M. Tech IN NETWORK ENGINEERING PROGRAMME
KERALA UNIVERSITY
CURRICULUM AND SCHEME OF EXAMINATIONS

SEMESTER I

Code No.	Name of Subject	Credits	Hrs / week	End Sem Exam hours	Marks			Remarks
					Internal Continuous Assessment	End Semester Exam	Total	
INC1001	Mathematical Foundations of Computing Systems	3	3	3	40	60	100	Of the 40 marks of internal assessment 25 marks for test and 15 marks for assignment. End semester exam is conducted by the University
INC1002	Advanced Computer Architecture	3	3	3	40	60	100	Do
INC1003	Advanced Operating Systems	3	3	3	40	60	100	Do
INC1004	Distributed Systems and Algorithms	3	3	3	40	60	100	Do
INC1005	Network Routing Protocols	3	3	3	40	60	100	Do
INC1006	Security in Computing	3	3	3	40	60	100	Do
INC1101	Networks and Engineering Lab	1	2	-	100	-	100	No End Sem Examinations
INC1102	Seminar	2	2	-	100	-	100	Do
	TOTAL	21	22					7 Hours of Departmental Assistance work

SEMESTER II

Code No.	Name of Subject	Credits	Hrs / week	End Sem Exam Hours	Marks			Remarks
					Internal Continuous Assessment	End Semester Exam	Total	
INC2001	Applied Cryptography	3	3	3	40	60	100	Of the 40 marks of internal assessment 25 marks for test and 15 marks for assignment. End semester exam is conducted by the University
INC2002	Modern Computing Paradigms	3	3	3	40	60	100	do
*	Stream Elective I	3	3	3	40	60	100	do
*	Stream Elective II	3	3	3	40	60	100	do
**	Department Elective	3	3	3	40	60	100	do
ICC2000	Research Methodology	2	2	3	40	60	100	Of the 40 marks of internal assessment 25 marks for test and 15 marks for assignment. End Semester Exam is conducted by the Individual Institutions
INC2101	Software Testing Lab	1	2	-	100		100	No End Sem Examinations
INC2102	Thesis – Preliminary – Part I	2	2	-	100		100	do
INC2103	Seminar	2	2	-	100		100	do
	TOTAL	22	23	---				6 hours of Departmental assistance work

* Students can select a subject from the subjects listed under stream electives for the second semester as advised by the course coordinator.
** Students can select a subject from the subjects listed under department electives for the second semester as advised by the course coordinator.

List of Stream Electives

INE 2011 Access Networks and Cellular Communication
INE 2012 High Speed Switching Architecture
INE 2013 Embedded Networks
INE 2014 Adhoc and Sensor Networks
INE 2015 Cloud Computing

List of Department Electives

INE 2016 Soft Computing
INE 2017 Advanced Database Systems
INE 2018 Web Technologies
INE 2019 Information Retrieval Techniques
INE 2020 Datamining and Warehousing

SEMESTER III

Code No.	Name of Subject	Credits	Hrs / week	End Sem Exam Hours	Marks			Remarks
					Internal Continuous Assessment	End Semester Exam	Total	
*	Stream Elective III	3	3	3	40	60	100	Of the 40 marks of internal assessment 25 marks for test and 15 marks for assignment. End Semester Exam is conducted by the Individual Institutions
*	Stream Elective IV	3	3	3	40	60	100	do
***	Non- Dept. (Interdisciplinary) Elective	3	3	3	40	60	100	do
INC3101	Thesis – Preliminary – Part II	5	14	-	200		200	No End Sem Examinations
	TOTAL	14	23					6 hours of departmental assistance work

* Students can select a subject from the subjects listed under stream electives for the second semester as advised by the course coordinator

*** Students can select a subject from the subjects listed under interdisciplinary electives for the second semester as advised by the course coordinator

List of Stream Electives

INE 3001 Multimedia Communication and Networks

INE 3002 Mathematical Model for Internet

INE 3003 Performance Evaluation of Computer Systems and Networks

INE 3004 Network Architecture and Design

INE 3005 Interconnection Networks

SEMESTER IV

Code No	Subject Name	Credits	Hrs / week	Marks					Remarks
				Continuous Assessment		University Exam		Total	
				Guide	Evaluation	Thesis Evaluation	Viva Voce		
INC4101	Thesis	12	21	150	150	200	100	600	*5 % of the mark is earmarked for Publication in journal/conference
	Total	12	21	150	150	200	100		8 hrs of departmental assistance work

SEMESTER I

INC 1001 MATHEMATICAL FOUNDATIONS OF COMPUTING SYSTEMS 3-0-0-3

Structure of the Course

Lecture : 3 hrs/ Week Credits : 3
Internal Continuous Assessment : 40 Marks
End Semester Examination : 60 Marks

Course Objectives

• To understand the foundational ideas in computing systems and be able to use this knowledge to guide their thinking in technical problem-solving.

• Be effective in the design and construction of software applications.

Learning Outcomes

• Students will develop a strong foundation in programming, software development and data manipulation.

. Ability to analyze a problem and identify and define the computing requirements to solution.

• students will develop proficiency with the techniques of mathematics , the ability to evaluate logical arguments, and the ability to apply mathematical methodologies to solving real world problems.

Module I

Relations, Functions, and Matrices – Relations, Topological Sorting, Relations and Databases, Functions, Matrices

Group, Subgroup, Abelian Group, Cyclic Group, Elementary Probabilty Theory, Bayes Theorem .

Module II

Graphs and Trees - Graphs and Their Representations, Trees and their Representations, Decision Trees, Huffman Codes .

Graph Algorithms - Directed Graphs and Binary Relations; Warshall's Algorithm, Euler Path and Hamiltonian Circuit, Shortest Path and Minimal Spanning Tree, Traversal Algorithms, Articulation Points and Computer Networks

Module III

Fundamental Theorem of Arithmatic (Eucldean Algorithm, Chinese Remainder Theorem) - Arithmetic Function: Euler totient Function, product formula , Congruences: definition and basic properties of congruencies, Residue classes and complete residue systems, Linear congruences, Quadratic Residues

Reference

1. Judith L. Gersting, “Mathematical Structures for Computer Science”, 5thEdition, W.H. Freeman and Company, 2003.
2. Introduction to Analytical Number Theory – Tom. M. Apostol
3. J. P. Tremblay and R. Manohar, “Discrete Mathematical Structures with Applications to Computer Science”, TMH, 1997.
4. Kenneth H. Rosen, “Discrete Mathematics and its Applications”, 5th Edition, TMH, 2003.
5. R.P. Grimaldi, “Discrete and Combinatorial Mathematics”, Pearson Edition, 2002.
6. M.K. Venkataraman, N. Sridharan and N. Chandrasekaran, “Discrete Mathematics”, The National Publishing Company, 2003.

Structure of the Question paper

For the end semester examination, the question paper consists of at least 60% problems and derivations. There will be three questions from each module out of which two questions are to be answered by the students.

INC 1002 ADVANCED COMPUTER ARCHITECTURE 3-0-0-3

Structure of the Course

Lecture : 3 hrs/ Week Credits : 3
Internal Continuous Assessment : 40 Marks
End Semester Examination : 60 Marks

Course Objectives

Develop an understanding of the principles and practices employed in the design and evaluation of processors and computer systems.

Learning Outcomes

- Understand the issues in high performance processor design.
- Quantitatively analyze the performance of computer systems

Module I
FUNDAMENTALS OF QUANTITATIVE DESIGN AND ANALYSIS - Measuring and Reporting Performance – Quantitative Principles of Computer Design. INSTRUCTION SET PRINCIPLES - Classifying Instruction set Architecture – Memory Addressing – Addressing Modes – Type and Size of Operands – Operations in the Instruction Set –Instructions for Control Flow – Encoding an Instruction Set – Example Architecture – MIPS.

Module II
INSTRUCTION LEVEL PARALLELISM - Pipelining and Hazards – Concepts of ILP – Compiler Techniques for Exposing ILP – Branch Prediction – Overcoming Data Hazards With Dynamic Scheduling –Dynamic scheduling – Examples and Algorithm - Hardware based Speculation – Exploiting ILP using Multiple Issues and Static Scheduling – Exploiting ILP using Dynamic Scheduling, Multiple Issues and Speculation - Limitations of ILP. THREAD LEVEL PARALLELISM **–** Centralized**,** Symmetric and Distributed Shared Memory Architectures – Synchronization – Models of Memory Consistency.

