003.
4. Sleinreitz ―Multimedia System‖ Addison Wesley.

COURSEPLAN

Module	Contents	Contact Hours	Sem.Exam Marks;%
I	Compression techniques, Compression ratio, lossless &lossy compression, Huffman coding, Non binary Huffman Algorithms, Adaptive Coding, Applications,Arithmetic Coding, Applications, Finite	7	15
II	Dictionary based Compression, Sliding Window Compression, LZ77, LZ78, LZW compression. Predictive Coding - prediction and partial match, move to front coding, Run Length encoding.	7	15
	FIRSTINTERNALEXAM		

III	Speech Compression & Synthesis: Digital Audio concepts, Sampling Variables, Lossless compression of sound, lossy compression & silence compression.	6	15
IV	Image Compression, Transform based techniques, Wavelet Methods, adaptive techniques. Images standards, JPEG Compression, ZigZag Coding.	6	15
SECONDINTERNALEXAM			
V	Video Compression- motion compensation, MPEG standards, recent development in Multimedia Video compression, packet video, Fractal techniques.	7	20
VI	Comparison of compression algorithms, Implementation of compression algorithms.	7	20
ENDSEMESTEREXAM			

CourseNo.	CourseName	L-T-P-Credits	YearofIntroduction
02CS 7121.3	COMPUTATIONAL GEOMETRY	3-0-0-3	2015

CourseObjectives

- *To fill the gap between geometric properties and algorithm design*
- *To familiarize data structures used for developing efficient algorithms*
- *To learn efficient techniques for solving geometric problems*

Syllabus

Geometric preliminaries; Data structures for geometric problems; Geometric searching; Plane sweep technique; Slab method; Monotone polygons; Kd-trees; Convex hulls; Triangulation; Post office problem; Voronoi diagrams; Introduction to visibility problems; Kernel of a simple polygon; Visibility graph; Shortest path for a point robot.

CourseOutcome

- Capable to develop efficient algorithms by exploiting geometric properties
- Capable in identifying properties of objects, expressing them as lemmas and theorems and proving their correctness.
- Capable in applying learned algorithm in diversified fields like data base Searching, data mining, graphics, image processing pattern recognition, computer vision motion planning and robotics

References

1. Franco P. Preparata, Michael Ian Shamos, "Computational Geometry- An Introduction", Texts and Monographs in Computer Science , Springer – Verlag
2. Mark de Berg, Otfried Cheong, Marc van Kreveld, Mark Overmars " Computational Geometry, Algorithms & Applications" Springer
3. Herbert Edelsbrunner, "Algorithms in Combinatorial Geometry", EATCS Monographs on Theoretical Computer Science, Springer – Verlag.
4. Art Gallery Theorems, Joseph O' Rourke, Oxford Press.
5. Joseph O' Rourke, " Computational Geometry in C", Cambridge University Press

COURSEPLAN

Module	Contents	Contact Hours	Sem.Exam Marks;%
I	Geometric Preliminaries, Data Structures for geometric problems :DCEL (Doubly Connected Edge List), Quad trees, Kd-trees and BSP (Binary Space Partition) trees. Geometric Searching - Planar Straight Line Graph (PSLG).	7	15

II	Point Location Problem, Location of a point in a planar subdivision, Plane Sweep Technique-applications- line segment inter section using plane sweep ,Slab method, Regularization of PSLG, Monotone polygons , Range Searching using Kd-trees.	7	15
FIRSTINTERNALEXAM			
III	Convex Hulls, Convex Hull Algorithms in the Plane -- Graham's Scan Algorithm, Jarvi's March, Divide and Conquer Algorithm, Quick Hull Algorithm.	6	15
IV	Triangulation— Polygon Triangulation, Art Gallery Theorem, Fisk's proof of Art Gallery theorem. Post Office Problem - Voronoi Diagrams- Properties , computing Voronoi diagram, Applications in the plane , Delaunay Triangulation	7	15
SECONDINTERNALEXAM			
V	Introduction to Visibility Problems-- Definition of direct visibility, Point visibility and Edge visibility, Algorithm for computing point-visible region inside a polygon	6	20
VI	Kernel of a simple polygon , Linear time algorithm for computing Kernel. Visibility graph, Shortest path for a point Robot	7	20
ENDSEMESTEREXAM			

