Ramakrishna Mission Residential College (Autonomous)
Vivekananda Centre for Research
Ramakrishna Mission Ashrama
(A Branch Centre of Ramakrishna Mission, Belur Math, Howrah-711202)
Narendrapur, Kolkata - 700 103, West Bengal, India
A Scientific Industrial Research Organisation, Recognised by DST, Govt. of India
College with Potential for Excellence (CPE), Re-accredited by NAAC - 'A' (CGPA 3.56 out of 4)

Department of Computer Science

Notice

Date: 16.07.2018

The next meeting of Board of Studies (BOS) of the Department of Computer Science will be held on 30.07.2018 at 11 A.M. in Departmental Teachers' Room. All the members are requested to attend the meeting.

Agenda:

1. To prepare the list of Paper Setter, Moderator for theory Papers for B.Sc. Odd Semester.
2. To prepare the list External Examiner for Practical Papers for B.Sc. Odd Semester.
3. To design the CBCS three year syllabus structure for B.Sc. Computer Science Programme.
4. To design the detailed syllabus for SEM – I and SEM – II for B.Sc. Computer Science Programme.
5. To design CBCS syllabus for M.Sc. Computer Science Programme.

PHONES : 24772201(3lines), 24772205 FAX : 033-24773597 EMAIL : rkmcnpur@vsnl.com
WEBSITE : www.rkmcnarendrapur.org

BOARD OF STUDIES

Date : 30/7/18.

MEMBER PRESENT :

1. Sivartha Sanyal - 30/7/18
2. Devadatta Sen 30/7/18
3. ~~Jt~~ Secretary 30/7/18.
4. [illegible] 30/7/18
5. Sgiri 30/7/18
6. Md Firoj Ali 30/7/18
7. Saptarshi Naskar 30/7/18

MINUTES :

1. Copies of resolution adopted at the board of studies held on 10.3.2018 were circulated among the members present at the meeting.

2. New syllabus for CBCS system are designed for SEM I to SEM-VI. and detailed syllabus for SEM-1 and SEM-II are proposed. for B.Sc computer Science programme. After discussion revisions & new courses were approved. (as appended)

3. Syllabus for M.Sc. course in computer Science is designed. for CBCS system, to introduce the programme from 2018-2019 session.

4. Seperate panels for paper setter, moderators, reviewers and external examiners for practical examination are prepared for SEM-I, SEM-III & SEM-V UG course and moderators for SEM-I PG course. for the session JULY, 2018 to DECEMBER, 2018.

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Department of Computer Science

Syllabi for Courses offered by the Department at Post Graduate Level

Under **CBCS**

2018

Programme Name: M.Sc. in Computer Science

Programme Code: MSXCOM

Course Structure: Semester-wise distribution of Courses

Semester	Course Code	Course Name	Credits
1	XCOM1CC01T	**Design and Analysis of Algorithms**	6
	XCOM1CC02T	**Advanced Operating Systems**	6
	XCOM1CC03T	**Data Communication and Computer Networks**	6
	XCOM1CC04P	**Object Oriented Programming with Java**	6
	XCOM1CC05P	**Algorithm Lab & Advanced OS Lab with Linux**	6
		Total	30
2	XCOM2CC06T	**Advanced Computer Architecture**	6
	XCOM2CC07T	**Advanced DBMS**	6
	DSE 1	**See Elective-I**	6
	XCOM2CC08P	**Advanced Web Design & Administration Lab**	6
	XCOM2CC09P	**Advanced DBMS Lab & S/W Tools Lab**	6
		Total	30
3	XCOM3CC10T	**Optimization Techniques**	6
	XCOM3CC11T	**Cryptography and Network Security**	6
	XCOM3CC12T	**Digital Image Processing**	6
	DSE 2	**See Elective-II**	6
	XCOM3CC13T	**Image Processing Lab & Minor Project**	6
		Total	30
4	XCOM4CC14T	**Software Engineering**	6
	XCOM4CC15T	**Artificial Intelligence**	6
	DSE 3	**See Elective-III**	6
	XCOM4CC16P	**Seminar & Grand Viva**	6
	XCOM4CC17J	**Project Work**	6
		Total	30
		Grand Total	**120**

Choices for Discipline Specific Electives (DSE)*

DSE1 (For Semester 2)		DSE2 (For Semester 3)		DSE3 (For Semester 4)	
Course Code	**Course Name**	**Course Code**	**Course Name**	**Course Code**	**Course Name**
XCOM2DS11T	Sensor network & IOT	XCOM3DS21P	Python programming	XCOM4DS31T	Data Science
XCOM2DS12T	Embedded Systems	XCOM3DS22P	R Programming	XCOM4DS32T	E-Commerce
XCOM2DS13T	Parallel Computing	XCOM3DS23P	PHP programming	XCOM4DS33T	Cloud Computing
XCOM2DS14T	Computational Intelligence	XCOM3DS24P	Android Programming	XCOM4DS34T	Mobile Computing
XCOM2DS15T	Information & Coding Theory	XCOM3DS25P	XML programming	XCOM4DS35T	Compiler Design
XCOM2DS16T	Data Mining & warehousing			XCOM4DS36T	Remote Sensing & GIS application

*A student has to opt for any one of the courses available/given by the department in a specific year under each category.

SEMESTER – 1	
XCOM1CC01T	Credits : 6 Full Marks : 40+10*
Number of classes required : 60	
*5 Marks are reserved for Internal Assessment & 5 marks for Attendance	

Outcomes : This course will enable students to:

1. Analyze the performance of algorithms.
2. Choose appropriate algorithm design techniques for solving problems.
3. Understand how the choice of data structures and the algorithm design methods impact the performance of programs.
4. Clear up troubles the usage of set of rules design methods including the grasping approach, divide and overcome, dynamic programming, backtracking.
5. Understand the variations among tractable and intractable problems.
6. Understand P and NP classes.

Paper - XCOM1CC01T

DESIGN AND ANALYSIS OF ALGORITHM

Introduction: Order notations, induction, floor and ceiling functions, pigeon-hole principle, recurrence relations. [5L]

Algorithm design techniques:

Greedy algorithms: Introduction, Huffman code, Dijkstra algorithm, Spanning tree and minimum spanning tree (Kruskal and Prims algorithm), knapsack Problem. [6L]

Divide and conquer algorithms: Introduction, Merge sort, Quick sort, Binary search, Multiplication of Large Integers,Strassen's Matrix Multiplication, Closest-Pair and Convex-Hull Problems. [10L]

Dynamic programming:Introduction,Longest common subsequence, Warshall's and Floyd's Algorithm, knapsack Problem, Chained matrix multiplication. [6L]

Backtracking Algorithms:N queens problem.[2L]

Branch and Bound Technique:Introduction, Assignment Problem, Traveling salesman problem. [4L]

Algorithms on arrays: Selection and median-finding, counting, string matching (Rabin-Karp and Knuth-Morris-Pratt algorithms). [6L]

Maximum flow Network: Introduction, Residual network, Ford-Fulkerson algorithm.[2L]

Randomized algorithms: Monte Carlo and Las Vegas algorithms. [4L]

Tree Algorithms: Binary Search Tree, AVL tree, 2- 3 Tree, Red Black Tree, Splay Tree – Amortized analysis. [10L]

NP-completeness: Classes P and NP, reduction, NP-completeness, Examples of NP-complete problems. [5L]

Text and References:

1. T.H.Cormen et al -Introduction to Algorithms, PHI
2. E.Horowitz, S.Sahani-Fundamentals of Computer Algorithms –Galgotia
3. Bratley et al - Fundamentals of Algorithms, PHI
4. Goodman: Introduction to Design and Analysis of Algorithms, TMH

Question Pattern for End Semester Examination

(XCOM1CC01T)

Section-I (Objective type)

- 4 questions each carrying 2 marks have to be answered.
- 6 questions each carrying 2 marks have to be given.

Section-II

- 4 questions each carrying 8 marks have to be answered.
- 6 questions each carrying 8 marks have to be given.

SEMESTER – 1	
XCOM1CC02T	Credits : 6 Full Marks : 40+10*
Number of classes required : 60	
*5 Marks are reserved for Internal Assessment & 5 marks for Attendance	

Outcomes : This course will enable students to:

1. Understand network aspect and foundations of Distributed Systems.
2. Analyze the inter process communication (IPC) paradigms like shared memory and message passing.
3. Understand different local and remote synchronization techniques.
4. Understand the fault tolerance and server types.
5. Understand the issues involved in studying process and resource management
6. Apply Distributed web-based system.
7. Understand the importance of security in distributed systems
8. Understand Distributed File Systems and Distributed Shared Memory.

Paper - XCOM1CC02T

ADVANCED OPERATING SYSTEMS

Fundamentals: Definition and basic concept of distributed computing; evolution; distributed system models; distributed operating system (dos) definition and basic concept; design issues of dos; distributed computing environment. [5]

Communication in Distributed System: Computer Network and Layered protocols, Message passing and related issues, synchronization, Buffering, Client Server model & its implementation, remote procedure call and implementation issues, Case Studies. [10]

Synchronization in distributed systems: Clock synchronization and related algorithms, mutual exclusion, Deadlock in distributed systems. [10]

Processes and scheduling in distributed systems: Threads, system model, scheduling in distributed systems: Load balancing and sharing approach, fault tolerance, process migration. [8]

Distributed File Systems: Introduction, features & goal of distributed file system, file models, file accessing models, file sharing semantics, file caching scheme, file replication, fault tolerance. [8]

Naming: Naming Overview, Features, Basic concepts, System oriented names, Object locating mechanisms, Issues in designing human oriented names, Name caches, Naming and security, DNS. [5]

Distributed Shared Memory: Introduction, general architecture of DSM systems, design and implementation issues of DSM, granularity, structure of shared memory space, consistency models, replacement strategy, thrashing, advantages of DSM. [10]

Security: Introduction of Security in Distributed OS, Overview of security techniques, features, Need, Access Control, Security Management. [4]

Text and References:

1. Distributed Operating Systems Concepts and Design, Pradeep K. Sinha, PHI
2. Distributed Systems: Concepts and Design by George Coulouris, Jean Dollimore, TimKindberg, Pearson
3. Distributed Operating Systems by Andrew S Tannebaum, Pearson
4. Distributed Computing by Sunita Mahajan & Seema Shah OXFORD
5. Distributed Systems: Principles and Paradigms by Andrew S Tanebaum, Maarten Van Steen, PHI
6. Distributed Computing, Fundamentals, Simulations and Advanced topics, 2nd Edition, HagitAttiya and Jennifer Welch, Wiley India
7. M. Singhal& N. Shivaratri, "Advanced Concepts in Operating Systems: Distributed, Database and Multiprocessor Operating Systems", Tata McGraw Hill, 2001.

Question Pattern for End Semester Examination

(XCOM1CC02T)

Section-I (Objective type)

- 4 questions each carrying 2 marks have to be answered.
- 6 questions each carrying 2 marks have to be given.

Section-II

- 4 questions each carrying 8 marks have to be answered.
- 6 questions each carrying 8 marks have to be given.

SEMESTER – 1	
XCOM1CC03T	Credits : 6 Full Marks : 40+10*
Number of classes required : 60	
*5 Marks are reserved for Internal Assessment & 5 marks for Attendance	

Outcomes : This course will enable students to:

1. Understand the basic concepts of data communications including the key aspects of networking and their interrelationship, packet switching, circuit switching and cell switching.
2. Unambiguously explain networking as it relates to the connection of computers, media, and devices (routing).
3. Intelligently compare and contrast local area networks and wide area networks in terms of characteristics and functionalities.
4. Evaluate the performance of a single link, logical process-to-process (end-to-end) channel, and a network as a whole (latency, bandwidth, throughput).
5. Differentiate among and discuss the four levels of addresses (physical, logical, port, and specific used by the Internet TCP/IP protocols.
6. Understand the concept of reliable and unreliable transfer protocol of data and how TCP and UDP implement these concepts, to understand the client/server model and socket API with their implications, skills to implement a network protocol based on socket programming.
7. Demonstrate the significance and purpose of protocols and standards and their key elements and use in data communications and networking.