Module III
MEMORY HIERARCHY - Cache Performance – Cache Optimizations – Virtual Memory – Protection and Examples of Virtual Memory – Memory Technology and Optimizations – Protection – Virtual Memory and Virtual Machines

Textbook

John L. Hennessey and David A. Patterson, "Computer Architecture A Quantitative Approach", 5th Edition, Morgan Kaufmann.

References

1. D. Sima- T. Fountain and P. Kacsuk, "Advanced Computer Architectures A Design Space Approach", Addison Wesley
2. Kai Hwang, "Advanced Computer Architecture Parallelism Scalability Programmability", Tata Mcgraw Hill
3. Vincent P. Heuring, Harry F. Jordan, "Computer System Design and Architecture", 2nd Edition, Addison Wesley

Structure of the Question paper

For the End Semester Examination the question paper will have three questions from each module out of which two questions are to be answered by the students.

INC1003 ADVANCED OPERATING SYSTEMS 3-0-0-3

Structure of the Course

Lecture : 3 hrs/ Week Credits : 3
Internal Continuous Assessment : 40 Marks
End Semester Examination : 60 Marks

Course Objectives:

This course contributes to the development of the following capabilities:

- Enabling Knowledge: the operation, implementation and performance of modern operating systems, and the relative merits and suitability of each for complex user applications.
- Problem Solving: Ability to model, abstract, and implement efficient software solutions in a complex system environment.
- Critical Analysis: Ability to compare, contrast, and evaluate the key trade-offs between multiple approaches to operating system design, and identify appropriate design choices when solving real-world problems.

Learning Outcomes

On completion of this course, students will be able to describe the basic principles used in the design of modern operating systems. Specifically, to:

- Explain the objective and functions of modern operating systems.
- Analyse the tradeoffs inherent in operating system design.
- Summarize techniques for achieving synchronization, mutual exclusion in an uni-processor and distributed operating systems.
- Handle issues like critical section problem, deadlocks in distributed environment.
- Design solution for the issues in distributed resource management, distributed shared memory and distributed scheduling
- Provide fault tolerance and failure recovery in distributed systems and distributed database systems

Module 1

OPERATING SYSTEM - Introduction - operating systems and services – CPU Scheduling approaches –Synchronization mechanisms-Concept of a Process, Concurrent Processes-The Critical section Problem, Other Synchronization problems–Language Mechanisms for Synchronization-Process Deadlocks –Models of deadlocks, Resources, System State-Necessary and Sufficient condition for Deadlock- Handling deadlocks.

DISTRIBUTED SYSTEMS - Introduction - Advantages of distributed system over centralized system, Limitations of Distributed system

Module 2

SYNCHRONIZATION IN DISTRIBUTED SYSTEMS - Clock synchronization–Lamport's logical clock, Vector clock, Causal ordering of messages, Causal Ordering of Messages; Mutual exclusion – Non token based algorithms – Lamport's Algorithm – Ricart-Agrawala Algorithm - Token based algorithms – Suzuki-Kasami's Broadcast Algorithm – Raymond's Tree-based Algorithm; Distributed deadlock detection and prevention-Issues- Centralized Deadlock-Detection Algorithms – Distributed Deadlock-Detection algorithms . DISTRIBUTED RESOURCE MANAGEMENT -

Distributed file system – Design Issues; Distributed Shared Memory (DSM) –Consistency Models – Memory Coherence, Distributed Scheduling – Issues in Load Distributing – Load Distributing Algorithms.

Module 3

FAILURE RECOVERY AND FAULT TOLERANCE - Recovery – Classification, Backward and forward error recovery, Recovery in concurrent systems, synchronous check pointing and recovery, Check pointing for Distributed database system. Fault tolerant – commit protocols, Voting protocols, Dynamic vote reassignment protocol.

References:

- Mukesh singhal and Niranjan G. Shivarathri, "Advanced Concepts in Operating Systems", Tata McGraw Hill, 1994.
- Andrew S. Tanenbaum, "Distributed Operating Systems", Pearson Education Asia, 1995.
- Silberschatz, Galvin, "Operating System Concepts", John Wiley, 2003.
- Stallings, "Operating system", PHI, New Delhi, 2004.

Structure of the Question paper

For the End Semester Examination, there will be three questions from each module out of which two questions are to be answered by the students.

INC1004 DISTRIBUTED SYSTEMS AND ALGORITHMS 3-0-0-3

Structure of the Course

Lecture : 3 hrs/ Week Credits : 3
Internal Continuous Assessment : 40 Marks
End Semester Examination : 60 Marks

Course Objectives

- Provide an introduction to the most important basic results in the area of distributed Algorithms.
- Should be able to use basic distributed algorithms and impossibility results
- Ability to apply distributed algorithms in large computer networks to multiprocessor shared-memory systems.

Learning Outcomes

- Understand various synchronous algorithms and consensus problems
- Understand various asynchronous shared memory algorithms and asynchronous network algorithms with the help of I/O automata.
- Understand partially synchronous algorithms

Module I

Synchronous Network Algorithm: Synchronous Network Model, Leader election in a synchronous ring, Algorithms in General Synchronous Networks- Flooding algorithm – Breadth First Search – Shortest Paths- Minimum Spanning Tree – Maximal Independent Algorithm- Distributed consensus with link failures.

Module II

Asynchronous Algorithms: Asynchronous System model - I/O automata- Operations on automata – Fairness – Inputs and outputs for problems – Properties and proof methods.

Asynchronous Shared Memory Algorithms: Asynchronous Shared Memory Model, Mutual Exclusion – Dijkstra's Mutual Exclusion algorithm – Lock out free Mutual Exclusion algorithms, Mutual Exclusion using Read – Modify - Write Variables - TicketME algorithm, Resource allocation, Consensus.

Module III

Asynchronous Network Algorithms: Asynchronous Network Model, Basic asynchronous network algorithms, synchronizers -The Local synchronizer – The safe synchronizer – Implementations - Applications.

Partially synchronous algorithms – MMT Timed automata – General Timed automata – Basic Definitions and operations – Transforming MMT automata into General Timed Automata.

Reference

1. Nancy A Lynch, "Distributed Algorithms", Morgan Kaufman

Structure of the Question paper

For the End Semester Examination the question paper will consist of 30% proof, 20% problems and 50 % Theory. There will be three questions from each module out of which two question are to be answered by the students.

INC 1005 NETWORK ROUTING PROTOCOLS 3-0-0-3

Structure of the Course

Lecture : 3 hrs/ Week Credits : 3
Internal Continuous Assessment : 40 Marks
End Semester Examination : 60 Marks

Course Objectives

- Create in-depth awareness of circuit switching network routing and routing in packet switching network.
- Should be able identify the capabilities, addressing and routing of High speed networks such as ATM networks.
- Should be able to analyse Mobile Communication networks and mobility management.
- Analyse various next generation routing techniques.
- Ability to apply RTOS concepts for solving multi task applications

Learning Outcomes

- Understand various communication architectures and protocols used in circuit switched and packet switched networks.
- Understand capabilities of High speed networks and the addressing and routing of ATM networks.
- Understand , Analyse Mobile networks, simulate switching techniques and QOS
- The Student should be able to apply the correct routing algorithm on a network depending on the type the network and the condition of the network.

Module I

CIRCUIT SWITCHING NETWORKS -AT & T's Dynamic Routing Network, Routing in Telephone Network-Dynamic Non Hierarchical Routing-Trunk Status Map Routing-Real Time Network Routing, Dynamic Alternative Routing-Distributed Adaptive Dynamic Routing-Optimized Dynamic Routing. PACKET SWITCHING NETWORKS -Distance vector Routing, Link State Routing, Inter domain Routing-Classless Interdomain routing (CIDR), Interior Gateway routing protocols (IGRP) - Routing Information Protocol (RIP), Open Shortest Path First (OSPF), Exterior Gateway Routing Protocol (EGRP) -Border Gateway Protocol (BGP), Apple Talk Routing and SNA Routing

Module II

HIGH SPEED NETWORKS -Routing in optical networks-The optical layer, Node Designs, Network design and operation, Optical layer cost tradeoffs, Routing and wavelength assignment, Architectural variations, Routing in ATM networks-ATM address structure, ATM Routing, PNNI protocol, PNNI signalling protocol, Routing in the PLANET network and Deflection Routing. MOBILE NETWORKS - Routing in Cellular Mobile Radio Communication networks-Mobile Network Architecture, Mobility management in cellular systems, Connectionless Data service for cellular systems.