CourseNo.	CourseName	L-T-P-Credits	YearofIntroduction
02CS 7121.4	BIOMEDICAL IMAGING	3-0-0-3	2015

CourseObjectives

- *Identify and describe in qualitative terms the principles of x-ray generation, x-ray-tissue interaction, and x-ray imaging*
- *Describe the principles of Computed Tomography (CT) and the 2D/3D image reconstruction methods involved*
- *Describe in qualitative terms the principles of ultrasound, PET, SPECT and MRI imaging*
- *Identify and describe image contrast, image resolution, and signal-to noise ratio involved in biomedical imaging 5. Identify and describe the complementary nature of various imaging techniques*

Syllabus

X-ray imaging , computed tomography, ultrasonic imaging, Magnetic Resonance Imaging, Nuclear Medicine and Infrared Imaging –principles, image characteristics, image acquisition, clinical applications

CourseOutcome

- Fundamental knowledge in different aspects and application areas of Medical Imaging modalities
- Capability to effectively and efficiently utilize the knowledge gained in one of the current research areas in biomedical imaging for the final thesis work.

References

1. Handbook of Medical Image Processing and Analysis (Second Edition), Issac N Bankman, 2008 Elsevier Inc
2. Medical Image analysis, second edition, Atam P Dhawan, IEEE Press, 2011
3. Physics of Medical Imaging, S Webb , Adam Highler, Bristol,
4. The Essential Physics of Medical Imaging, 3rd edition, Jerrold T. Bushberg, J. Anthony Seibert Lippincott Williams & Wilkins, 2011
5. Medical Imaging Signals and Systems, 2 edition , Jerry L. Prince, Jonathan, pearson education, 2015

COURSEPLAN

Module	Contents	Contact Hours	Sem.Exam Marks;%
I	General Principles of Imaging with X-Rays, X-Ray Production, Interactions of X-Rays with Tissue, Linear and Mass Attenuation Coefficients of X-Rays in Tissue, X-Ray Image Characteristics. X-Ray Imaging Methods. Clinical Applications of X-Ray Imaging.	6	15

II	Computed Tomography- Image Processing for Computed Tomography, Spiral/Helical Computed Tomography. Multislice Spiral Computed Tomography. Image Reconstruction- Backprojection and Filtered Backprojection. Clinical Applications of Computed Tomography.	7	15
FIRSTINTERNALEXAM			
III	General Principles of Ultrasonic Imaging-Wave Propagation and Characteristic Acoustic Impedance-Wave Reflection and Refraction-Instrumentation-Diagnostic Scanning Modes. Artifacts in Ultrasonic Imaging - Image Characteristics, Blood Velocity Measurements Using Ultrasound, Clinical Applications of Ultrasound.	7	15
IV	General Principles of Magnetic Resonance Imaging, Nuclear Magnetism, Gradient coils, RF pulses, Instrumentation, Imaging Sequences, Image Characteristics, Concepts in Magnetic Resonance Angiography, Diffusion Weighted Imaging and Functional MRI. Clinical Applications of MRI	8	15
SECONDINTERNALEXAM			
V	General Principles of Nuclear Medicine, Radioactivity, The Production of Radionuclides, Types of Radioactive Decay, The Gamma Camera, Image Characteristics, Single Photon Emission Computed Tomography, Positron Emission Tomography, Clinical Applications of Nuclear Medicine.	6	20
VI	Infra red Imaging-Physics of thermography-Imaging systems-Pyroelectricvidicon camera, clinical themography-liquid crystal thermography.	6	20
ENDSEMESTEREXAM			

CourseNo.	CourseName	L-T-P-Credits	YearofIntroduction
02CS 7121.5	BIGDATA ANALYTICS	3-0-0-3	2015

CourseObjectives

- *To impart the concepts of Big data analytics, Tools and practices for working with big data and Time series and text analytics to students.*

Syllabus

Introduction to big data- features and evolution of big data; big data analytics – data analytics lifecycle overview-case study ; Review of basic data analytics method –exploratory data analysis and methods for evaluation- advanced analytical theory and methods - time series analysis and text analysis; advanced analytics technology and tools- map reduce and hadoop.