Paper - XCOM1CC03T

DATA COMMUNICATION AND NETWORKING

Introduction to Computer Networks: Evolution of Computer Networks; Networksgoals, uses and applications; Network Hardware and Software; Protocol Hierarchies, Design issues for the Layer; Reference Models: OSI and TCP/IP; Example Networks-Internet, ARPANET, NSFNET; Connection Oriented Networks: X.25, Frame Relay, and ATM, Overview of communication. [8]

Communication model – Data communications and Networking – Data transmission concepts and terminology – Transmission media –Data Encoding Techniques – Digital Data communication Techniques- Data link Control Protocols: Aloha and Carrier Sense Protocols, Ethernet, Token Ring, FDDI. [10]

Flow Control: Stop and wait ARQ, Sliding Window, Go Back N, Selective Repeat. [6]

Connecting Devices: Bridges, Backbone Networks, Virtual LAN. [3]

Internetworking: Virtual Circuits and datagrams, IP addressing, Subnetting, CIDR. [6]

Routing Algorithms: Introduction and Classification of R.A.: Interior and exterior routing; Properties of R.A.; Optimality Principle; Shortest Path Routing; Multipath (MPA); Centralized Routing; Hot Potato; Flooding; Distributed-Distance Vector Routing; Link State Routing; Routing in Ad Hoc Networks, etc. [10]

Congestion : Congestion Control Algorithms, General Principle of Congestion Control; Congestion Prevention Policies; Congestion Control in Virtual Circuit Subnet and Datagram Subnet; Techniques for achieving good quality of service (QoS). Networks Performance Issues.Techniques for improving the QoS. [10]

Application Layer: Domain Name System(DNS) – Telnet – rlogin – FTP – SMTP – MIME – IMAP – HTTP – SNMP. [7]

Texts and References:

1. B. Forouzan – Data Communication and Networks, 3rdEddition, TMH.
2. Larry L. Peterson & Bruce S. Davie, "Computer Networks - A systems Approach", 2nd Edition, Harcourt Asia/Morgan Kaufmann, 2000.
3. Larry L. Peterson & Bruce S. Davie, "Computer Networks - A systems Approach", 5th Edition, Morgan Kaufmann, 2012.
4. James F. Kurose, Keith W. Ross, "Computer Networking: A Top-Down Approach", SixthEdition, Addison-Wesley, 2008.
5. William Stallings, "Data and Computer Communications", Ninth Edition, PHI, 2004.
6. Andrew S. Tanenbaum, "Computer Networks", Tata McGraw Hill, 3rd Edition, 2001.

Question Pattern for End Semester Examination

(XCOM1CC03T)

Section-I (Objective type)

- 4 questions each carrying 2 marks have to be answered.
- 6 questions each carrying 2 marks have to be given.

Section-II

- 4 questions each carrying 8 marks have to be answered.
- 6 questions each carrying 8 marks have to be given.

SEMESTER – 1	
XCOM1CC04P	Credits : 6 Full Marks : 40+10*
Number of classes required : 60	
*5 Marks are reserved for Internal Assessment & 5 marks for Attendance	

Outcomes : This course will enable students to:

1. Understand structure and model of the Java programming language.
2. Use the Java programming language for various programming technologies.
3. Develop software in the Java programming language.
4. Evaluate user requirements for software functionality required to decide whether the Java programming language can meet user requirements.
5. Use of certain technologies by implementing them in the Java programming language to solve the given problem.
6. Choose an engineering approach to solving problems, starting from the acquired knowledge of programming and knowledge of operating systems.

Paper - XCOM1CC04P

OBJECT ORIENTED PROGRAMMING WITH JAVA

Introduction to Java: Compiling and Executing a Java Program, Doing basic program output of Data types, variable, expressions, operators, and control structures, Implementation of class and object, Implementation of Constructor and overloading.

Arrays, Strings and I/O: Creating & Using Arrays (One Dimension and Multi-dimensional).Implementation of basic String handling concepts- String (discuss charAt() , compareTo(), equals(), equalsIgnoreCase(), indexOf(), length() , substring(), toCharArray() , toLowerCase(), toString(), toUpperCase() , trim() , valueOf() methods) &StringBuffer classes (discuss append(), capacity(), charAt(), delete(), deleteCharAt(), ensureCapacity(), getChars(), indexOf(), insert(), length(), setCharAt(), setLength(), substring(), toString() methods), concept of mutable and immutable string, Implementation of I/O operations – keyboard input using BufferedReader & Scanner classes

Inheritance, Interfaces, Packages: Implementation of Single Level, Multilevel, Method Overriding and Dynamic Method Dispatch. Write programs on interfaces. Write programs on packages.

Exception Handling, Threading: Implementation of try, catch, throw, throws and finally, Creating own exceptions, Implementation of Multithreading, Synchronization, Inter Thread communication and deadlock**.**

Applets and Event Handling: Basics of applet programming, applet life cycle, Implementation of even handling and listener, Creation of buttons and text fields**.**

Text and Reference books:

1. Ken Arnold, James Gosling, David Homes, "The Java Programming Language", 4th Edition, 2005.

2. James Gosling, Bill Joy, Guy L Steele Jr, GiladBracha, Alex Buckley"The Java Language Specification, Java SE 8 Edition (Java Series)", Published by Addison Wesley, 2014.

3. Joshua Bloch, "Effective Java" 2nd Edition,Publisher: Addison-Wesley, 2008.

4. Cay S. Horstmann, GaryCornell, "Core Java 2 Volume 1 ,9th Edition,Printice Hall.2012

5. Cay S. Horstmann, Gary Cornell, "Core Java 2 Volume 2 - Advanced Features)", 9th Edition, Printice Hall.2013

6. Bruce Eckel, "Thinking in Java", 3rd Edition, PHI, 2002.

7. E. Balaguruswamy, "Programming with Java", 4th Edition, McGraw Hill.2009.

8. Paul Deitel, Harvey Deitel, "Java: How to Program", 10th Edition, Prentice Hall, 2011.

9. "Head First Java", Orielly Media Inc. 2nd Edition, 2005.

10. David J. Eck, "Introduction to Programming Using Java", Published by CreateSpace Independent Publishing Platform, 2009.

11. John R. Hubbard, "Programming with JAVA", Schaum's Series, 2nd Edition, 2004.

Question Pattern for End Semester Examination

(XCOM1CC04P)

Problem Solving using Java:

- Program Code: 10
- Output: 10

Viva: 10

LNB: 10

SEMESTER – 1	
XCOM1CC05P	Credits : 6 Full Marks : 40+10*
Number of classes required : 60	
*5 Marks are reserved for Internal Assessment & 5 marks for Attendance	

Outcomes : This course will enable students to:

UNIT-1:

1. Learn implementation of different algorithm techniques.
2. Implement Greedy algorithm techniques
3. Implement Divide and conquer algorithm techniques
4. Implement Dynamic programming techniques
5. Implement advanced tree, variable code, shortest-path algorithms.

UNIT-2:

1. Implement advanced concepts of unix/linux systems calls and write multi-process client-server application using them.
2. Implement dynamic arrays and multithreading program application.
3. Implement socket programming to gain practical knowledge of network programming.
4. Implement RMI application to get true sense of distributed systems.
5. Implement the algorithms of distributed operating systems like clock synchronization, mutual exclusion etc.

Paper - XCOM1CC05P

ALGORITHM LAB & ADVANCED OS LAB WITH LINUX

Unit – I: Algorithm Lab

Implementation of Greedy algorithms like Huffman code, Dijkstra algorithm, Kruskal and Prims algorithm for finding Minimal Spanning Tree, Fractional knapsack Problem.

Implementation of Divide and conquer algorithms like Merge sort, Quick sort, Binary search, Multiplication of Large Integers, Strassen's Matrix Multiplication, Closest-Pair.

Implementation of Dynamic programming like Longest common subsequence, Warshall's and Floyd's Algorithm, 0/1 Knapsack Problem

Implementation of Algorithms on array like Selection and median-finding, string matching (Rabin-Karp and Knuth-Morris-Pratt algorithms)

Implementation of Tree Algorithms like Binary Search Tree, AVL tree

Unit – II: Advanced OS Lab with Linux

Advanced Linux : program implementation with different system call interfaces: process related system calls like fork() , exec(), exit(), wait(), File related system calls like open(),close(), dup(), Message passing etc, basic shell implementation with system call interface. Multiprocessing implementation using system calls,

Advanced Java Object concepts: Java Collection: dynamic arrays like List, ArrayList, Vector, Stack ,Queue , HashSet etc, Object serialization interface, Java Multithreading implementation.

Network Programming using JAVA: Concept of sockets classes and interfaces, TCP socket client server programs, UDP sockets, TCP multicasting, URL concepts, Chat application.

Java RMI: client side & server side RMI, data marshalling, RMI registry, simple RMI application.

Theory implementation: Implementation of Christian , Berkley's clock synchronization algorithm , implementation of mutual exclusion algorithms like Suzuki-Kasami, Ricart-Agrawal , Lamport's, Maekawa etc, edge chasing algorithm.

Textbook and References:

1. K. L. Calvert and M. J. Donahoo, TCP/IP Sockets in Java: Practical Guide for Programmers (The Practical Guides Series), Morgan Kaufmann Publishers, 2001
2. W. R. Stevens, UNIX Network Programming, Prentice Hall PTR, 2nd edition, 1998
3. Advanced Programming in the UNIX environment, first edition, W. Richard Stevens, Addison-Wesley, 1992.
4. Java Network Programming, Second Edition, Elliotte Rusty Harold, "O'Reilly Media, Inc.", 2000
5. Distributed Operating Systems by Andrew S Tannebaum, Pearson
6. Bruce Eckel, "Thinking in Java", 3rd Edition, PHI, 2002.
7. E. Balaguruswamy, "Programming with Java", 4th Edition, McGraw Hill.2009.

Question Pattern for End Semester Examination

(XCOM1CC05P)

Unit – I: Algorithm Lab

- Program Code: 5
- Output: 5

Unit – II: Advanced OS Lab with Linux

- Program Code: 5
- Output: 5

Viva: 10

LNB: 10

SEMESTER – 2	
XCOM2CC06T	Credits : 6 Full Marks : 40+10*
Number of classes required : 60	
*5 Marks are reserved for Internal Assessment & 5 marks for Attendance	

Outcomes : This course will enable students to:

1. Understand the Parallelism concepts in Programming.
2. Achieve an elaborate idea about the different memory systems and buses.
3. Understand the advanced processor architectures.
4. Know about the importance of multiprocessor and multi-computers.
5. Understand about the concept of data flow computer architectures.

Paper - XCOM2CC06T

ADVANCED COMPUTER ARCHITECTURE

Introduction to Parallel Processing: Parallel Computer Structures (pipeline, array processor, multiprocessor, dataflow computer), Architectural Classification Parallel Processing Applications. [5L]

Memory and I/O sub-systems: Hierarchical Memory Structures, Virtual memory system, Cache Memories andManagement, I/O sub-systems. [10L]

Principles of Pipelining and Vector Processing: Pipelining, Instruction and Arithmetic Pipelines, Principles of designing pipelined processors (instruction pre-fetch, branch handling, data buffering, internal forwarding, register tagging, hazard, job sequencing), vector processing requirements (characteristics, methods). [20L]

Array Processors: SIMD Array Processors, SIMD Interconnection networks (static, dynamic, mesh, cube, barrael shifter, shuffle-exchange, omega), Parallel Algorithms for Array Processors – Matrix multiplication, Sorting. [10L]

Multiprocessor: Functional Structures, Interconnection Networks, Parallel Memory Organizations, Multiprocessor operating system, inter-process communication, scheduling, deadlock, parallel algorithms. [10L]

Data flow computer: Data driven computing, data flow architecture, Systolic array. [5L]

Text/Reference books:

1. Kai Hwang, Advanced Computer Architecture,TataMcGraw Hills
2.Kai Hwang and F. A. Briggs, Computer Architecture and Parallel Processing, Tata McGraw Hills
3. Hennessy Patterson, Computer Architecture, A quantitative Approach , 5thed, Elsevier.
4. Stone, H.S., “Advanced Computerat”, Addison Wesley, 1989.