Module III

Mobility and Routing in Cellular Digital Packet Data (CDPD) network, Packet Radio Routing-DARPA packet radio network, Routing algorithms for small, medium and large sized packet radio networks. Internet based mobile ad-hoc networking, communication strategies, routing algorithms – Table-driven routing - Destination Sequenced Distance Vector (DSDV), Source initiated ondemand routing- Dynamic Source Routing (DSR), Ad-hoc On- demand Distance Vector (AODV),

Hierarchical based routing- Cluster head Gateway Switch Routing (CGSR) and Temporally-Ordered Routing Algorithm (TORA), Quality of Service.

Reference

1. M. Steen strub, "Routing in Communication networks", PH International, NY, 1995.
2. "Internetworking Technologies Handbook", Fourth Edition, Inc. Cisco Systems, ILSG Cisco Systems, 2003.
3. William Stallings, "ISDN & Broadband ISDN with Frame Relay & ATM", PHI, ND, 2004.
4. Behrouz A Forouzan, "Data Communications and Networking (3/e), TMH, 2004
5. William Stallings, "High Speed Networks TCP/IP and ATM Design Principles", Prentice Hall International, New York, 1998.
6. Mohammad Ilyas, "The Handbook of Ad hoc Wireless Networks" CRC Press, 2002
7. Vijay K.Garg, "Wireless Network Evolution: 2G to 3G", Pearson Education, ND, 2003.
8. Rajiv Ramaswami and Kumar N.Sivarajan, "Optical Networks",Morgan Kaufmann Publishers,1998.
9. Sumit Kasera and Pankaj sethi, "ATM Networks", TMH Publishing Co. Ltd, ND,2001.
10. IEEE Journal on Selected Areas in Communications, Special issue on Wireless Ad-hoc Networks, Vol. 17, No.8, 1999.
11. Scott. M. Corson, Joseph P. Macker, Gregory H. Cirincione, IEEE Internet Computing Vol.3, No. 4, July – August 1999.
12. Alder M.Scheideler.Ch. Annual ACM Symposium on Parallel Algorithms and Architectures, ACM, NewYork 1998.
13. http://www.cisco.com/univercd/cc/td/doc/cisintwk/ito_doc/
14. www.moment.cs.ucsb.edu

Structure of the Question paper

There will be three questions from each module out of which two questions are to be answered by the students.

INC 1006 SECURITY IN COMPUTING 3-0-0-3

Structure of the Course

Lecture : 3 hrs/ Week Credits : 3
Internal Continuous Assessment : 40 Marks
End Semester Examination : 60 Marks

Course Objectives

- Understanding of basic issues, concepts, principles, and mechanisms in network security.
- To identify the set of activities designed to protect the network.
- To understand how network security helps to protect customers' data and reduce the risk of legal action from data theft.

Learning Outcome

- Prevent /Mitigate/Limit the security threats that step bad software.
- To understand how to secure a system, students have to understand what sort of attacks is possible.
- Learning effective network security will target a variety of threats and stops them from entering or spreading on the network.
- Network Security enhances the ability to determine appropriate mechanisms for protecting the networked system.
- Students will be able to determine where to apply/use cryptography.

Module I

Introduction to Classical and Modem techniques - Attacks, services and mechanisms, classical encryption techniques, DES, Block cipher design principles and modes of operation. Encryption Algorithms and Hash Functions - Triple DES, RC5, key management.

Module II

Public key Cryptography RSA Algorithm, Digital signatures and authentication protocols.System Security - Backups, integrity management, protecting against programmed threats,viruses and worms, physical security, personnel security.

Module III

Network Security - Protection against eavesdropping, security for modems, IP security, web security, electronic mail security, authentication applications.
Security tools - Firewalls, wrappers, proxies, discovering a break-in, denial of service attacks and solutions, Cryptographic security tools: KERBEROS, PGP, SSH, SRP, OPIE.

Reference

1. William Stallings, "Cryptography and Network Security Principles and Practice ", 11 Edition, Pearson Education Asia Publishers (Low priced Edition), 2000, Ch 1 to 16.
2. Simson Garjainkal, and Gene Spafford, "Practical UNIX and Internet Security" 2nd edition Oreilly Pule Pvt. Ltd. 2000
3. Steve Burnett and Stephene Paine, "RSA Security 's official guide to cryptography", RSA Press, Tata McGraw Hill Edition, 2001.

Structure of the Question paper

For the End Semester Examination the question paper will consist of 60% Design problems and 40 % Theory. There will be three questions from each module out of which two questions are to be answered by the students.

INC1101 NETWORKS AND ENGINEERING LAB 0-0-2-1

Structure of the Course

LAB : 2 hrs/ Week Credits : 1
Internal Continuous Assessment : 100 Marks

Course Objectives

- Perform and verify static and dynamic routing protocols within and between networks.
- Understand switch operations. Configure and use IPV6
- Understand Network Management. Identify the common issues associated with a networks configuration, management and security
- Identify the basic parameters to configure on a wireless network , compare and contrast wireless security features.

Learning Outcomes

- Design and develop networks to meet varying need of an organization depending on the available resources.
- Implement and verify WAN Links.
- Select the appropriate administrative tasks required for a WLAN
- Implement , verify and troubleshoot NAT and ACLs in a medium sized office network.

Familiarization of different network cables – Color coding – Crimping – routers & Switches

Experiments using routers

Configuring routers – Implementing static & dynamic routing – Implementing BGP –

Experiments using switches

Configuring switches – Layer2 switching & spanning tree Protocol - VLAN – VTP – VTP pruning – Implementing inter VLAN routing

Configuring IPV6 – Configuring RIPng – Configuring OSPFv3

Security - Access control List - Network Address Translation –

Configuring Client –Server Component – enable SNMP probe using Access Lists

Wide Area networks -Configuring PPP

Experiments using wireless networking

Experiments on network security – Network reconnaissance – Network sniffers – address spoofing – network monitoring – Configuring firewalls, IDS and VPN – wireless security tools

INC1102 **SEMINAR**

Structure of the Course

Seminar	: 2 hrs/week	Credits: 2
Internal Continuous Assessment	: 100 Marks	

Each student is required to select a topic on advanced technologies in Network Engineering/ Computer Science / Information Technology, and get it approved by the faculty-in-charge of seminar. Each student should also prepare a well documented report on the seminar as per an approved format and submit to the department. The seminar and report will be evaluated for the award of sessional marks.

SEMESTER II

INC 2001 APPLIED CRYPTOGRAPHY 3-0-0-3

Structure of the Course

Lecture : 3 hrs/ Week Credits : 3
Internal Continuous Assessment : 40 Marks
End Semester Examination : 60 Marks

Course Objectives

At the end of the course students should be able to:

- Understand intermediate-level issues of deploying cryptographic mechanisms.
- Apply a crypto or security standard to fit the solution sought.
- Judge pros and cons of crypto methods considered for deployment.
- Independently design and test simple cryptographic solutions.
- Evaluate common crypto protocols in terms of security and efficiency.

Learning Outcome

- Prevent /Mitigate/Limit the security threats that step bad software.
- To understand how to secure a system, students have to understand what sort of attacks is possible.
- Learning effective network security will target a variety of threats and stops them from entering or spreading on the network.
- Network Security enhances the ability to determine appropriate mechanisms for protecting the networked system.
- Students will be able to determine where to apply/use cryptography.

Module I

Classical Cryptography-The Shift Cipher, The Substitution Cipher, The Affine Cipher - Cryptanalysis-Cryptanalysis of the Affine Cipher, Cryptanalysis of the Substitution Cipher,Cryptanalysis of the Vigenere Cipher,Shannon's Theory - Block Cipher and the Advanced Encryption Standard-Substitution -Permutation Networks, Linear Cryptanalysis, Differential Cryptoanalysis - The Data Encryption Standard, The Advanced Encryption Standard, Modes of Operation ,Cryptography Hash Function-Hash Function and Data Integrity,Security of Hash Function ,Iterated Hash Functions-Message Authentication Codes.

Module II

The RSA Cryptosystem - Introduction to Public–key Cryptography, Number theory,The RSA Cryptosystem, Attacks on RSA, The ELGamal Cryptosystem, Shanks' Algorithm, Signature Scheme –Digital Signature Algorithm. Identification Scheme and Entity Attenuation-Challenge – and – Response in the Secret-key Setting,Challenge–Response in the Public key Setting,The Schnorr Identification Scheme, Key distribution - Diffie-Hellman key exchange, Unconditionally Secure key Predistribution, Key Agreement Scheme- Diffie-Hellman Key agreement, PKI,

Certificates,Trust Models.

Module III

Secret Sharing Schemes-The Shamir Threshold Scheme,Access Structure and General Scret key sharing, Information Rate and Construction of Efficient Schemes, Multicast Security and Copyright production- Multicast Security, Broadcast Encryption, Multicast Re-keying, Copyright Protection ,Tracing Illegally Redistribution keys.