CourseOutcome

- Capability to deploy a structured lifecycle approach to data analytics problems and apply appropriate analytic techniques and tools to analyzing big data.
- Capability to use techniques to investigate complex problems through research and effectively utilize appropriate modern engineering tools to solve it.

References

1. David Dietrich, Barry Heller, Biebie Yang, Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data, EMC Education Services, John Wiley &Sons, Inc
2. Frank J Ohlhorst, Big Data Analytics: Turning Big Data into Big Money, Wiley and SAS Business Series, 2012.
3. Colleen Mccue, Data Mining and Predictive Analysis: Intelligence Gathering and Crime Analysis, Elsevier, 2007
4. AnandRajaraman and Jeffrey David Ullman, Mining of Massive Datasets, Cambridge University Press, 2012.
5. Bill Franks, Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics, Wiley and SAS Business Series, 2012.
6. Paul Zikopoulos, Chris Eaton, Paul Zikopoulos, Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data, McGraw Hill, 2011.
7. Paul Zikopoulos, Dirk deRoos, Krishnan Parasuraman, Thomas Deutsch , James Giles, David Corrigan, Harness the Power of Big data – The big data platform, McGraw Hill, 2012.
8. Pete Warden, Big Data Glossary, O'Reilly, 2011.
9. M SudheepElayidom, Datamining and Warehousing, 1st Edition, Cengage Learning India Pvt Ltd
10. Jiawei Han, MichelineKamber Data Mining Concepts and Techniques, Second Edition, Elsevier, Reprinted 2008.

COURSEPLAN

Module	Contents	Contact Hours	Sem.Exam Marks;%

I	Introduction To Big Data: Nuances of big data – Value – Big data characteristics -Volume, Veracity, Velocity, Variety. Features of Big Data - Security, Compliance, auditing and protection – Evolution of Big data. Analyst Perspective on Data Repositories , State of the Practice in Analytics, BI Versus Data Science, Current Analytical Architecture, Drivers of Big Data, Key roles for new big data ecosystem, Examples .	7	15
II	Big Data Analytics: Data Analytics Lifecycle Overview-Phases: Discovery, data Preparation, Model planning, model building, communicate results, operationalize .Case Study: Global Innovation Network and Analysis (GINA).	7	15
FIRSTINTERNALEXAM			
III	Review of basic data analytic methods using R: Introduction to R, R graphical user interface-data import and export-attribute and data type. Exploratory data analysis-Visualization, Dirty data, single and multiple variables, data exploration versus presentation. Statistical methods for evaluation-Hypothesis testing, difference of means, Wilcoxon rank sum test, type I and II errors, power and sample size, ANNOVA	7	15
IV	Advanced analytical theory and methods: Time Series Analysis- Overview of Time Series Analysis, Box-Jenkins Methodology ARIMA Model, Autocorrelation Function (ACF), Autoregressive Models, MovingAverage Models, ARMA and ARIMA Models Building and Evaluating an ARIMA Model, Reasons to Choose and Cautions.	6	15
SECONDINTERNALEXAM			
V	Text Analysis : Text Analysis Steps, A Text Analysis Example, Collecting Raw Text, Representing Text , Term Frequency Inverse Document Frequency (TFIDF)Categorizing Documents by Topics, Determining Sentiments, Gaining Insights.	7	20
VI	Advanced Analytics-technology and tools: MapReduce and Hadoop, Analytics for Unstructured Data, MapReduce Framework, Apache Hadoop, The Hadoop Ecosystem, Pig, Hive, HBase, Mahout, NoSQL.	8	20
ENDSEMESTEREXAM			