Question Pattern for End Semester Examination

(XCOM2CC06T)

Section-I (Objective type)

- 4 questions each carrying 2 marks have to be answered.
- 6 questions each carrying 2 marks have to be given.

Section-II

- 4 questions each carrying 8 marks have to be answered.
- 6 questions each carrying 8 marks have to be given.

SEMESTER – 2	
XCOM2CC07T	Credits : 6 Full Marks : 40+10*
Number of classes required : 60	
*5 Marks are reserved for Internal Assessment & 5 marks for Attendance	

Outcomes : This course will enable students to:

1. Learn the inherent execution of a query with the physical file organization, internal representation and optimizations.
2. Understand different normalization techniques and their needs.
3. Understand transaction as a general scenario, properties its advantages and disadvantages.
4. Handle concurrent transaction operation its complications and remedies.
5. Know the modern day Database that is not confined to a single machine, rather they can be distributed is different machines and works as a single coherent unit. Their practicality, problems and solutions.

Paper - XCOM2CC07T

ADVANCED DBMS

Review of basic DBMS concepts: Basic Data models, Functional dependency and basic Normalisation concepts upto BCNF, Physical file Organization. [6L]
Query processing and optimization: Steps of query processing, External sorting, query interpretation, Implementation of basic relational algebraic expressions, equivalence of expression, estimation of cost, join strategies [10 L]
Concepts of Transaction Management: States of Transaction, ACID properties, consistency model, storage model, cascading rollback, recoverable schedules. [8L]
Concurrency Control: Schedules, Testing for serializability, Lock-based protocols-Two-phase locking protocol, Timestamp based protocol, optimistic techniques, deadlock handling. [10L]
Recovery: Failure classification, storage hierarchy, log-based recovery, shadow paging [8L]
Concepts of Normalisation: Idea of multivalued dependency, advanced normal forms like 4NF, 5NF, Simple problem solving. [6L]
Distributed Database: Principles of distributed database, DDBMS, levels of distribution transparency, data fragmentation and replication, allocation techniques. [12L]

Books and References:

1. Elmasri,Navathe,Fundamentals of Database System,3/e,Pearson Education.
2. Korth, Silberschatz :Database System Concepts, McGrawHill ,
3. Ozsu,Principals of Distributed Database System,Pearson Education.
4. Ceri andPelagatti, Distributed Databases: Principles and System: McGrawHill.

Question Pattern for End Semester Examination

(XCOM2CC07T)

Section-I (Objective type)

- 4 questions each carrying 2 marks have to be answered.
- 6 questions each carrying 2 marks have to be given.

Section-II

- 4 questions each carrying 8 marks have to be answered.
- 6 questions each carrying 8 marks have to be given.

SEMESTER – 2	
DSE 1	Credits : 6 Full Marks : 40+10*
Number of classes required : 60	
*5 Marks are reserved for Internal Assessment & 5 marks for Attendance	

Elective – I

DSE1 (For Semester 2)	
Course Code	**Course Name**
XCOM2DS11T	Sensor network & IOT
XCOM2DS12T	Embedded Systems
XCOM2DS13T	Parallel Computing
XCOM2DS14T	Computational Intelligence
XCOM2DS15T	Information & Coding Theory
XCOM2DS16T	Data Mining & warehousing

XCOM2DS11T: SENSOR NETWORK & IOT

Outcomes : This course will enable students to:

1. Understand various sources of IoT & M2M communication protocols.
2. Describe Cloud computing and design principles of IoT.
3. Become aware of MQTT clients, MQTT server and its programming.
4. Understand the architecture and design principles of WSNs.
5. Enrich the knowledge about MAC and routing protocols in WSNs.

Overview of Internet of Things: IoT Conceptual Framework, IoT Architectural View, Technology Behind IoT, Sources of IoT, M2M communication, Modified OSI Model for the IoT/M2M Systems, data enrichment, data consolidation and device management, web communication protocols, Message communication protocols. [5L]

Architecture and Design Principles for IoT: Internet connectivity, Internet-based communication, IPv4, IPv6, 6LoWPAN protocol, IP Addressing in the IoT, Application layer protocols: HTTP, HTTPS,FTP,TELNET and ports. [5L]

Data Collection, Storage and Computing using a Cloud Platform: Introduction, Cloud computing paradigm for data collection, storage and computing, Cloud service models, IoT Cloud- based data collection, storage and computing services using Nimbits. [10L]

Prototyping and Designing Software for IoT Applications: Introduction, Prototyping Embedded device software, Programming Embedded Device Arduino Platform using IDE, Reading data from sensors and devices, Devices, Gateways, Internet and Web/Cloud services software development. [10L]

Programming MQTT clients and MQTT server: Introduction to IoT privacy and security. Vulnerabilities, security requirements and threat analysis, IoT Security Tomography and layered attacker model.[10L]

Overview of Wireless Sensor Networks: Challenges for Wireless Sensor Networks, Enabling Technologies for Wireless Sensor Networks. Single-Node Architecture - Hardware Components, Energy Consumption of Sensor Nodes, Operating Systems and Execution Environments, Network Architecture-Sensor Network Scenarios, Optimization Goals and Figures of Merit, Design principles for WSNs, Service interfaces of WSNs Gateway Concepts. [10L]

Communication Protocols: Physical Layer and Transceiver Design Considerations, MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols And Wakeup Concepts, The Mediation Device Protocol, Wakeup Radio Concepts, Contention based protocols, Schedule based protocols, Address and Name Management in WSNs, Assignment of MAC Addresses, Routing Protocols- Energy-Efficient Routing, Geographic Routing, Hierarchical networks by clustering.[10L]

TEXT/REFERENCES:

1. Internet of Things: A Hands-On Approach, ArsheepBahga and Vijay Madisetti.

2. IoT Fundamentals: Networking Technologies, Protocols and Use Cases for the Internet of Things by , Hanes David, Salgueiro Gonzalo, Grossetete Patrick, Barton Rob.

OR

XCOM2DS12T: EMBEDDED SYSTEMS

Outcomes : This course will enable students to:

1. Foster ability to understand the internal architecture and interfacing of different peripheral devices with Microcontrollers.
2. Foster ability to write the programs for microcontroller.
3. Foster ability to understand the role of embedded systems in industry.
4. Foster ability to understand the design concept of embedded systems.

Introduction to embedded systems: Requirements analysis; specifications; design methodologies, overview. [4]
Microcontroller Organization: Computer architectures, ARM organization, ARM instruction set, data operations, control flow, PIC, TI DSPs. [10]

CPUs: I/O and memory mapping, addressing modes, interrupts and traps, caches, co-processors, memory management unit, virtual memory, address translation, CPU performance, pipelining. [8]

Embedded Platforms: Hardware and software components of embedded platforms, bus protocols, DMA, system bus configurations, the AMBA and AHB buses, memory devices, example embedded platforms, bandwidth, bus and memory performance, performance bottleneck. [10]

Program Design and Analysis: State machines, circular buffers, queues, models of programs, the compilation process, program performance and optimization, power analysis, program size analysis, validation and testing. [10]

Processes and Operating Systems: Tasks and processes, process timing requirements, real-time operating systems, preemptive execution, context switching, scheduling processes, priority scheduling, inter-process communication, shared-memory systems, message passing. [8]

Networks and Multiprocessors: Multiprocessor systems, distributed embedded systems, CAN bus, I2C bus, multiprocessor system-on-chip (MPSoC), accelerators. [10]

Texts and References:

1. Elecia White, Making Embedded Systems: Design Patterns for Great Software, Oreilly
2. Arnold S. Berger, Embedded Systems Design: An Introduction to Processes, Tools, and Techniques, CMP Books
3. Jean J. Labrosse, Embedded Systems Building Blocks, CMP Books

OR

XCOM2DS13T: PARALLEL COMPUTING

Outcomes : This course will enable students to:

1. Define terminology commonly used in parallel computing, such as efficiency and speedup.
2. Describe different parallel architectures; inter-connect networks, programming models, and algorithms for common operations such as matrix-vector multiplication.
3. Develop an efficient parallel algorithm to solve given problem.
4. Analyze a parallel algorithm for time complexity as a function of the problem size and number of processors.
5. Implement a problem using MPI, OpenMP, pthreads, or a combination of MPI and OpenMP.
6. Analyze a given parallel code for its performance, determine computational bottlenecks, and optimize the performance of the code.

Fundamentals of Parallel Computing : Need for Parallel Computing, Parallel Computer Models and Data Parallelism, Parallel Programming Overview, Processes, Tasks and Threads, Parallel Programming Models, Shared Memory Programming, Message Passing Paradigm, Interaction and Communication, Interconnection Networks. [10]

Challenges of Parallel Programming: Identifying Potential Parallelism, Techniques for Parallelizing Programs, Issues, Cache Coherence issues, Memory Consistency Models, Maintaining Memory Consistency, Synchronization Issues, Performance Considerations. [10]

Shared Memory Models And OpenMP Programming: OpenMP Execution Model, Memory Model and Consistency, Open MP Directives, Run Time Library Routines, Handling Data and Functional Parallelism, Performance Considerations. [10]

MPI Programming: The MPI Programming Model, MPI Basics, Circuit Satisfiability, Global Operations, Asynchronous Communication, Collective Communication, Other MPI Features, Performance Issues, Combining OpenMP and MPI. [15]

Programming Heterogeneous Processors GPU Architecture: Basics of CUDA, CUDA Threads, CUDA Memories, Synchronization Handling, Performance Issues, Application Development, Introduction to OpenCL. [15]

Texts and References:

1. John L. Hennessey and David A. Patterson, “Computer Architecture – A quantitative approach”, Morgan Kaufmann / Elsevier Publishers, 5th. Edition, 2012.
2. Peter S. Pacheco, “An Introduction to Parallel Programming”, Morgan Kaufmann, 2011.
3. Michael J Quinn, “Parallel programming in C with MPI and OpenMP”, Tata McGraw Hill, 2003.

4. David B. Kirk and Wen-mei W. Hwu, “Programming Massively Parallel Processors”, Morgan Kaufmann, 2010.
5. AnanthGrama, George Karypis, Vipin Kumar and Anshul Gupta, “Introduction to Parallel Computing”, Second Edition, Pearson Education Limited, 2003.
6. Shameem Akhter and Jason Roberts, “Multi-core Programming”, Intel Press, 2006.
7. Ian Foster, “Designing and Building Parallel Programs: Concepts and Tools for Parallel Software Engineering”, Addison Wesley Longman Publishing Co., USA, 1995.

OR

XCOM2DS14T: COMPUTATIONAL INTELLIGENCE

Outcomes : This course will enable students to:

1. Understand the various searching techniques, constraint satisfaction problem and example problems- game playing techniques.
2. Apply these techniques in applications which involve perception, reasoning and learning.
3. Explain the role of agents and how it is related to environment and the way of evaluating it and how agents can act by establishing goals.
4. Acquire the knowledge of real world Knowledge representation.
5. Analyze and design a real world problem for implementation and understand the dynamic behavior of a system.
6. Use different machine learning techniques to design AI machine and enveloping applications for real world problems.