Reference

1 Douglas R. Stinson ,"Cryptography Theory and Practice ", Third Edition, Chapman & Hall/CRC,2006

2 Menges A. J , Oorschot P, Vanstone S.A,"Handbollk of Appliled Cryptography" CRC Press,1997.

3 William Stallings, "Cryptography and Network Security: Principles and Practices", Third Edition, Pearson Education,2006.

4. Wenbo Mao, "Modern Cryptography – Theory and Practice", Pearson Education, First Edition, 2006.

5.Charles B. Pfleeger, Shari Lawrence Pfleeger, "Security in Computing", Fourth Edition, Pearson Education, 2007.

6. Wade Trappe and Lawrence C. Washington, "Introduction to Cryptography with Coding Theory" Second Edition, Pearson Education, 2007.

Structure of the Question paper

For the End Semester Examination the question paper will consist of 60% Design problems and 40 % Theory. There will be three questions from each module out of which two questions are to be answered by the students.

INC2002 MODERN COMPUTING PARADIGMS 3-0-0-3

Structure of the Course

Lecture : 3 hrs/ Week Credits : 3
Internal Continuous Assessment : 40 Marks
End Semester Examination : 60 Marks

Course Objectives

- 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 computing

Learning Outcomes

- Understand various computing paradigms, its issues and its applications in the business
- Understand various tools and methods to implement Grid and Cloud computing

Module 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.
Cluster Computing – Cluster Computing at a Glance – Cluster Setup and its Administration – Cluster Architectures – Detecting and Masking Faults – Recovering from Faults .
Grid Computing – Fundamentals – Benefits of Grid Computing – Grid Terms and Concepts – Grid Security – Grid Architecture Models – Grid Topologies.

Module II

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.
Familiarization of EUCALYPTUS – an open source software framework for cloud computing.
Familiarization of CloudSim: A Toolkit for Modeling and Simulation Cloud Computing Environments

Module III

Virtualization - Virtualization Types – Desktop Virtualization – Network Virtualization – Server and Machine Virtualization – Storage Virtualization – 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.

References

1. Rajkumar Buyya, High Performance Cluster Computing – Architecture and Systems, Pearson Education.
2. Bart Jacob, Michael Brown, et al, Introduction to Grid Computing, IBM RedBooks
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.

Structure of the Question paper

There will be three questions from each module out of which two questions are to be answered by the students.

ICC2000 RESEARCH METHODOLOGY

Structure of the Course

Lecture : 2 hrs/ Week Credits : 2
Internal Continuous Assessment : 40 Marks
End Semester Examination : 60 Marks

Course Objectives

Gives students an insight into the steps to be followed in doing a research, provide an idea about technical report writing etc.

Module I

Introduction - Meaning of research - Objectives of research - Motivation in research - Types of research - Research approaches - Significance of research - Research methods vs Methodology - Criteria of good research.

Defining Research Problem - What is a research problem - Selecting the problem - Necessity of defining the problem - Literature review - Importance of literature review in defining a problem - Critical literature review - Identifying gap areas from literature review

Module II

Research design - Meaning of research design - Need- Features of good design - Important concepts relating to research design - Different types - Developing a research plan

Method of data collection - Collection of data- observation method - Interview method - Questionnaire method - Processing and analysis of data - Processing options - Types of analysis - Interpretation of results

Module III

Report writing - Types of report - Research Report, Research proposal ,Technical paper - Significance - Different steps in the preparation - Layout, structure and Language of typical reports - Simple exercises - Oral presentation - Planning - Preparation - Practice - Making presentation - Answering questions - Use of visual aids - Quality & Proper usage - Importance of effective communication - Illustration .

References

1. Coley S M and Scheinberg C A, 1990, *Proposal Writing,* Newbury Sage Publications.
2. Leedy P D, *Practical Research: Planning and Design,* 4th Edition, N W MacMillan Publishing
3. Day R A, *"How to Write and Publish a Scientific Paper",* Cambridge University Press, 1989.

INC2101 SOFTWARE TESTING LAB 0-0-2-1

Structure of the Course

Lecture : 2 hrs/ Week Credits : 1

Internal Continuous Assessment : 100 Marks

Course Objectives

- Understanding software testing automation

Learning Outcomes

- Ability to perform various types testing

Understanding Software Testing Tasks – Test planning – Test automation .

Experiments on testing desktop applications

- Forms testing
- Page content testing
- Navigation testing
- Functional testing
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Experiments on testing Web applications

– Functional testing
– Usability Testing
– Navigation Testing
– Forms Testing

– Page content testing

Experiments on Performance testing

– Scalability testing
– Load testing
– Stress testing
– Configuration & Compatibility testing

Experiments on Security testing

– End to end transaction testing

INC2102 THESIS – PRELIMINARY – PART I

Structure of the Course

Weekly Hours: 2 hrs/ Week Credits : 2

Internal Continuous Assessment : 100 Marks

The student is expected to start the preliminary background studies towards the Thesis by conducting a literature survey in the relevant field. He/she should broadly identify the area of the Thesis work, familiarize with the design and simulation tools required for the Thesis work and plan the experimental platform, if any, required for Thesis work .The student will submit a detailed report of these activities at the end of the semester.

Thesis-Preliminary comprises of two seminars and submission of an interim thesis report. This report shall be evaluated by the Evaluation Committee. The second thesis would be an extension of this work in the same area. The first presentation would highlight the topic, objectives, methodology and expected results. It shall be conducted in the first half of the semester. The second presentation should include scope of work, literature survey and problem definition(s) along with a report .

Distribution of marks

Internal assessment of work by the guide: 50%
Internal Evaluation by Committee: 50%

INC2103 **SEMINAR**

Structure of the Course

Weekly Hours: 2 hrs/ Week Credits: 2
Internal Assessment: 100 Marks

Each student is required to select a topic on advanced technologies in Network Engineering/ Computer Science / Information Technology, and get it approved by the faculty-in-charge of seminar. Each student should also prepare a well documented report on the seminar as per an approved format and submit to the department. The seminar and report will be evaluated for the award of sessional marks.

Distribution of marks

Seminar Report Evaluation: 40
Seminar Presentation: 60

STREAM ELECTIVES – ELECTIVE I and II

INE2011 ACCESS NETWORKS AND CELLULAR COMMUNICATION 3-0-0-3

Structure of the Course

Lecture : 3 hrs/ Week Credits : 3
Internal Continuous Assessment : 40 Marks
End Semester Examination : 60 Marks

Course Objectives

- The course describes in detail how communication services are conceived, developed and deployed in wireless networks.
- Describes optical access networks, its architecture, routing techniques and types of passive optical networks.

Learning Outcomes

- The ability to understand technologies used in wireless and mobile communication
- Able to understand access network technologies, its architecture, routing techniques and analyse the working of different types of passive optical networks.

Module I

Mobile Radio Propagation-Propagation Models, Propagation Mechanisms, Path Loss models, Small scale Multipath Propagation, Parameters of Mobile Multipath Channels , Rayleigh and Ricean Distributions, level crossing and fading statistics. Wireless Communication Systems and Standards, WLL, PACS, cellular data services, satellite base wireless systems.

Module II

Cellular System Design & Signalling-Channel assignment, cell planning, power control, erlang capacity, database and mobility management, power control, interference and system capacity, signalling standards, antennas for mobile radio. WAP- Architecture, protocols, security issues, Routing Techniques in Ad Hoc wireless networks.

Module III

Optical Access Networks: PON Architecture, Broadband PON, Gigabit capable PON, Ethernet PON, Next generation optical access network, WDM-PON components and Network Architecture, Hybrid TDM/WDM PON, WDM-PON protocol and Scheduling algorithm. Hybrid optical wireless access networks: Technologies, architecture, routing algorithm.

References

1. T.S.Rappaport, Wireless Communications: Principles and Practice, 2nd Edition, Pearson Education/ Prentice Hall of India, Third Indian Reprint 2003.
2. W.C.Y.Lee, Mobile Communications Engineering: Theory and applications, 2nd Edition, McGraw-Hill International, 1998.
3. Andreas F.Molisch, Wideband Wireless Digital Communications, Pearson Education, 2001.
4. R. Blake, Wireless Communication Technology, Thomson Delmar, 2003.
5. Leonid G. Kazovsky, Ning Cheng, Wei-Tao Shaw, David Gutierrez, Shing-Wa Wong Broadband Optical Access Networks, Wiley

Structure of the Question paper

There will be three questions from each module out of which two questions are to be answered by the students.