Artificial Neural Network: Basic concept of Soft Computing; Basic concept of neural networks, Mathematical model, Properties of neural network, Characteristics and Comparison with biological neural network, Basic model of Artificial Neural Network: Single layer Perceptron model, Learning, Feed Forward Neural Network, Error, Back Propagation and weight updation, Perceptron, Bayesian Networks, Neural computational model-Hopfield Nets. [20L]

Fuzzy Logic and Application : Fuzzy sets, application – basic operations, Properties, Fuzzy Relations, Fuzzy inference, Notion of Fuzziness, Operations on Fuzzy sets, Fuzzy Numbers, Brief overview of crisp sets, Crisp relations, Fuzzy relations, Max*-composition of fuzzy relation, Max*-transitive closure, Probability measures of fuzzy events, Fuzzy expected value, Approximate reasoning, Different methods of role aggregation and defuzzification. [15L]

Genetic Algorithm (GA): Evolutionary Computing. Basics of Genetic Algorithms Reproduction, Crossover Mutation, Schemata, and Fitness function. Optimization problems with Constraints, Stochastic models Applications or GA: GA in Machine Learning, Navigational Planning for Robots, GA in Optimization Problems, Intelligent Search Integrated Systems. Fuzzy Neural Systems for Pattern Recognition [15L]

Hybrid Systems: Hybrid systems, GA based BPNN (Weight determination, Application); Neuro Fuzzy Systems—Fuzzy BPNN--fuzzy Neuron, architecture, learning, application; Fuzzy Logic controlled G.A. [10L]

Books and References:

1. David Kriesel, “A Brief Introduction to Neural Network”.
2. H.J.Zimmermann, “Fuzzy Set Theory – and its Applications”
3. Ross, T. J. (2009). Fuzzy Logic with Engineering Applications: Wiley.
4. Sivanandam, S. N., Sumathi, S., &Deepa, S. N. (2006). Introduction to Fuzzy Logic using MATLAB: Springer.
5. Fuzzy Sets and Fuzzy Logic: Theory and Applications 1st Editionby George J. Klir& Bo Yuan

6. P.D. Wassermann, “An Introduction to Neural Computing: Theory and Practice”, Van Nostrand Reinhold, New York, 1989.
7. B. Yegnarayana, “Artificial Neural Networks”, Prentice Hall of India.
8. Melanie Mitchell “An Introduction to Genetic Algorithms”, First MIT Press paperback edition, 1998
9. R. L. Haupt and S. E. Haupt, Practical Genetic Algorithms: Wiley, 2004.
10. David E. Goldberg, “Genetic Algorithms in Search, Optimization, and Machine Learning”, 1989
11. Multi-Objective Optimization using Evolutionary Algorithms, Kalyanmoy Deb, Wiley Student Edition
12. Introduction to Evolutionary Computing, A.E. Eiben and J.E. Smith, Springer, 2003
13. Kenneth De Jong's MIT Press book "Evol. Comp. -- A Unified Approach"
14. Practical Handbook of Genetic Algorithms (in 3 volumes), Lance Chambers D.
15. Genetic algorithms reference (in 2 volumes), T.D.Gwiazda
16. Genetic Algorithms in Search, Optimization, and Machine Learning, Goldberg D.E

OR

XCOM2DS15T: INFORMATION & CODING THEORY

Outcomes : This course will enable students to:

1. Understand the basic notions of information and channel capacity.
2. Understand convolutional and block codes, decoding techniques, and automatic repeat request (ARQ) schemes.
3. Understand how error control coding techniques are applied in communication systems.
4. Understand the basic concepts of cryptography.

Source Coding: Uncertainty and information, average mutual information and entropy, information measures for continuous random variables, source coding theorem, Huffman codes. [10L]

Channel Capacity and Coding: Channel models, channel capacity, channel coding, information capacity theorem, The Shannon limit. [10L]

Linear and Block Codes for Error Correction: Matrix description of linear block codes, equivalent codes, parity check matrix, decoding of a linear block code, perfect codes, Hamming codes. [10L]

Cyclic Codes: Polynomials, division algorithm for polynomials, a method for generating cyclic codes, matrix description of cyclic codes, Golay codes. [10L]

BCH Codes: Primitive elements, minimal polynomials, generator polynomials in terms of minimal polynomials, examples of BCH codes. [10L]

Convolutional Codes: Tree codes, trellis codes, polynomial description of convolutional codes, distance notions for convolutional codes, the generating function, matrix representation of convolutional codes, decoding of convolutional codes, distance and performance bounds for convolutional codes, examples of convolutional codes, Turbo codes, Turbo decoding. [10L]

Books

1. Information theory, coding and cryptography - Ranjan Bose; TMH.

2. Information and Coding - N Abramson; McGraw Hill.

3. Introduction to Information Theory - M Mansurpur; McGraw Hill.

4. Information Theory - R B Ash; Prentice Hall.

5. Error Control Coding - Shu Lin and D J Costello Jr; Prentice Hall.

OR

XCOM2DS16T: DATA MINING & WAREHOUSING

Outcomes : This course will enable students to:

1. Store voluminous data for online processing and preprocess the data for applications.
2. Apply the association rules for mining the data.
3. Design and deploy appropriate classification techniques.
4. Cluster the high dimensional data for better organization of the data.
5. Discover the knowledge imbibed in the high dimensional system.

Introduction to Data Mining: What is data mining, Related technologies - Machine Learning, DBMS, OLAP, Statistics, Data Mining Goals,Stages of the Data Mining Process, Data Mining Techniques, Knowledge Representation Methods, Applications. [5]

Data Warehouse and OLAP: Data Warehouse and DBMS, Multidimensional data model, OLAP operations. [5]

Data preprocessing: Data cleaning, Data transformation, Data reduction, Discretization and generating concept hierarchies. [8]

Data mining knowledge representation: Task relevant data, Background knowledge, Interestingness measures, Representing input data and output knowledge, Visualization techniques. [6]

Attribute-oriented analysis: Attribute generalization, Attribute relevance, Class comparison, Statistical measures. [6]

Data mining algorithms: Association rules: Motivation and terminology,Basic idea: item sets, Generating item sets and rules efficiently, Correlation analysis, Classification: Basic learning/mining tasks, Inferring rudimentary rules: 1R algorithm, Decision trees, Covering rules, Prediction: The prediction task, Statistical (Bayesian) classification, Bayesian networks, Instance-based methods (nearest neighbor), Linear models. [10]

Clustering: Basic issues in clustering, First conceptual clustering system: Cluster/2, Partitioning methods: k-means, expectation maximization (EM), Hierarchical methods: distance-based agglomerative and divisible clustering, Conceptual clustering: Cobweb. [10]

Advanced techniques: Data Mining software and applications, Text mining: extracting attributes (keywords), structural approaches (parsing, soft parsing), Bayesian approach to classifying text, Web mining: classifying web pages, extracting knowledge from the web, Data Mining software and applications. [10]

Texts:

1. Tan, Steinbach &Kumar, Introduction to data mining
2. Han, Kamber& Pei, Data Mining: Concepts and Techniques
3. Zaki&Meira, Data Mining and Analysis Fundamental Concepts and Algorithms
4. Aggarwal, Data Mining: The Textbook

Question Pattern for End Semester Examination

(DSE 1)

Section-I (Objective type)

- 4 questions each carrying 2 marks have to be answered.
- 6 questions each carrying 2 marks have to be given.

Section-II

- 4 questions each carrying 8 marks have to be answered.
- 6 questions each carrying 8 marks have to be given.

SEMESTER – 2	
XCOM2CC08P	Credits : 6 Full Marks : 40+10*
Number of classes required : 60	
*5 Marks are reserved for Internal Assessment & 5 marks for Attendance	

Outcomes : This course will enable students to:

1. Create Web Applications using Java Servlet and JSP.
2. To understand the importance of extension JDBC package in Enterprise Java applications.
3. To master the whole process of designing, implementing and deploying J2EE Applications.
4. To implement MVC architecture.
5. Manage Web Session using Servlet and JSP.
6. Handle Errors and Exceptions in Web Applications.
7. Study of Important LINUX Services.
8. Understanding administrative LINUX commands.

Paper - XCOM2CC08P

ADVANCED WEB DESIGNING& ADMINISTRATION LAB

Unit – I: ADVANCED WEB DESIGNING

Servlet: Overview of servlet, Life cycle, Client Request, Server response, state management(cookie, session, URL rewriting, Hidden field), Database handling.

JSP: Overview of JSP, Implicit objects, different types of tags and action tags. Implement, MVC model.

Web Designing: HTML, CSS, Java Script

Unit – II: ADMINISTRATION LAB

User Management commands, Directory management commands, Startup & Shutdown scripts, Process management commands and their execution, Firewall Configuration, Study of Important LINUX Services

Question Pattern for End Semester Examination

(XCOM2CC08P)

Unit – I: ADVANCED WEB DESIGNING

- Program Code: 10
- Output: 5

Unit – II: ADMINISTRATION LAB

- Commands Execution: 5

Viva: 10

LNB: 10

SEMESTER – 2	
XCOM2CC09P	Credits : 6 Full Marks : 40+10*
Number of classes required : 60	
*5 Marks are reserved for Internal Assessment & 5 marks for Attendance	

Outcomes : This course will enable students to:

UNIT-I:

1. Understand the different constructs of PL/SQL.
2. Understand the advantages of PL/SQL w.r.t. SQL.
3. Analyze Functions, Cursors and Triggers as structured data processing.
4. Understand unstructured data processing and intermediate form of data storage in between heterogeneous data platforms.
5. Know pandas as basic data processing, data visualization and reduction of coding in python.
6. Learn data handing in pandas
7. Learn some basic statistical functions can be learnt in pandas.

UNIT_II

1. Format an article or book in a correct and structured manner, and using fonts other than the default ones
2. Familiar with the tools for producing bibliography and indexes (such as BibTEX or Makeindex).
3. Include graphics files in the document.
4. Use LATEX to produce professional-looking PDF documents.
5. Build complex mathematical structures.
6. Produce specialized graphical material such as commutative diagrams and graphs.

Paper - XCOM2CC09P

ADVANCED DBMS LAB & S/W TOOLS LAB

Unit – I: Advanced DBMS Lab

Introduction to PL/SQL: Declaring PL/SQL Variables, Writing Executable Statements, Using SQL Statements within a PL/SQL Block, Writing Control Structures, Working with Composite Data Types, Using Explicit Cursors, Handling Exceptions, Creating subprograms

Develop PL/SQL Program: Creating Stored Procedures, Creating Functions and Debugging Subprograms, Creating Packages, Working With Packages, Using Oracle-Supplied Packages in Application Development Using Dynamic SQL, Creating Triggers, Creating Compound, DDL, and Event Database Triggers.

Introduction to XML: Documents, Declaration, Tags, Elements, Attributes, Comments, DTD, Schemas, Tree structure, DOM.

Introduction to Pandas: Concept of data frames, concepts of dictionary, accessing rows and columns of a data frame, Series, iteration sorting, descriptive statistics, working with text data, importing excel and csv files.

Unit – II: S/W Tools Lab

LATEX: Download and install a comprehensive LATEX distribution, Create basic types of LATEX documents (article, report, letter, book), Format words, lines, and paragraphs, design pages, create lists, tables, references, and figures in LATEX, Typeset complicated mathematics: beginning with basic formulas (inline) and centered and numbered equations (display math) and aligning multi-line equations. In particular, you will learn how to typeset mathematics symbols such as roots, arrows, Greek letters, and a wide variety of mathematical operators. Furthermore, you will learn how to build complex math structures such as fractions, stacked expressions, and matrices. Import graphics, as well as: building diagrams, enhancing figures, and plotting functions, using the graphics packages: pstricks, and PGF/tikZ. Listing content and references: creating a table of contents and lists of figures and tables; as well as how to cite books, create bibliographies, and generate an index. Develop large documents: create complex projects building upon sub-files, Enhance your documents further: bring color into your documents, and learn how to create feature rich PDF documents with bookmarks, hyperlinks, and meta-data, Create professional presentations using LATEX; using both the beamer and the powerdot packages.

Text and References:

1. SQL, PL/SQL: The Programming Language of Oracle by Ivan Bayross; BPB publication
2. Steven Feuerstein, "Oracle PL/SQL Programming", 1st, First Edition, 1995.
3. XML Programming Success In A Day, Sam Key
4. Python for Data Science For Dummies : By Luca Massaron and John Paul Mueller
5. Python for Data Analysis: By Wes McKinney
6. Learning Pandas – Python Data Discovery and Analysis Made Easy: By Michael Heydt ; Packt publishing

Question Pattern for End Semester Examination

(XCOM2CC09P)

Unit – I: Advanced DBMS Lab

- Program Code: 10
- Output: 5

Unit – II: S/W Tools Lab

- Application using S/W tools: 5

Viva: 10

LNB: 10

SEMESTER – 3	
XCOM3CC10T	Credits : 6 Full Marks : 40+10*
Number of classes required : 60	
*5 Marks are reserved for Internal Assessment & 5 marks for Attendance	

Outcomes : This course will enable students to:

1. Describe clearly a problem, identify its parts and analyze the individual functions.
2. Perform Feasibility study for solving an optimization problem
3. Find a mathematical translation of the verbal formulation of an optimization problem.
4. Design algorithms, the repetitive use of which will lead reliably to finding an approximate solution
5. Evaluate and measure the performance of an algorithm.
6. Discovery, study and solve optimization problems.
7. Understand optimization techniques using algorithms.
8. Investigate, study, develop, organize and promote innovative solutions for various applications.

Paper - XCOM3CC10T

OPTIMIZATION TECHNIQUES

Introduction: Origin and development of operation research, Nature and characteristic features, models in O.R., application of O.R. [4]

Linear Programming Problem: Introduction, mathematical formulation of the problem and graphical solution method. [5]

Simplex Method: Introduction, computational procedure, artificial variable, problem of degeneracy, application of simplex method. [8]

Duality: Concept, formulation of primal – dual, duality and simplex method, Dual Simplex method. [5]

Transportation Problem: Introduction, mathematical formulation, finding initial basic feasible solution, optimality, degeneracy, unbalanced transportation problem. [6]

Assignment Problem: Introduction, mathematical formulation and solution. [5]

Inventory Model: Introduction to inventory control, deterministic inventory model, EOQ model with quantity discount. [8]

Queuing Models: Concepts relating to queuing systems, basic elements of queuing model, role of Poison & exponential distribution, concepts of birth and death process. [6]

Network Scheduling: Introduction, Critical Path Method (CPM), PERT calculation. [8]

Information Theory: Introduction, Entropy and its properties, joint and conditionalentropies, Mutual information, Encoding. [5]

Boosk and References:

1. J K Sharma, Operations Research Theory and Applications, MacMillan India Ltd.
2. N D Vohra, Quantitative Techniques in management, Tata McGraw Hill.
3. Handy A Taha, Operations Research – An Introduction, Prentice Hall of India, New Delhi.
4. Wagner H M, Principles of Operations Research: With Applications to Management Decisions, Prentice-Hall of India, New Delhi.
5. Hillier F S and Lieberman G J, Operations Research, Holden Day Inc., San Francisco.
6. Payne T A, Quantitative Techniques for Management: A Practical Approach, Reston Publishing Co. Inc., Virginia.

Wilkes F M, Baum P and Smith G D, Management Science: An introduction, John Wiley and Sons, Santa Barbara.

Question Pattern for End Semester Examination

(XCOM3CC10T)

Section-I (Objective type)

- 4 questions each carrying 2 marks have to be answered.
- 6 questions each carrying 2 marks have to be given.

Section-II

- 4 questions each carrying 8 marks have to be answered.
- 6 questions each carrying 8 marks have to be given.

SEMESTER – 3	
XCOM3CC11T	Credits : 6 Full Marks : 40+10*
Number of classes required : 60	
*5 Marks are reserved for Internal Assessment & 5 marks for Attendance	

Outcomes : This course will enable students to:

1. Understand basics of Cryptography and Network Security.
2. Able to secure a message over insecure channel by various means.
3. Learn about how to maintain the Confidentiality, Integrity and Availability of a data.
4. Understand various protocols for network security to protect against the threats in the networks.

Paper - XCOM3CC11T

CRYPTOGRAPHY & NETWORK SECURITY

Introduction: Introduction to Cryptography, Security Threats, Vulnerability, Types of attacks, Security approaches, Principles of Security, Security servicesand mechanism, Conventional Encryption Model, CIA model. [5L]

Mathematical Background: Modular Arithmetic, Euclidean and Extended Euclidean algorithm, Prime numbers, Fermat and Euler's Theorem. [10L]

Cryptography Concepts: Introduction, Plaintext & Cipher text, Substitution Techniques, Transposition Techniques, Encryption & Decryption, Symmetric & Asymmetric key Cryptography, Key Range & Key Size. [10L]

Symmetric Key Algorithm: Introduction, DES (Data Encryption Standard) algorithm, IDEA (International Data Encryption Algorithm) algorithm, RC5 (Rivest Cipher 5) algorithm, AES (Advanced Encryption Standard). [10L]

Asymmetric Key Algorithm: Introduction, RSA algorithm, Rabin cryptosystem, Elgamal cryptosystem, Elliptic curve cryptosystem, Digital Signature, Basic concepts of Message Digest and Hash Function. [15L]

Internet Security Protocols & User Authentication: Basic Concepts, SSL protocol, Authentication Basics, Password, Authentication Token, Certificate based Authentication, Biometric Authentication. [5]

Network Security: TCP/IP, Firewall, IP Security, VPN. [5]

Text/Reference books:

1. "Cryptography and Network Security", William Stallings, 2nd Edition, Pearson Education Asia
2. "Network Security private communication in a public world", C. Kaufman, R. Perlman and M. Speciner, Pearson

3. Cryptography & Network Security: AtulKahate, TMH.
4. Cryptography and Network Security - B.A.Forouzan, McGraw-Hill publications.
5. “Network Security Essentials: Applications and Standards” by William Stallings, Pearson
6. “Designing Network Security”, MerikeKaeo, 2nd Edition, Pearson Books

Question Pattern for End Semester Examination

(XCOM3CC11T)

Section-I (Objective type)

- 4 questions each carrying 2 marks have to be answered.
- 6 questions each carrying 2 marks have to be given.

Section-II

- 4 questions each carrying 8 marks have to be answered.
- 6 questions each carrying 8 marks have to be given.

SEMESTER – 3	
XCOM3CC12T	Credits : 6 Full Marks : 40+10*
Number of classes required : 60	
*5 Marks are reserved for Internal Assessment & 5 marks for Attendance	

Outcomes : This course will enable students to:

1. Learn analog and digital images, basic images processing techniques.
2. Learn spatial domain image enhancement techniques like histograms, filtering
3. Learn frequency domain techniques like Fourier transform.
4. Learn grayscale as well as color image processing.
5. Learn how morphological operation works on images.
6. Learn to detect object and region of interest through segmentation techniques.
7. Learn spatial and frequency domain image compression techniques.

Paper - XCOM3CC12T

DIGITAL IMAGE PROCESSING

Introduction: Introduction of Image Processing with its applications, Components of Image processing system, Image Formation model. Image Sampling and Quantization - Spatial and Gray-Level Resolution; Some Basic Relationships Between Pixels -Neighbors, Adjacency, Connectivity, Regions, and Boundaries, Distance Measures, Image Operations on a Pixel Basis; Linear and Nonlinear Operations. [8L]

Image Enhancement in the Spatial Domain: Some Basic Gray Level Transformations - Negatives, Log, Power-Law; Histogram Processing - Histogram Equalization, Histogram Matching (Specification)t; Enhancement Using Arithmetic/Logic Operations – Image Subtraction, Image Averaging; Basics of Spatial Filtering, Smoothing Spatial Filters; Sharpening Spatial Filters - Use of First and Second Derivatives for Enhancement [10L]

Image Enhancement in the Frequency Domain: Introduction to the Fourier Transform and the Frequency Domain - One-Dimensional Fourier Transform and its Inverse, Two-Dimensional DFT and Its Inverse, Filtering in the Frequency Domain, Smoothing and Frequency-Domain Filters; Sharpening and Frequency Domain Filters; The Fast Fourier Transform; [10L]

Color Image Processing: Color Fundamentals, Color Models - RGB, CMY, HSI; Pseudocolor Image Processing – Intensity Slicing, Gray Level to Color Transformations; Basics of Full-Color Image Processing.[4L]

Morphological Image Processing : Some Basic Concepts from Set Theory, Logic Operations Involving Binary Images, Dilation and Erosion, Opening and Closing, The Hit-or-Miss Transformation, Some Basic Morphological Algorithms - Boundary Extraction, Region Filling, Extraction of Connected Components, Convex Hull, Thinning, Thickening; Extensions to Gray-Scale Images.[10L]

Image Segmentation: Detection of Discontinuities - Point Detection, Line Detection, Edge Detection, Edge Linking and Boundary Detection - Local Processing, Global Processing via the Hough Transform, Thresholding

- , Basic Global Thresholding, Basic Adaptive Thresholding, Optimal Global and Adaptive Thresholding, Local Thresholding; Region-Based Segmentation - Region Growing, Region Splitting and Merging.[10L]

Image Compression: Introduction, Lossy Compression techniques and Loss less image compression techniques, Huffman coding, Run Length Encoding, JPEG, Block Truncation compression.[8L]

Text and Reference Books:

1. Gonzalez, R. C. and Woods, R. E. [2002/2008], Digital Image Processing, 2nd/3rd ed., Prentice Hall
2. Sonka, M., Hlavac, V., Boyle, R. [1999]. Image Processing, Analysis and Machine Vision (2ndedition), PWS Publishing, or (3rd edition) Thompson Engineering, 2007
3. Gonzalez, R. C., Woods, R. E., and Eddins, S. L. [2009]. Digital Image Processing Using MATLAB, 2nd ed., Gatesmark Publishing, Knoxville, TN.
4. Anil K. Jain [2001], Fundamentals of digital image processing (2nd Edition), Prentice-Hall, NJ
5. Willian K. Pratt [2001], Digital Image Processing (3rd Edition), , John Wiley & Sons, NY
6. Burger, Willhelm and Burge, Mark J. [2008]. Digital Image Processing: An Algorithmic Introduction Using Java, Springer
7. Digital Image Analysis (With CD-ROM), Kropatsch, Springer, ISBN 978038795066
8. Digital Image Processing, 6e (With CD), Jähne, Springer, ISBN:978-3-540-24035-8 2

Question Pattern for End Semester Examination

(XCOM3CC12T)

Section-I (Objective type)

- 4 questions each carrying 2 marks have to be answered.
- 6 questions each carrying 2 marks have to be given.

Section-II

- 4 questions each carrying 8 marks have to be answered.
- 6 questions each carrying 8 marks have to be given.

SEMESTER – 3	
DSE 2	Credits : 6 Full Marks : 40+10*
Number of classes required : 60	
*5 Marks are reserved for Internal Assessment & 5 marks for Attendance	

Elective – II

DSE2 (For Semester 3)	
Course Code	**Course Name**
XCOM3DS21P	Python programming
XCOM3DS22P	R Programming
XCOM3DS23P	PHP programming
XCOM3DS24P	Android Programming
XCOM3DS25P	XML programming

XCOM3DS21P: PYTHON PROGRAMMING

Outcomes : This course will enable students to:

1. Acquire programming skills in core Python.
2. Acquire Object Oriented Skills in Python.
3. Develop the skill of designing Graphical user Interfaces in Python
4. Develop the ability to write database applications in Python.

Introduction: Python Installation and Working with Python Understanding Python variables Python basic Operators Understanding python blocks.
Data Types: Declaring and using Numeric data types: int, float, complex Using string data type and string operations Defining list and list slicing Use of Tuple data type.
Flow Control: if, else and elif, For loop using ranges, while loop.
Functions: Modules and Packages.
String: List,Dictionary and Tuples, Regular Expression
File Operation: read(), readline(), readlines(),write() and writelines()
Object Oriented Programming: Oops Concept of class, object and Inheritance.
Exception Handling
Database Handling using PyMySQL.
Python Multithreading Programming.

OR

XCOM3DS22P: R PROGRAMMING

Outcomes : This course will enable students to:

1. Use R-Studio to write and run R code
2. Write syntactically correct R expressions that involve variables, variable assignment, operators and functions
3. Identify basic R data types (character, double, integer and logical)
4. Identify basic R data structures relevant to modern data analysis (atomic vectors and data frames)
5. Import data into R
6. Apply the basic verbs of data transformation (filtering, selecting, mutating, renaming and arranging)
7. Create statistical graphics with ggplot2

Introduction: Basic programs over Arithmetic Operators, Relational Operators, Relational Operators, Relational Operators, Miscellaneous Operators, Implementing if, if…else, switch and different loops(repeat, while, for).Program using built in functions and user defined functions**.**

Strings, vectors, lists: Different string manipulation programs, Vector Creation, Accessing Vector Elements, Vector Manipulation, Creating a List, Naming List Elements, Accessing List Elements, Manipulating List Elements, Merging Lists, Merging Lists, Converting List to Vector**.**

Matrices, arrays, factors: Accessing Elements of a Matrix, Matrix Computations..Naming Columns and Rows, Accessing Array Elements, Manipulating Array Elements, Calculations Across Array Elements, Factors in Data Frame, Changing the Order of Levels, Generating Factor Levels.