INE2012 HIGH SPEED SWITCHING ARCHITECTURES 3-0-0-3

Structure of the Course

Lecture : 3 hrs/ Week Credits : 3
Internal Continuous Assessment : 40 Marks
End Semester Examination : 60 Marks

Course Objectives

- Introduction to the most important switching architectures.
- Understanding the architecture of different switching technology like store and forward/cut-through switching technology
- half-duplex and full duplex modes
- several methods for flow control and it's needs

Learning Outcomes

- Understand various switching architectures.
- Characterization of different communication services.
- Understanding features and properties of underlying communication network that support services.
- Understanding LAN switching that increase the efficiency of local area networks and solve the current bandwidth problems.
- Understand how switches can be used to implement virtual LANs and ease management functions.
- Classification of ATM switching architectures

MODULE I

LAN SWITCHING TECHNOLOGY - Switching Concepts, switch forwarding techniques, switch path control, LAN Switching, cut through forwarding, store and forward, virtual LANs.

ATM SWITCHING ARCHITECTURE - Blocking networks - basic - and- enhanced banyan networks, sorting networks - merge sorting, re-arrangable networks - full-and- partial connection networks, non blocking networks - Recursive network construction.

QUEUES IN ATM SWITCHES - Internal Queueing -Input, output and shared queueing, multiple queueing networks..

MODULE II

HIGH PERFORMANCE PACKET SWITCHING ARCHITECTURES - Architectures of Internet Switches and Routers- Bufferless and buffered Crossbar switches, Multi-stage switching, Optical Packet switching; Switching fabric on a chip; Internally buffered Crossbars.

MODULE III

IP SWITCHING - Addressing model, IP Switching types - flow driven and topology driven solutions, IP Over ATM address and next hop resolution, multicasting, Ipv6 over ATM.

REFERENCES:

1. AchillePattavina, “Switching Theory: Architectures and performance in Broadband ATM networks ",John Wiley & Sons Ltd, New York. 1998
2. Elhanany M. Hamdi, “High Performance Packet Switching architectures”, Springer Publications, 2007.
3. Christopher Y Metz, “Switching protocols & Architectures”, McGraw - Hill Professional Publishing, NewYork.1998.
4. Rainer Handel, Manfred N Huber, Stefan Schroder, “ATM Networks - Concepts Protocols, Applications”, 3rd Edition, Addison Wesley, New York. 1999.

Structure of the Question paper

For the End Semester Examination the question paper will consist of 30% proof, 20% problems and 50 % Theory. There will be three questions from each module out of which two question are to be answered by the students.

INE2013 EMBEDDED NETWORKING 3-0-0-3

Structure of the Course

Lecture : 3 hrs/ Week Credits : 3
Internal Continuous Assessment : 40 Marks
End Semester Examination : 60 Marks

Course Objectives

- To study the concepts of embedded networking.
- To explore CAN open standard, Configuration, underlying technology.
- To Implement CAN open and identify various issues associated with it.

Learning Outcome

- Understand embedded network requirements, CAN open features and testing
- Design and analyse an application using CAN open Configuration

Module I

EMBEDDED NETWORK REQUIREMENTS - Embedded networking – code requirements – Communication requirements – Introduction to CAN open – CAN open standard – Object directory – Electronic Data Sheets & Device – Configuration files – Service Data Objectives – Network management CAN open messages – Device profile encoder.

Module II

CAN OPEN - CAN open configuration – Evaluating system requirements choosing devices and tools – Configuring single devices – Overall network configuration – Network simulation – Network Commissioning – Advanced features and testing. **CAN:** Controller Area Network – Underlying Technology CAN Overview – Selecting a CAN - Controller – CAN development tools.

Module III

IMPLEMENTATION OF CAN OPEN - Implementing CAN open Communication layout and requirements – Comparison of implementation methods – Micro CAN open – CAN open source code – Conformance test – Entire design life cycle. ISSUES - Physical layer – Data types – Object dictionary – Communication object identifiers – Emerging objects – Node states.

References

1. Glaf P.Feiffer, Andrew Ayre and Christian Keyold , Embedded Networking with CA and CAN open, Embedded System Academy 2005.
2. Frank Vahid, Givargis ‘Embedded Systems Design: A Unified Hardware/Software Introduction’, Wiley Publications
3. Raj Kamal, ìEmbedded Systemsî, TMH
4. 2. David E. Simon, ìAn Embedded Software Primer ", Pearson Education

Structure of the Question paper

There will be three questions from each module out of which two questions are to be answered by the students.

INE2014 AD HOC AND SENSOR NETWORKS 3-0-0-3

Structure of the Course

Lecture : 3 hrs/ Week Credits : 3
Internal Continuous Assessment : 40 Marks
End Semester Examination : 60 Marks

Course Objectives

- 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.

Learning Outcomes

- 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.

ModuleI

Introduction : Fundamentals of wireless communication technology, the electro magnetic spectrum radio propagation, characteristics of wireless channels, modulation techniques,multiple access techniques, wireless LANs, PANs, WANs, and MANs, Wireless Internet.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 adhoc wirelesss networks, issues in design of sensor network, sensor network archeitecture, data dissemination and gathering.

Module II

MAC Protocols : Issues in desiging 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.

Routing Protocols : Issues in designing a routing protocol, classification of routing protocols,table-driven, on-demand, hybrid, flooding, hierarchical, and power aware routing protocols.

Module III

QoS and Energy Management : Issues and Challenges in providing QoS, classifications,MAC, network layer solutions, QoS frameworks, need for energy management,classification, battery, transmission power, and system power management schemes.

Text book

1. C. Siva Ram Murthy, and B. S. Manoj, "AdHoc Wireless networks ", pearson Education - 2008.

Reference Book

1. Feng Zhao and Leonides Guibas, "Wireless sensor networks ", Elsevier publication - 2004.
2. Jochen Schiller, "Mobile Communications ". Pearson Education, 2nd Edition, 2003.
3. William Stallings, "Wireless Communications and Networks ", Pearson Education - 2004

Structure of the Question paper

For the End Semester Examination the question paper will consist of 60% Design problems and 40 % Theory. There will be three questions from each module out of which two questions are to be answered by the students.

INE2015 **CLOUD COMPUTING** **3-0-0-3**

Structure of the Course

Lecture : 3 hrs/ Week Credits : 3
Internal Continuous Assessment : 40 Marks
End Semester Examination : 60 Marks

Course Objectives

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

Learning Outcomes

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

Module 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 – 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

Module II

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

Module III

Collaborating on Calendars, Schedules and Task Management – Exploring Online Scheduling Applications – Exploring Online Planning and Task Management – Collaborating on Event Management – Collaborating on Contact Management – Collaborating on Project Management – Collaborating on Word Processing - Collaborating on Databases – Storing and Sharing Files. 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

References

1. Michael Miller, Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online, Que Publishing, August 2008.
2. Haley Beard, Cloud Computing Best Practices for Managing and Measuring Processes for On-demand Computing, Applications and Data Centers in the Cloud with SLAs, Emereo Pty Limited, July 2008.

Structure of the Question paper

For the End Semester Examination the question paper will have three questions from each module out of which two questions are to be answered by the students.

DEPARTMENTAL ELECTIVES

INE 2016 **SOFT COMPUTING** **3-0-0-3**

Structure of the Course

Lecture : 3 hrs/ Week Credits : 3
Internal Continuous Assessment : 40 Marks
End Semester Examination : 60 Marks

Course Objectives

- 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.

Learning Outcomes

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

Module I

SOFT COMPUTING AND CONVENTIONAL AI - AI Search algorithm-Predicate calculus rules of interface - Semantic networks-frames-objects-Hybrid models - applications.

Module II

ARTIFICIAL NEURAL NETWORKS - Basic-concepts-single layer perception-Multi layer perception-Supervised and un supervised learning back propagation networks, Application. FUZZY LOGIC - Fuzzy sets and Fuzzy reasoning -Fuzzy matrices - Fuzzy functions-decomposition - Fuzzy automata and languages- Fuzzy control methods-Fuzzy decision making, Applications.

Module III

NEURO-FUZZY MODELLING - Adaptive networks based Fuzzy interfaces-Classification and Representation trees-Data dustemp algorithm –Rule base structure identification - Neuro-Fuzzy controls GENETIC ALGORITHM- Survival of the fittest-pictures computations-cross over mutation-reproduction-rank method-rank space method, Application.