Data frames, packages, data reshaping: Extract Data from Data Frame, Expand Data Frame, Implementation of packages and data reshaping.

Files: Reading and writing of csv files, excel file, binary files.

Charts: Implementation of pie charts, bar charts, boxplots, histograms, line graphs, scatter plots**.**

Statistics , Regression and distribution: Implementation of mean, median & mode; linear regression, multiple regression, logistic regression; normal distribution, binomial distribution and poisson regression analysis of covariance**.**

OR

XCOM3DS23P: PHP

Outcomes : This course will enable students to:

1. Understand how server-side programming works on the web.
2. Gain the PHP programming skills needed to successfully build interactive, data-driven sites.
3. Able to setup and configure MySQL, PHP, Apache web server development environment.
4. Use the MVC pattern to organize code
5. Test and debug a PHP application
6. Work with form data
7. Use cookies and sessions
8. Work with regular expressions, handle exceptions, and validate data

Introduction: Introduction to PHP, Handling Html Form With Php, Decisions and loop, Function, String, Array, Working with file and Directories.
State managemen: cookie, session, URL rewriting, Hidden field.
Introduction to OOPS: Class and Objects, Inheritance & code reusability, Polymorphism, Interface, Exception Handling.
Database Connectivity with MySql: Introduction to RDBMS, Connection with MySql Database, Performing basic database operation (DML) (Insert, Delete, Update, Select), Setting query parameter, Executing query.
Web Designing: HTML, CSS, Java Script.

OR

XCOM3DS24P: ANDROID PROGRAMMING

Outcomes : This course will enable students to:

1. Build and deploy Android application.
2. Understand the operation of the application, application lifecycle, configuration files, intents, and activities.
3. Understanding of the UI - components, layouts, event handling, and screen orientation.
4. Develop a working knowledge of the custom UI elements and positioning.
5. Have an in-depth understanding of broadcast receivers and services.
6. Perform networking capabilities such as JAVA Sockets, JAVA XML and JSON are taught.

Introduction: Preparing the Environment (Installing the SDK, Creating Android Emulator, Installing Eclipse, Installing Android Development Tools), Creating and publishing different types of App.
Android Architecture: Android Stack, Android applications structure, UI Architecture-Application context, Intents, Activity life cycle.
User Interface Widgets: Text and Button controls, Images, Notification and Toast-Parameters on Intents, Toast notifications, Menus: Options and Context menu, Dialogs-Alert and custom dialog.
Lists: Using string arrays, Creating lists, Custom lists.
Location and Maps: Google maps, Using GPS to find current location.
Working with data storage: Files access, SQLite database.
Network Communication: Web Services, HTTP Client, XML and JSON.

OR

XCOM3DS25P: XML PROGRAMMING

Outcomes : This course will enable students to:

1. Understand XML family of technologies, and the latest W3C and WS-I XML standards.
2. Understand various applications of XML in the areas of information representation, Presentation Oriented Publishing, Message Oriented Computing and Application Configuration Web Services Protocols.
3. Combined use of XML and Java technologies to support the development of modern applications targeted to the evolving spectrum of distributed and decentralized enterprise platforms.
4. Expose to the advanced XML-enabled capabilities of the Java 2 development environment for Enterprise Applications.
5. Demonstrate the use of XML to support the modern approach at building comprehensive business applications using XML Markup Language technologies, XML information modeling, XML information processing, XML information rendering, XML information retrieval, XML secure messaging, XML-Based frameworks, and XML application implementation and testing methodologies and tools.
6. Demonstrate the application of XML in distributed communications enabling, enterprise systems assurance, web enabling, application enabling, and enterprise data enabling.

Introduction to Extensible Markup Language (XML), XML vs HTML, Structure of a XML Document, XML Elements, XML: Attributes, XML Entity References, CDATA Sections, Includes Document Type Definition (DTD), Linking Documents in XML, SAX, DOM, well-formed and valid XML documents, Data Binding, XML schemes, and Extensible Style Language (XSL), Web Services (WSDL)

Question Pattern for End Semester Examination

(DSE 2)

Problem Solving:

- Program Code: 15
- Output: 5

Viva: 10

LNB: 10

SEMESTER – 3	
XCOM3CC13P	Credits : 6 Full Marks : 40+10*
Number of classes required : 60	
*5 Marks are reserved for Internal Assessment & 5 marks for Attendance	

Outcomes : This course will enable students to:

UNIT-I:

1. Learn to read image and video files
2. Learn to use different color spaces like RGB, HSV,CMY etc
3. Learn to segment object from background in an image as well as video files
4. Learn to detect object through Hough transform.
5. Learn to detect edges, lines, points
6. Learn to enhance images, restore images and videos.
7. Learn basic of steganography techniques, MRA, object classification etc.
8. Visualize Data through matplotlib, seaborn.

UNIT-II:

1. Learns to handle small scale projects mainly in-house and research oriented.
2. Learn to write a technical paper for publication.
3. Get the ideas of the spectrum of research and product development.

Paper - XCOM3CC13P

IMAGE PROCESSING LAB & MINOR PROJECT

Unit – I: Image Processing Lab

OpenCV Python: Installation of IDEs like Anaconda, Jupyter, Spyder, PyCharm, Image read, write , saving; Loading Video from WebCam/File, Drawing and Writing on Images, Basic Image Operations, Add Images and Threshold, Blending Images, Bitwise Operator, TrackBar, Object Detection using HSV Color space, Basic Thresholding, Histogram, Basic Geometric Transformation, Perspective Transformation, Affine Transformation, Adaptive Thresholding, Image Smoothing, Morphological Transformation, Edge Detection Operators;Find and Draw contours, Template Matching, Hough lines transform, Corner Detection, Image Pyramid (Blending and Reconstruction),Feature Detection (SIFT,SURF,ORB), Feature Matching, Mouse Events, Histogram and Back Projection, Object Tracking with Mean Shift, Object Tracking with Camshift, Optical-flow-with-lucas-kanade-method, Background Subtraction, k-NN Classification, Object Tracking using Homography, Fourier Transform, Wavelets, Face Detection Using Haar cascade classifier.

Matplotlib package : Drawing Line, Scatter plot, Box plots etc ; Display of one of multiple images**,** Histograms, Creating subplots, Adding title to axes and plot; figure size, legends; Showing and Saving plots, use of Seaborn.

Theory Implementation: Bit plane slicing, Image negative, Local Binary Pattern, Histogram equalization, Convolution, Edge detection: : Sobel, Prewitt, Laplacian, Canny, Marr-Hilderth; Otsu and other thresholding, Contours, Morphological operators: erosion, dilation, opening ,closing, Hit and Miss transform, Thinning,

Thickening, Watershed algorithm; Frequency domain transform: DFT,DCT,DWT; Multi resolution analysis (MRA), Huffman coding, Run length encoding, JPEG. Basic steganography: LSB, PVD,DWT etc.

Unit – II: Minor Project

Each student is assigned a minor project in this paper. It is basically an in-house project in our institute. The students are free to do any outside project if they can do it without disturbing the normal routine of the programme. An internal guide must be there in any case. They have to submit project report at the end-semester evaluation.

Some relevant Domains: Image Processing, Cryptography, Steganography, Compression, Data Structures, Web Technologies, Ditributed OS, Networking etc.

Text and References:

1. Gonzalez, R. C. and Woods, R. E., Digital Image Processing, 2nd/3rd ed., Prentice Hall
2. Sonka, M., Hlavac, V., Boyle, R., Image Processing, Analysis and Machine Vision (2ndedition), PWS Publishing, or (3rd edition) Thompson Engineering, 2007
3. Gonzalez, R. C., Woods, R. E., and Eddins, S. L., Digital Image Processing Using MATLAB, 2nd ed., Gatesmark Publishing, Knoxville, TN.
4. Anil K. Jain, Fundamentals of digital image processing (2nd Edition), Prentice-Hall, NJ
5. Mastering OpenCV 4 with Python: A practical guide covering topics from image processing, augmented reality to deep learning with OpenCV 4 and Python 3.7; Alberto Fernandez Villan ; Packt Publishing.
6. Learning OpenCV; Gary Bradski, Adrian Kaehler; O'Reilly

Question Pattern for End Semester Examination

(XCOM3CC13P)

Unit – I: Image Processing Lab

- Program Code: 5
- Output: 5
- LNB: 5
- Viva: 5

Unit – II: Minor Project

- Presentation : 5
- Project Report: 10
- Viva: 5

SEMESTER – 4	
XCOM4CC14T	Credits : 6 Full Marks : 40+10*
Number of classes required : 60	
*5 Marks are reserved for Internal Assessment & 5 marks for Attendance	

Outcomes : This course will enable students to:

1. Develop Skills to debug software.
2. Develop Skills to efficiently resolve problems.
3. Develop Proficiency in various programming languages.
4. Develop knowledge of software and hardware.
5. Develop Teamwork capabilities
6. Develop knowledge of Computer Aided Software Engineering tools.

Paper - XCOM4CC14T

SOFTWARE ENGINEERING

Introduction: Software Engineering – Product and process – process models - Waterfall Life cycle model – Spiral Model – Prototype Model – fourth Generation Techniques – Agile methods. [8]

Software Project: Planning a Software Project. Effort Estimation: (COCOMO and Function Points Model), Project Scheduling, Staffing and Personnel Planning, Software Configuration Management Plan, Quality Assurance Plans, Project Monitoring Plans, Risk Management. [10]

Software Requirement Analysis and Specification: Need for SRS, Problem Analysis, Requirements Specification. [6]

Software Design: Design objectives and principles. Module level concepts, Coupling and Cohesion. Design Notations and specifications. Structured Design Methodology, Object Oriented Design,Detailed Design, Verification (Design Walkthroughs, Critical Design Review, Consistency Checkers), Metrics. [10]

Software Coding: Programming Principles and Guidelines, Common coding errors, Some Programming Practices, Coding Standards, Refactoring, Basic Concepts, Modern programming language features. Verification and Validation techniques (Code reading, Static Analysis, Code Inspections or Reviews). Combining different techniques. [10]

Metrics: Size Measures, Complexity Metrics, Style Metrics. [3]

Documentation: Internal and External Documentation. [3]

Software Testing and Maintenance: Testing Fundamentals: Error, Fault and Failure, Test Oracles, Test Cases and Test Criteria, Psychology of Testing. Testing Objectives and Principles.Software Testing:Black Box and White Box testing. Black Box Testing:Equivalence Class Partitioning, Boundary Value Analysis, Cause Effect Graphing, Special Cases.White Box Testing: Mutation Testing, Test Case Generation and Tool Support.
Testing Process:Comparison of Different Techniques, Levels of Testing, Test Plan, Test Case Specifications, Test Case Execution and Analysis. Software Maintenance. [10]

Books and References:

1. PankajJalote, An Integrated Approach to Software Engineering (3rd ed.), NarosaPublishing House, 2005.
2. R.S. Pressman, Software Engineering: A Practitioner's Approach (6th ed.), McGraw-Hill,2006.
3. Somerville, Software Engineering (6th ed.), Pearson Education, 2004
4. Fairley, R.E. , Software Engineering Concepts, Mc-Graw Hill.
5. K.K. Agarwal and Y. Singh, Software Engineering (revised 2nd ed.), New AgeInternational Publishers, 2006.
6. Douglas Bell, Software Engineering for Students (4th ed.), Addison-Wesley, 2005.
7. Rajib Mall**,** Fundamentals of Software Engineering (2nd ed.), Prentice-Hall of India, 2006.

Question Pattern for End Semester Examination

(XCOM4CC14T)

Section-I (Objective type)

- 4 questions each carrying 2 marks have to be answered.
- 6 questions each carrying 2 marks have to be given.

Section-II

- 4 questions each carrying 8 marks have to be answered.
- 6 questions each carrying 8 marks have to be given.

SEMESTER – 4	
XCOM4CC15T	Credits : 6 Full Marks : 40+10*
Number of classes required : 60	
*5 Marks are reserved for Internal Assessment & 5 marks for Attendance	

Outcomes : This course will enable students to:

1. Understand the various searching techniques, constraint satisfaction problem and example problems- game playing techniques.
2. Apply these techniques in applications which involve perception, reasoning and learning.
3. Explain the role of agents and how it is related to environment and the way of evaluating it and how agents can act by establishing goals.
4. Acquire the knowledge of real world Knowledge representation.
5. Analyze and design a real world problem for implementation and understand the dynamic behaviour of a system.
6. Use different machine learning techniques to design AI machine and enveloping applications for real world problem.

Paper - XCOM4CC15T

ARTIFICIAL INTELLIGENCE

Introduction: AI applications, AI techniques, AI Problems. Importance of AI [2L]

State Space search: State Space Graphs, Implicit and explicit graphs, Production Systems, formulating thestate-space; *Uninformed search*: breadth first search, depth first search; Uniform cost algorithm; *Informed search*: Generate-and-test, Hill Climbing, Best First Search, Problem Reduction, Constraint Satisfaction , Mean-Ends Analysis ;Analysis and comparison of search algorithms. [10L]

Knowledge Representation: Representations and Mappings, Knowledge representation method- Propositional Logic, Predicate logic, Representing Simple facts in Logic, Representing Instances and Isa relationships, Computable Functions and Predicates, Resolution- Forward and backward chaining. [10L]

Slot and Filler Structures: Semantic Networks, Frames, Conceptual Dependencies, Scripts [8L]

Game Playing: Two agent games, AND/OR graphs, Minimax procedure, and game trees, Alpha – Betapruning procedure, learning evaluation functions. [6L]

Uncertainty: different types of uncertainty - degree of belief and degree of truth, various probabilityconstructs - prior probability, conditional probability, probability axioms, probability distributions, and jointprobability distributions, Bayes' rule, other approaches to modeling uncertainty, Dempster-Shafer theory,fuzzy sets/logic.[10L]

Expert Systems: Concepts of Expert system systems; examples of expert systems. [4L]

Logic Programming: Introduction to programming in logic. Declarative and Procedural Meaning, Data Objects, Lists, Operators, Controlled Backtracking. [10L]

Books and References:

1. Elaine Rich and Kevin Knight: Artificial Intelligence, TMH
2. Dan W. Patterson: Introduction to Artificial Intelligence and Expert Systems, PHI
3. S. Russel and P. Norvig, "Artificial Intelligence, A modern Approach"
4. Computational Intelligence, Eberhart, Elsevier.
5. Artificial Intelligence: A New Synthesis, Nilsson, Elsevier.

Question Pattern for End Semester Examination

(XCOM4CC15T)

Section-I (Objective type)

- 4 questions each carrying 2 marks have to be answered.
- 6 questions each carrying 2 marks have to be given.

Section-II

- 4 questions each carrying 8 marks have to be answered.
- 6 questions each carrying 8 marks have to be given.

SEMESTER – 4	
DSE 3	Credits : 6 Full Marks : 40+10*
Number of classes required : 60	
*5 Marks are reserved for Internal Assessment & 5 marks for Attendance	

Elective – III

DSE3 (For Semester 4)	
Course Code	**Course Name**
XCOM4DS31T	Data Science
XCOM4DS32T	E-Commerce
XCOM4DS33T	Cloud Computing
XCOM4DS34T	Mobile Computing
XCOM4DS35T	Compiler Design
XCOM4DS36T	Remote Sensing & GIS application

XCOM4DS31T: DATA SCIENCE

Outcomes : This course will enable students to:

1. Learns the probability and statistics.
2. Learn different aspect of sampling theorems and data testing methods.
3. Understand data preparation techniques, clustering, regression and classification techniques.
4. Understand exploratory analysis of data and different models to do that.
5. Gain deep knowledge of neural networks as a super problem solver.
6. Gain the ideas of machine learning, deep learning through CNNs and RNNs.
7. Learn the time series data analysis.
8. Get the basic ideas of natural language processing models.

Probability: Combinatorial probability, Independence of events, Conditional probabilities, Random variables, densities, Expectation, Variance and moments, Standard univariate distributions, Independence of random variables. [8L]

Statistics: Introduction to Statistics with examples of its use, Draw random samples, Descriptive statistics, Graphical statistics: Histogram, scatter diagram, Pie diagram, estimates sample moments, sample mean, sample standard deviation. [8L]

Sampling distributions based on normal populations - t, chi-square and F distributions, Testing of Hypothesis: one sample and two sample tests based on t, chi-square and F distributions. - Error probabilities, statistical power of test, p-values, log-likelihood ratio test. [8L]

Unsupervised Learning: Basic Concept, K-means Clustering, K-Nearest Neighbours. [5L]

Supervised Learning: Linear Regression, Polynomial Regression, Logistic Regression,Naïve Bayes, Bayes Theorem. Decision Trees, Random Forests, Perceptrons, Gradient Descent, Multi-Layered Perceptrons (MLP), Support Vector Machines. [10L]

Train-test, F1 Score, Accuracy, Confusion Matrix, Precision, Principal Component Analysis, Dimensionality Reduction. [5L]

Data Visualization: Basic principles; ideas and tools for data visualization. [4L]

Introduction Deep learning: Basic concept of Deep Learning, Difference of Machine Learning. Convolutional Neural Networks: Architectures, convolution / pooling layers, Recurrent Neural Networks: LSTM, GRU, Encoder Decoder architectures. [12L]

TEXT/REFERENCES:

1. Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk from the Frontline. O'Reilly. 2014.

2. Jure Leskovek, Rajaraman and Jefffey Ullman, Mining of Massive Datasets.v2.1, Cambridge University Press. 2014.

3. Kevin P. Murphy. Machine Learning: A Probabilistic Perspective.

4. Trevor Hastie, Robert Tibshirani and Jerome Friedman, Elements of Statistical Learning, Second Edition.

5. Avrim Blum, John Hopcroft and RavindranKannan, Foundations of Data Science.

OR

XCOM4DS32T: E-COMMERCE

Outcomes : This course will enable students to:

1. Demonstrate an understanding of the foundations and importance of E-commerce.
2. Analyze the impact of E-commerce on business models and strategy.
3. Describe Internet trading relationships including Business to Consumer, Business-to-Business, Intra-organizational.
4. Describe the infrastructure for E-commerce.
5. Describe the key features of Internet, Intranets and Extranets and explain how they relate to each other.
6. Discuss legal issues and privacy in E-Commerce.
7. Assess electronic payment systems.
8. Recognize and discuss global E-commerce issues.

Introduction to E-Commerce: Fundamental of e-commerce, Brief history of e-commerce, Impact of e-commerce, Benefits and limitations of e-commerce, Classification of e-commerce: Inter organizational e-commerce, Intra organizational e-commerce, Business to Business electronic commerce, Business to Customer electronic commerce and Collaborative commerce, Mobile Commerce etc., Applications of e-commerce technologies, E-Commerce Business models. [15]

E-Commerce Infrastructure: Framework of e-commerce, I-Way Concept, EC Enablers, Review of the Internet structure, the TCP/IP Protocol Suite, The client/server model, Review of the architectural components of World-Wide Web, Proxy servers, Internet call centers, cookies, Agents in e-commerce and their role, Network infrastructure for e-commerce: Intranets and their applications, Extranets and their applications, Virtual Private Networks (VPNs), Internet-based VPNs, Firewalls and their types. [15]

Security in E-Commerce: Issues in Network and Transaction Security, Cryptography and Cryptanalysis,Symmetric and Public Key Cryptographic systems, Authentication protocols, Public Key Infrastructure (PKI), Integrity and Non-repudiation, Digital Certificates, Digital Signatures, Electronic mail security, Security protocols for web commerce: SSL, SET etc. [15]

Electronic Payments: Introduction to Money, The nature of money, Overview of electronic payment systems, Limitations of traditional payment instruments, Electronic payment system issues, Some methods of payment, Electronic payment system requirements, Micro payments, Online payment systems, Card-based payment systems. [15]

Books and References:

1. Ravi KalaKota, Andrew Whinston “Frontiers of Electronic Commerce” Addition Wesley
2. Diwan, Sharma “E-Commerce” Excel
3. Asset International “Net Commerce” TMH
4. Bajaj and Nag “E-Commerce: The Cutting Edge of Business” TMH
5. Denlal Amor “The E Business Revolution” Addition Wesley
6. Sokal “From EDI to E-Commerce: A Business Inttiative” TMH
7. Greeanstein and Feinman “E-Commerce” TMH

8. Bharat Bhasker “Electronic Commerce-Framework, Technologies & Applications” TMH
9. K. C. Laudon and C. G. Traver “E-commerce: business, technology, society”, AddisonWesley.
10. David Whiteley “E-commerce:Strategies,Technologies and Applications”, TMH
11. P.T. Joseph, E-Commerce An Indian Perspective, Prentice-Hall of India, 2007
12. Norman Sadeh “M-Commerce : Technologies, Services & Business Module” Wiley
13. O’MalinoyDonalad, M.A. Peirce, Hitesh Tiwari” Electronic Payment Systems for E-Commerce.
14. Brian E.Mennecke, Troy J.Strader, “Mobile Commerce: (Soft Cover):Technology,Theory and Applications”, Idea group Inc., IRM Press,2003
15. Pete Loshin, Paul A Murphy, Electronic Commerce, 2nd Edition, Jaico Publishers,1996.
16. 3. David Whiteley, e - Commerce : Strategy, Technologies and Applications -McGraw Hill, 2000.

OR

XCOM4DS33T: CLOUD COMPUTING

Outcomes : This course will enable students to:

1. Get the fundamental ideas behind Cloud Computing, the evolution of the paradigm, its applicability; benefits, as well as current and future challenges;
2. Get the basic ideas and principles in data center design; cloud management techniques and cloud software deployment considerations;
3. Understand Different CPU, memory and I/O virtualization techniques that serve in offering software, computation and storage services on the cloud; Software Defined Networks (SDN) and Software Defined Storage (SDS);
4. Understand Cloud storage technologies and relevant distributed file systems, NoSQL databases and object storage;
5. Understand the variety of programming models and develop working experience in several of them.

Cloud Computing Basics: Overview, Applications, Intranets and the Cloud. [4L]

Your Organization and Cloud Computing: Benefits, Limitations, Security Concerns. [2L]

Hardware and Infrastructure: Clients, Security, Network, Services. [4L]

Software as a Service (Saas): Understanding the Multitenant Nature of SaaS Solutions, Understanding SOA. [4L]

Platform as a Service (PaaS): IT Evolution Leading to the Cloud, Benefits of Paas Solutions, Disadvantages of Paas Solutions. [4L]

Infrastructure as a Service (Iaas): Understanding IaaS, Improving Performance through Load Balancing, System and Storage Redundancy, Utilizing Cloud-Based NAS Devices, Advantages, Server Types.[4L]

Identity as a Service (IDaaS): Understanding Single Sign-On (SSO), OpenID, Mobile ID Management. Cloud Storage-Overview, Cloud Storage Providers. [4L]

Virtualization: Understanding Virtualization, History, Leveraging Blade Servers, Server Virtualization, Data Storage Virtualization. [4L]

Securing the Cloud: General Security Advantages of Cloud-Based Solutions, Introducing Business Continuity and Disaster Recovery. [4L]

Service Oriented Architecture: Understanding SOA, Web Services Are Not Web Pages, Understanding Web Service Performance, Reuse and Interoperability. [4L]

Developing Applications: Google, Microsoft, Cast Iron Cloud, Bungee Connect, Development. [6L]

Migrating to the Cloud: Cloud Services for Individuals, Cloud Services Aimed at the Mid-Market, Enterprise-Class Cloud Offerings, and Migration. [4L]

Designing Cloud Based Solutions: System Requirements, Design Is a Give-and-Take Process. [4L]

Coding Cloud Based Applications: Creating a Simple Yahoo Pipe, Using Google App Engine and creating a Windows Azure Application. [4L]

Application Scalability: Load-Balancing Process, Designing for Scalability, Capacity Planning Versus Scalability, Scalability and Diminishing Returns and Performance Tuning. [4L]

Text and References Books:

1. Cloud Computing: A Practical Approach by Anthony T. Velte Toby J. Velte, Robert Elsenpeter, 2010 by The McGraw-Hill.
2. Cloud Computing: SaaS, PaaS, IaaS, Virtualization and more. by Dr. Kris Jamsa.
3. Cloud Computing Bible by Barrie Sosinsky, Published by Wiley Publishing, 2011.
4. Cloud Computing for Dummies by Judith Hurwitz, Robin Bloor, Marcia Kaufman, and Dr. Fern Halper, Wiley Publishing, 2010.