Reference

1. Jang J. S. R., Sun C.T and Mizutami E, “Neuro Fuzzy and Soft computing”, Prentice Hall, New Jersey,1998.
2. Timothy J. Ross, “Fuzzy Logic Engineering Applications”. McGraw Hill, New York, 1997.
3. Laurene Fauseett, “Fundamentals of Neural Networks”, Prentice Hall India, New Delhi, 1994.
4. George J. Klir and Bo Yuan, “Fuzzy Sets and Fuzzy Logic”, Prentice Hall Inc., New Jersey, 1995.
5. Nih. J. Ndssen, “Artificial Intelligence”, Harcourt Asia Ltd.,Singapore,1998.

Structure of the Question paper

For the End Semester Examination the question paper will consist of 60% Design problems and 40 % Theory. There will be three questions from each module out of which two questions are to be answered by the students.

INE2017 ADVANCED DATABASE SYSTEMS 3-0-0-3

Structure of the Course

Lecture : 3 hrs/ Week Credits : 3
Internal Continuous Assessment : 40 Marks
End Semester Examination : 60 Marks

Course Objectives

- To provide an understanding of the needs for and uses of database management systems.
- To understand the context, phases and techniques for designing and building database information systems and an understanding of the components of a computerized database information system (application)
- To develop an ability to correctly use the techniques, components and tools of a typical database management system
- To have an understanding of some advanced topics in database management, e.g., object-oriented data modeling and object-oriented database development

Learning Outcomes

After completing this course the student must demonstrate the knowledge and ability to:

- Explain the advantages of the database approach, compared to traditional file processing.
- Describe the components of a typical database environment.
- Describe the purpose of database analysis, design, and implementation activities.
- Draw simple data models that show the scope of a database.

Module I

QUERY AND TRANSACTION PROCESSING - Querying : QueryProcessing Algorithms – Query Optimization Techniques – Transaction Management: Transaction Processing Concepts – Concurrency Control – Recovery Techniques –Database Security.

PARALLEL DATABASES - Database System Architectures: Centralized and
Client-Server Architectures – Server System Architectures – Parallel Systems- Distributed Systems – Parallel Databases: I/O Parallelism – Inter and Intra Query Parallelism – Inter and Intra operation Parallelism.

Module II

DISTRIBUTED DATABASES - Distributed Database Concepts - Distributed Data Storage– Distributed Transactions – Commit Protocols – Concurrency Control – Distributed Query Processing – Three Tier Client Server Architecture- Case Studies**.**

OBJECT AND OBJECT RELATIONAL DATABASES - Concepts for Object Databases: Object Identity –Object structure – Type Constructors – Encapsulation of Operations – Methods – Persistence – Type and Class Hierarchies – Inheritance – Complex Objects – Object Database Standards,

Languages and Design: ODMG Model – ODL – OQL – Object Relational and Extended – Relational Systems : Object Relational features in SQL / Oracle – Case Studies.

Module III

EMERGING TECHNOLOGIES - Mobile Databases: Location and Handoff Management -Effect of Mobility on Data Management - Location Dependent Data Distribution – Mobile Transaction Models - Concurrency Control - Transaction Commit Protocols – Web Databases - Information Retrieval - Data Warehousing - Data Mining. ENHANCED DATA MODELS - Active Database

Concepts and Triggers – Temporal Databases – Spatial Databases – Multimedia Databases – Deductive Databases – XML Databases: XML Data Model XML Schema - XML Querying - Geographic Information Systems -Genome Data Management**.**

References

1. R. Elmasri, S.B. Navathe, "Fundamentals of Database Systems", Fifth Edition, Pearson Education/Addison Wesley, 2007.
1. Thomas Cannolly and Carolyn Begg, " Database Systems, A Practical Approach to
2. Design, Implementation and Management", Third Edition, Pearson Education, 2007.
3. Henry F Korth, Abraham Silberschatz, S. Sudharshan, "Database System

Structure of the Question paper

For the End Semester Examination the question paper will consist of 60% Design problems and 40 % Theory. There will be three questions from each module out of which two questions are to be answered by the students.

INE2018 WEB TECHNOLOGIES 3-0-0-3

Structure of the Course

Lecture : 3 hrs/ Week Credits : 3
Internal Continuous Assessment : 40 Marks
End Semester Examination : 60 Marks

Course Objectives

1. Understand concepts and principles of web application, architecture, and its role in the bigger system.
2. Understand basics of server side technologies and apply them to develop dynamic web applications.
3. Know how to use the state-of -the-art development environments, frameworks, and toolkits.
4. Understand current issues and latest developments in web technologies and applications.

Learning Outcome

Upon successful completion of this course, students will be able to apply the technologies to develop an web application.

Module I

HTML 4 protocols – HTTP, SMTP, POP3, MIME, IMAP. JAVA Scripts – Object Based Scripting for the web. Structures – Functions – Arrays – Objects. Introduction – Object refers, Collectors all and Children. Dynamic style, Dynamic position, frames, navigator, Event Model – On check – On load – On over – Mouse rel – Form process – Event Bubblers – Filters – Transport with the Filter – Creating Images – Adding shadows – Creating Gradients – Creating Motion with Blur – Data Binding – Simple Data Binding – Moving with a record set – Sorting table data –Binding of an Image and table.

Module II

Audio and video speech synthesis and recognition - Electronic Commerce – E-Business Model – E- Marketing – Online Payments and Security – Web Servers – HTTP request types – System Architecture – Client Side Scripting and Server side Scripting – Accessing Web servers – IIS – Apache web server. Database, Relational Database model – Overview, SQL – ASP – Working of ASP – Objects – File System Objects – Session tracking and cookies – ADO – Access a Database from ASP – Serverside. Active-XComponents

Module III

Web Resources – XML – Structure in Data – Name spaces – DTD – Vocabularies – DOM methods. Introduction – Servlet Overview Architecture – Handling HTTP Request – Get and post request – redirecting request – multi-tier applications – JSP – Overview – Objects – scripting – Standard Actions –Directives.

Textbook

Deitel & Deitel, Goldberg, “Internet and world wide web – How to Program”, Pearson Education Asia,2001.

References

1. Eric Ladd, Jim O' Donnel, "Using HTML 4, XML and JAVA", Prentice Hall of India – QUE, 1999.

2. Aferganatel, "Web Programming: Desktop Management", PHI, 2004.
Rajkamal, "Web Technology", Tata McGraw-Hill, 2001

Structure of the Question paper

For the End Semester Examination the question paper will consist of 60% Design problems and 40 % Theory. There will be three questions from each module out of which two questions are to be answered by the students.

INE2019 INFORMATION RETRIEVAL TECHNIQUES 3-0-0-3

Structure of the Course

Lecture : 3 hrs/ Week Credits : 3
Internal Continuous Assessment : 40 Marks
End Semester Examination : 60 Marks

Course Objective

To provide an introduction to the methods used in the storage and retrieval of textual, pictorial, graphic, and voice data.

Learning Outcome

- understand the complexity of information retrieval;
- understand the functions of an information retrieval system;
- be able to understand and measure the contribution of the components of an information retrieval system to its performance;
- be able to isolate the factors which optimize the information retrieval process;
- be aware of current issues in information retrieval, including search engines.

Overview- Concepts of a document- data structures in the large- document surrogates- Vocabulary control- data compression- text documents- images and sound, Query structures- Boolean queries- vector queries- fuzzy queries- probabilistic queries

Relevance and similarity measures- Effects of Weighting- Effects of scaling- the Matching process, Indexing- Matrix representations- Term Association- Document Analysis- stemming- thesauri- user profiles and their use, Multiple Reference point systems- document clusters- Retrieval Effectiveness- Precision and Recall- Operating curves- Expected search Length- satisfaction and Frustration, Effectiveness Improvement Techniques, Relevance feedback,

Genetic Algorithms- TREC Experiments- Alternative Retrieval Techniques- Citation Processing- Hypertext links- Information Filtering and passage Retrieval.

References

1. Korfhage Robert R., Information storage and retrieval, John Wiley & Sons, Inc, 1997.
2. Richardo & Bertheir, Modern Information Retrieval, Pearson Education, 2000

Structure of the Question paper

For the End Semester Examination the question paper will consist of 60% Design problems and 40 % Theory. There will be three questions from each module out of which two questions are to be answered by the students.

INE2020 DATA WAREHOUSING AND DATA MINING 3-0-0-3

Structure of the Course

Lecture : 3 hrs/ Week Credits : 3
Internal Continuous Assessment : 40 Marks
End Semester Examination : 60 Marks

Course Objective

- Identify the key processes of data mining, data warehousing and knowledge discovery process;
- Describe the basic principles and algorithms used in practical data mining and understand their strengths and weaknesses of the functions of an information retrieval system;

Learning Outcome

- Apply data mining techniques to solve problems in other disciplines in a mathematical way
- Apply data mining methodologies with information systems and generate results which can be immediately used for decision making in well-defined business problems.

Module I

Relation to Statistics – Databases – Data Mining Functionalities – Steps in Data Mining Process – Architecture of a Typical Data Mining Systems – Classification of Data Mining Systems – Overviewof Data Mining Techniques.Data Preprocessing – Data Cleaning – Integration – Transformation – Reduction – Discretization Concept Hierarchies – Concept Description Data Generalization and Summarization BasedCharacterization – Mining Association Rules in Large Databases.

Module II

Classification and Prediction Issues Regarding Classification and Prediction – Classification by Decision Tree Induction – Bayesian Classification – Other Classification Methods – Prediction – Clusters Analysis – Types of Data in Cluster Analysis – Categorization of Major Clustering Methods – Partitioning Methods – Hierarchical Methods.

Module III

Data Warehousing Components – Multi Dimensional Data Model – Data Warehouse Architecture – Data Warehouse Implementation – Mapping the Data Warehouse to Multiprocessor Architecture – OLAP – Need – Categorization of OLAP Tools. Applications of Data Mining – Social Impacts of Data Mining – Tools – An Introduction to DB .Miner – Case studies – Mining WWW – Mining Text Databases – Mining Spatial Databases.

Text book

Jiawei Han, Micheline Kamber, "Data Mining Concepts and Techniques", Morgan Kaufmann Publishers, 2002.

References

1. Alex Berson, Stephen J Smith, “Data Warehousing, Data Mining & OLAP”, Tata Mcgraw Hill, 2004.
2. Usama M. Fayyad, Gregory Piatetsky , Shapiro, Padhrai Smyth and Ramasamy Uthurusamy,
3. "Advances In Knowledge Discovery And Data Mining", The M.I.T Press, 1996.
4. Ralph Kimball, "The Data Warehouse Life Cycle Toolkit", John Wiley & Sons Inc., 1998.
5. Sean Kelly, "Data Warehousing In Action", John Wiley & Sons Inc., 1997.

Structure of the Question paper

There will be three questions from each module out of which two questions are to be answered by the students.

SEMESTER III

INC3101 THESIS – PRELIMINARY – PART II

Structure of the Course

Thesis : 15 hrs/ Week Credits : 5
Internal Continuous Assessment : 200 Marks

The student is expected to start the preliminary background studies towards the Thesis by conducting a literature survey in the relevant field. He/she should broadly identify the area of the Thesis work, familiarize with the design and simulation tools required for the Thesis work and plan the experimental platform, if any, required for Thesis work .The student will submit a detailed report of these activities at the end of the semester.

Thesis-Preliminary comprises of two seminars and submission of an interim thesis report. This report shall be evaluated by the Evaluation Committee. The fourth semester thesis would be an extension of this work in the same area. The first seminar would highlight the design plan and data collection, analysis techniques used in the project. The first seminar shall be conducted in the first half of this semester. The second seminar is presentation of the interim thesis report of the work they have completed.

Internal assessment of work by the guide: 50%
Internal Evaluation by Committee: 50%

STREAM ELECTIVES – ELECTIVE III and IV

INE 3001 MULTIMEDIA COMMUNICATION AND NETWORKS 3-0-0-3

Structure of the Course

Lecture : 3 hrs/ Week Credits : 3
Internal Continuous Assessment : 40 Marks
End Semester Examination : 60 Marks

Course Objectives

- The ability to model and analyze IP networks like Internet
- Ability to design various routing policies for IP networks, and handle issues with IP routing with QoS management
- To discuss multimedia requirements in the communication systems
- To know the Internet protocol suite for multimedia communications.
- To illustrate multimedia networks in wired and wireless medium

Learning Outcomes

- Understand IP Networks and its issues, Intra and Inter Routing architecture, Network Performance parameters and QoS aware routing
- Understand streaming characteristics of multimedia and various multimedia communication standards and frame works for wired and wireless networks

Module I

Open Data Network Model – Narrow Waist Model of the Internet - Success and Limitations of the Internet – Suggested Improvements for IP and TCP – Significance of UDP in modern Communication – Network level Solutions – End to End Solutions – BestEffort service model – Scheduling and Dropping policies for Best Effort Service model

Module II

Intra AS routing – Inter AS routing – Router Architecture – Switch Fabric – Active Queue Management – Transition from IPv4 to IPv6 – Multicasting – Abstraction of Multicast groups – Group Management – IGMP – Group Shared MulticastTree – Source based Multicast Tree – Multicast routing in Internet – DVMRP and MOSPF.
Network Performance Parameters – Quality of Service and metrics – WFQ and its variants – Random Early Detection – QoS aware Routing – Admission Control – Resource Reservation – RSVP - Traffic Shaping Algorithms.

Module III

Stream characteristics for Continuous media – Temporal Relationship – Object Stream Interactions, Media Levity, Media Synchronization – Models for Temporal Specifications – Streaming of Audio and Video – Jitter – Fixed playout and Adaptive playout –Recovering from packet loss – RTSP — Multimedia Communication Standards –RTP/RTCP – SIP and H.263.
End to End QoS provisioning in Wireless Multimedia Networks – Adaptive Framework – MAC layer QoS enhancements in Wireless Networks – A Hybrid MAC protocol for Multimedia Traffic – Call Admission Control in Wireless Multimedia Networks – A Global QoS Management for Wireless Networks

References

1. Jean Warland and Pravin Vareya, 'High Performance Networks', Morgan Kauffman Publishers, 2002
2. Mahbub Hassan and Raj Jain, 'High Performance TCP/IP Networking', Pearson Education, 2004.
3. William Stallings, 'High Speed Networks: Performance and Quality of Service',2nd Edition, Pearson Education, 2002.
4. Kurose and Ross, 'Computer Networks : A top down Approach', Pearson Education, 2002
5. Nalin K Sharda, 'Multimedia Information Networking', Prentice Hall of India, 1999
6. Aura Ganz, Zvi Ganz and Kitti Wongthawaravat, 'Multimedia Wireless Networks:Technologies, Standards and QoS', Prentice Hall, 2003.
7. Ellen Kayata Wesel, 'Wireless Multimedia Communications: Networking Video, Voice and Data', Addision Wesley, 1998

Structure of the Question paper

There will be three questions from each module out of which two questions are to be answered by the students.

INE 3002 MATHEMATICAL MODELS FOR INTERNET 3-0-0-3

Structure of the Course

Lecture : 3 hrs/ Week Credits : 3
Internal Continuous Assessment : 40 Marks
End Semester Examination : 60 Marks

Course Objectives

- To introduce mathematical models for internet.

Learning Outcomes

- Students will be able to apply mathematical models to study different various mechanisms such as network congestion.

Module I

Definition and characteristics of mathematical models. Modelling the network - queuing systems, modelling the QoS for improvement. Mathematical models of fairness and stability.

Module II

Modelling a self-managed internet. Moving away from the end to end concept. Modelling required in an untrustworthy world.

Module III

Mathematical modelling of the internet, Mathematical models of traffic control in internet, Modelling of an internet based application.

Reference

1. Harold Tipton, Micki Krause, Information Security Management Handbook, 5th Edition, Auerbach / CRC Press 2004
2. Seymour Bosworth, M E Kabay .Computer Security Handbook, 4th Edition. John Wiley, 2002.
3. Theo Dimitrakos, Fabio Martinelli, (Editors). Formal Aspects in Security and Trust: Proceedings of IFIP Workshop on Formal Aspects in Security and Trust (FAST) 2004, Springer 2005
4. Ali E Abdallah, Peter Ryan, Steve Schneider (Editors). Formal Aspects of Security: Proceedings of First International Conference, FASec 2002. LNCS 2629, Springer 2003
5. Markus Schumacher. Security Engineering with patterns: origins, theoretical model, and new applications. LNCS 2754, Springer.
6. V. A. Vasenina, G. I. Simonovab, Mathematical models of traffic control in internet: new approaches based of TCP/AQM schemes, Avtomat. i Telemekh., 2005:8, 94–107
7. Frank Kelly, Mathematical modelling of the Internet, Proc. Fourth International Congress on Industrial and Applied mathematics, Edinburgh, 1999.
8. Frank Kelly, Models for a Self Managed Internet, Philosophical Transactions of the Royal Society A358, pp. 2335-2348, 2000

Structure of the Question paper

For the End Semester Examination the question paper will consist of 60% Design problems and 40 % Theory. There will be three questions from each module out of which two questions are to be answered by the students.