OR

XCOM4DS34T: MOBILE COMPUTING

Outcomes : This course will enable students to:

1. Explain the principles and theories of mobile computing technologies.
2. Understand Wireless and mobile computing application.
3. Understand details of wireless transmission
4. Understand the architecture of different mobile network models like GSM, GPRS, UMTS.
5. Learn inner details of the networking protocols.
6. Understand large mobile networks like MANET
7. Learn different mobile s/w and h/w platforms.

Introduction: Mobile Computing vs. wireless Networking – Mobile Computing Applications – Characteristics of Mobile computing – Structure of Mobile Computing Application. Advantages and disadvantages, evolution, special considerations for node mobility. [10]

Wireless transmission: Frequency band for signal transmission, signal propagation, multiplexing, modulation, spread spectrum, cellular systems; Cellular organization of mobile telephone networks – Operation of cellular networks - Frequency Reuse - Tessellation - Handoff – Capacity Improvement. [15]

Wireless Networks - Global System for Mobile Communication (GSM) – General Packet Radio Service(GPRS) – Universal Mobile Telecommunication System (UMTS). [8]

Mobile Internet Protocol and Transport Layer: Overview of Mobile IP – Features of Mobile IP – Key Mechanism in Mobile IP –route Optimization. Overview of TCP/IP – Architecture of TCP/IP- Adaptation of TCP Window– Improvement in TCP Performance. [12]

Mobile Ad-Hoc Networks:Ad-Hoc Basic Concepts – Characteristics – Applications – Design Issues – Routing – Essential of Traditional Routing Protocols –Popular Routing Protocols – Vehicular Ad Hoc networks (VANET) – MANET vs. VANET – Security. [8]

Mobile Platforms And Applications: Mobile Device Operating Systems – Special Constrains & Requirements – Commercial Mobile Operating Systems – Software Development Kit: iOS, Android, BlackBerry, Windows Phone – MCommerce – Structure – Pros & Cons – Mobile Payment System – Security Issues. [7]

Books and References:

1. AsokeTalukder, Hasan Ahmed, RupaYavagal, “Mobile Computing: Technology, Applications and Services Creation”, Second Edition, TMH, 2010.
2. Prasant Kumar Pattnaik, Rajib Mall, “Fundamentals of Mobile Computing”, PHI Learning Pvt.Ltd, New Delhi – 2012.
3. C.K.Toh, “AdHoc Mobile Wireless Networks”, First Edition, Pearson Education, 2002.
4. William Stallings, “Wireless Communication and Networks”, Pearson, 2009.
5. Jochen Schiller, “Mobile Communications”, Second Edition, Pearson, 2009.
6. UweHansmann et al, “Principles of Mobile Computing”, Springer, 2003.
7. Ivan Stojmenovic, “Handbook of Wireless Networks and Mobile Computing”,Wiley, 2002.

OR

XCOM4DS35T: COMPILER DESIGN

Outcomes : This course will enable students to:

1. Understand the major phases of compilation and to understand the knowledge of Lex tool & YAAC tool.
2. Develop the parsers and experiment the knowledge of different parsers design without automated tools.
3. Construct the intermediate code representations and generation.
4. Convert source code for a novel language into machine code for a novel computer.
5. Apply for various optimization techniques for dataflow analysis.

Review: Grammars, Languages – types of grammars and their recognizers, Basic concepts of translators: boot strapping, cross compiler, Different phases of compilation. [6L]

Lexical analyzer: Concepts, Tokens, Schemas, Design using FSM, LEX. [6L]

Syntax Analysis: Top down and Bottom up parser; Operator precedence; Recursive descent; LL (1); SLR , canonical LR, LALR (1); Comparison, YACC. [10L]

Intermediate code generation: Three Address Code, Representation of three address code – Quadruples, Triples and Indirect Triples. [6L]

Syntax directed translation: Attributes, Semantic Actions, Translation schemes. [6L]

Code Optimization: Basic blocks, loop optimization, flow graph, DAG representations of basic blocks.[6L]

Code generation: Object Programs, Assembly language, Problems in Code Generation. [8L]

Error handling: detection, reporting, recovery and repair. [4L]

Symbol tables: Organization and management techniques. [4L]

Runtime storage management: static allocation; dynamic allocation, activation records; heap allocation, recursive procedures. [4L]

Books and References:

1. Alfred V. Aho and Jeffrey D. Ullman, Principles of Compiler Design, Narossa Publication
2. Aho, Sethi and Ullman, Compilers – Principles, Techniques and Tools, Narossa Publication
3. Peter Linz ,Formal Language and Automata Theory, Narossa Publication

OR

XCOM4DS36T: REMOTE SENSING AND GIS

Outcomes : This course will enable students to:

1. Analyze the principles and components of photogrammetric and remote sensing.
2. Describe the process of data acquisition of satellite images and their characteristics.
3. Compute an image visually and digitally with digital image processing techniques.
4. Explain the concepts and fundamentals of GIS.
5. Compute knowledge of remote sensing and GIS in different civil engineering applications.
6. Apply the various methods of remote sensing and GIS to different geospatial datasets
7. Design and construct optimum solutions for real world problems that can be resolved by GIS & remote sensing.

Basics of remote sensing: Electromagnetic Radiation (EMR), Electromagnetic spectrum (EMS), Platforms and sensors, Stages in remote sensing data acquisition, Types of satellites &images, Framing and scanning systems, EMR interaction with atmosphere and earth's surface.Black body radiation and radiation laws. [6L]

Sensors: Characteristics on board IRS, LANDSAT, SPOT, NOAA, IKONOS, Quickbird satellites, ASTER and SRTM missions, Spectral reflectance of soil, water vegetation and rock types. Spectral, spatial, temporal and radiometric resolutions. [8L]

Elements of image interpretation: photographic and geotechnical. Image characteristics of common land cover types, Image characteristics of common rock types- sandstone, shale, limestone, granite, basalt, Characteristics of cultural and natural features, GCPs and their utility. [8L]

Mapping from remotely sensed data: Image characteristics of Flood inundation, cyclone affected areas, environmentally degraded areas, degraded land and desertified areas, Case studies. [8L]

Maps: Elements, scale, base and reference map. Thematic maps.Toposheets: cultural and natural features. Types of Map projections: Conical Cylindrical and Azimuthal, Datum and coordinate systems. [8L]

Basics of GIS: Data, structure, relational, hierarchical network input, format, analysis in GIS, Data integration and overlay analysis in GIS, Functions of GIS, Digitization, editing and topology building in GIS, Concept and applications of Digital Elevation Model (DEM), Data Base Management System (DBMS). [6L]

Introduction to Global positioning system: GPS satellite constellations, GPS segments: space, control, user, signals & codes. GPS receivers, Operating principle and sources of errors in GPS, Modes of measurements and Post processing of data, accuracy of GPS observation.GPS applications in various fields, Concept of DGPS and WAAS. [8L]

Applications: GIS in natural resources mapping, socio-economic mappings and infrastructure mapping. Utility of GPS surveys in various fields. Case studies. [8L]

Text Book and Reference Books:

1. Fundamentals of GIS by Micheal Demers
2. Remote Sensing and Geographic Information System by Anji Reddy
3. Remote Sensing and Geographic Information System by A.M. Chandra.
4. Remote Sensing-Principles and Interpretation by Sabins.
5. Remote Sensing and image interpretation by Lillesand and Keifer
6. Fundamentals of Remote Sensing by George Joseph
7. Remote sensing and GIS by Basudeb Bhatta

Question Pattern for End Semester Examination

(DSE 3)

Section-I (Objective type)

- 4 questions each carrying 2 marks have to be answered.
- 6 questions each carrying 2 marks have to be given.

Section-II

- 4 questions each carrying 8 marks have to be answered.
- 6 questions each carrying 8 marks have to be given.

SEMESTER – 4	
XCOM4CC16P	Credits : 6 Full Marks : 40+10*
Number of classes required : --	
*5 Marks are reserved for Internal Assessment & 5 marks for Attendance	

Outcomes : This course will enable students to:

Unit – I:

1. Aware how to use values in improving your own professionalism.
2. Implement values for bridging and harmonizing.
3. Learn about personal and communication styles for team building.
4. Learn from history, art and music from natural human life.
5. Learn management of values.
6. Use values for business development.
7. Increase knowledge of Emotional Intelligence
8. The seminar combines interactive lectures with actual cases (analyses of definite situations), business games, demonstration of examples from real life, work in groups, discussions. Pictures from video along with music are used as supplement to oral lectures.

Unit – II:

Judge about the knowledge acquired in relevant courses over 2 years of study in the postgraduate computer science program.

Paper - XCOM4CC16P

SEMINAR & GRAND VIVA

Unit – I: Seminar

Guidelines for presenting a seminar:

- The seminar will consist of a typewritten report covering the topic related to his area of final year project.
- If more number of students are working on same project then they should separate the seminar topics from the project area which is relevant and which will contribute for completion of project.
- Weekly report of students work for finalization of his area of work and topic of seminar should be submitted to the faculty during designated hours meant for seminar.
- Format of weekly report should be finalized by the department with sufficient inputs received from the students.
- It is expected that the candidate prepares a report based on outcomes of literature studies, field visits, observation schedules, focus group meetings etc related to a problem in relevant technology area. The report shall be tested for any plagiarism out of books, journals and internet based articles and reports by appropriate web based tool.

- The candidate shall deliver seminar on the topic on first two occasions to students of his class for peer assessment. Format for peer group assessment should be designed by the faculty with approval of department.
- Final presentation for term work should be attended by minimum 2 faculty members.
- Each candidate may be given time minimum of 8 to 10 minutes.
- Assessment criteria for seminar delivery for term work should be designed by the faculty with inputs received from students of the class.
- Assessment Criteria so designed will be displayed on the department notice board with the approval from department along with these guidelines.

Unit – II: Grand Viva

The fundamentals of the subject taught over the two year Post Graduate Programme will be examined in Grand viva-voce. The viva-voce will be conducted by a Panel of external examiners.

Question Pattern for End Semester Examination

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Unit – I: SEMINAR

- Presentation : 5
- Seminar Report: 10
- Viva: 5

Unit – II: GRAND VIVA

- Viva: 20

SEMESTER – 4	
XCOM4CC17J	Credits : 6 Full Marks : 40+10*
Number of classes required : --	
*5 Marks are reserved for Internal Assessment & 5 marks for Attendance	

Outcomes : This course will enable students to:

1. Identify a suitable problem to be solved computationally and reflectively analyze proposed solutions to the identified computing problem.
2. Design and develop solutions to the problem and analyze results.
3. Prepare a thesis and defend the thesis on the work done.
4. Augment the knowledge base in the chosen area of computing, adhering to ethical practices at every stage.

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PROJECT WORK

The students are expected to demonstrate the core competency in the development of enhancements to the knowledge base in the area of interest in computing. The secondary competencies include the management of time bound projects involving research, analysis of problem complexities, design and development of effective solutions and communication of the project's progress, adhering to ethical practices at every stage. This stage of the project evaluates the state of maturity of these competencies. The students are expected to present two reports at intermediate stages, as well as prepare and defend a thesis on their research work. The students should take a new research-oriented project in consultation with the assigned project supervisor.

Question Pattern for End Semester Examination

(XCOM4CC17P)

Project Work

- Presentation : 10
- Seminar Report: 20
- Viva: 10