INE3003 PERFORMANCE EVALUATION OF COMPUTER SYSTEMS AND NETWORKS 3-0-0-3

Structure of the Course

Lecture : 3 hrs/ Week Credits : 3
Internal Continuous Assessment : 40 Marks
End Semester Examination : 60 Marks

Course Objectives

- The objective of this course to understand the fundamental concepts of computer system performance evaluation
- Ability to perform mathematical modeling techniques, discrete event simulation modeling, experiment design, workload characterization, measurement of performance metrics, and presentation of results.

Learning Outcomes

- Understand computer system, networks and various evaluation criteria
- Understand modelling techniques, computational methods and simulation process for computer system and network
- Understand and analyse tools and methods for system performance evaluation

Course prerequisite

Undergraduate Operating Systems course, Undergraduate Computer Networks course, Basics of Probability and Statistics

Module I

FUNDAMENTALS - Need for Performance Evaluation – Role of Performance Evaluation – Performance Evaluation Methods – Performance Metrics and Evaluation Criteria – CPU and I/O Architectures – Distributed and Network Architectures – Secondary Storage – Topologies – Computer Architecture – Fundamental Concepts and Performance Measures.

Module II

PROBABILITY AND STOCHASTIC PROCESSES - Scheduling Algorithms – Workloads – Random Variables –Probability Distributions – Densities – Expectation – Stochastic Processes – Poisson Process – Birth Death Process – Markov Process. QUEUING THEORY - Queuing Systems – Networks of Queues – Estimating Parameters and Distributions – Computational Methods – Simulation Process – Time Control – Systems and Modeling.

Module III

PETRI NETS AND SYSTEM PERFORMANCE - Petri Nets – Classical Petri Nets – Timed Petri Nets – Priority–based Petri Nets – Colored Petri Nets - – Generalized Petri Nets – Tool Selection – Validation of Results – Performance Metrics – Evaluation – Multiple Server Computer System Analysis. ANALYSIS - OS Components – System Architecture – Workloads – Design –

Simulation – Analysis – Database System Performance – Computer Networks Components – Simulation Modeling of LAN.

References

1. Paul J. Fortier, Howard E. Michael, "Computer Systems Performance Evaluation and Prediction", Elsevier Science 2003.
2. Thomas G. Robertazzi, "Computer Networks and Systems Queing theory and Performance Evaluation", 3rd Edition, Springer, 2000.
3. Domenico Ferrari , Giuseppe Serazzi ,Alexandro Zeijher, "Measurement & Tuning of Computer Systems ", Prentice Hall Inc, 1983.
4. Michael F. Mories and Paul F. Roth, "Tools and techniques Computer Performance Evaluation", Van Nostrand, 1982.

Structure of the Question paper

There will be three questions from each module out of which two questions are to be answered by the students.

INE3004 NETWORK ARCHITECTURE AND DESIGN 3-0-0-3

Structure of the Course

Lecture : 3 hrs/ Week Credits : 3
Internal Continuous Assessment : 40 Marks
End Semester Examination : 60 Marks

Course Objective

- Understand the principles of structured cabling network design criteria for LAN and WAN implementations and their application
- Understand the concepts and characteristics of high-speed networks, user-network interface, routing, switching, distributed resource management, distributed network management, and measures of network performance.
- Understand how to determine the network design most appropriate for a given site or combination of sites.
- Master local and wide area network concepts and terminology
- Understand and be able to identify the network standards, protocols, and access methods to be implemented in a given network design

Learning Outcome

- Verify component health
- Verify network communications
- Verifying infrastructure devices
- Verify cabling and termination
- Troubleshoot and repair problems

Module I

INTRODUCTION, REQUIREMENT ANALYSIS - Overview of Analysis, Architecture and Design Processes-Performance Characteristics, Requirement analysis- User Requirement- Application Requirement- Device Requirement- Network Requirement- Other Requirement, Gathering and Listing Requirements- Developing RMA, Delay and Capacity Requirements- Developing Supplemental Performance Requirements.

Module II

FLOW ANALYSIS, NETWORK ARCHITECTURE - Flows-Individual and Composite flow-Critical Flow, Flow models, Flow Specification, Network Architecture- Component Architecture, Reference Architecture, Architectural Models. NETWORK MANAGEMENT ARCHITECTURE - Addressing Mechanisms- Classful Addressing - Subnetting-Variable length Subnetting-Supernetting-Private Addressing and NAT, Routing Mechanisms, Addressing Strategies, Routing Strategies, Architectural Consideration, Network management, Network management Mechanisms, Architectural Considerations.

Module III

PERFORMANCE ARCHITECTURE, SECURITY AND PRIVACY ARCHITECTURE - Performance Mechanisms- Quality Services- Service level Arrangements, Architectural Consideration- Evaluation of Performance Mechanisms- Internal Relationship- External Relationship, Security and privacy Plan- Administration, Security and privacy Mechanisms, Architectural considerations- Evaluation of Security Mechanisms- Internal Relationship- External Relationship. INTERCONNECTING TECHNOLOGIES - Developing Criteria for Technology Evaluation, Making Technology Choices for the Network Design, Shared Medium, Switching, hybrid Mechanism-NHRP-MPOA, Applying Interconnection Mechanisms to the Design.

References

1. Network Analysis, Architecture and Design, 2nd Edition (The Morgan Kaufmann Series in Networking) James D. McCabe, Elsevier Science (USA), 2003.
2. Network Architecture & Design, A Field Guide for IT Professionals, Dimarzio, J.F. DiMarzio, SAMS Series
3. Top-Down Network Design Priscilla Oppenheimer from Cisco Press.1999.

Structure of the Question paper

There will be three questions from each module out of which two questions are to be answered by the students.

INE3005 INTERCONNECTION NETWORKS 3-0-0-3

Structure of the Course

Lecture : 3 hrs/ Week Credits : 3
Internal Continuous Assessment : 40 Marks
End Semester Examination : 60 Marks

Course Objectives

- To provide an in-depth study of interconnection networks for high-performance computing (HPC) systems and multi-cores. Interconnection networks offer an attractive and economical solution to this communication crisis and are fast becoming pervasive at all levels of digital system, whether it be on-chip, inter-chip, inter-board and inter-rack.

Learning Outcomes

In-depth understanding of the design and engineering of interconnection networks

- Ability to understand techniques for designing various network/interconnect topologies
- Ability to differentiate between various switching and routing techniques
- Ability to understand various flow control techniques implemented by interconnection networks
- Ability to understand the working of the router microarchitecture
- Ability to evaluate future technologies for implementing the interconnection network

Module I

Introduction Parallel computing and networks, network design considerations, classification of interconnection network, shared medium networks Message switching layer- n/w and router model, Basic switching techniques, virtual channels, hybrid switching techniques, Optimizing switching techniques, Comparison of switching techniques.

Module II

Deadlock , live lock and Starvation—Deadlock avoidance , Deadlock prevention, Deadlock recovery, Live lock avoidance Routing algorithms-Deterministic routing algorithms, Different types adaptive routing algorithms, Backtracking and Non minimal routing algorithms, backtracking protocols, Routing in MIN's, routing in switch based network with irregular topologies, resource allocation policies.

Module III

Collective communication Support- system support, models for multi cast communication- h/w and s/w implementation of multi cast, Fault tolerant routing- fault induced deadlock and live lock, channel and network redundancy, fault models, fault tolerant routing, dynamic fault recovery Network architecture- network topologies and physical constraints- router architecture- performance evaluation

REFERENCE

1. Interconnection Networks: An Engineering Approach, Jose Duato, Sudhakar Yalamanchili, Lionel M. Ni, Morgan Kaufman Publishers.
2. Principles and Practices of Interconnection Networks**,** William James Dally, Brian Patrick Towles, Morgan Kaufmann Publishers.

Structure of the Question paper

There will be three questions from each module out of which two questions are to be answered by the students

SEMESTER IV

INC4101 **THESIS**

Structure of the Course

Weekly Hours : 21 hrs/ Week Credits : 12
Internal Continuous Assessment : 300 Marks
End Semester Examination : 300 Marks

In the fourth semester there will be only thesis work. Towards the end of the semester there would be a pre-submission seminar to assess the quality and quantum of the work by the Department Evaluation Committee. This would be the pre-qualifying exercise for the students for getting approval for the submission of Thesis-Final. Students are encouraged publish technical papers in Journals/ Conferences. The final evaluation of the Thesis-Final would be external evaluation.

Distribution of marks

Internal evaluation of the Thesis work by the guide: 150 marks
Internal evaluation of the Thesis by the Evaluation Committee: 150 marks
Final evaluation of the Thesis Work by the Internal and External Examiners:
[Evaluation of Thesis: 200 marks *+ Viva Voce: 100 marks *(*5% of the marks is ear marked for publication in Journal/Conference)*] TOTAL – 300 marks