Curriculum and Syllabi

Department of Computer Applications
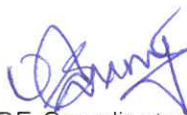
(MCA)

Semesters I to II

Regulations 2019

Department of Computer Applications

Vision

To Make MCA Department, a well-known center of excellence in Research & Development and achieve a State of Honor
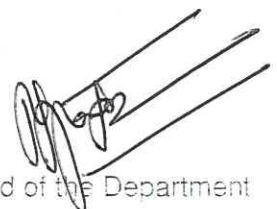
Mission

- To provide an environment that promotes the innovation and dissemination of knowledge
- To develop individuals who are leaders, innovators, entrepreneurs and independent learners, well prepared to contribute to their local, regional and global community

OBE Coordinator   Programme Coordinator   Head of the Department

Head - OBE

Programme: Master of Computer Applications(MCA)

Programme Educational Objectives (PEOs) - Regulations 2019

After 2 to 3 years of completion of the programme the graduates will be able to:

PEO1. Domain Expertise: Possess technical expertise, excel in communication skills and leadership to manage diverse audience in their career

PEO2. Computing Skills and Ethics: Employ technical skills to solve societal and environmental issues in an ethical manner

PEO3. Lifelong Learning and Research: Involve in learning the recent technologies to meet the global demands –To be updated

Programme Outcomes (POs) - Regulations 2019

On successful completion of the programme the graduates will be able to:

PO1. Domain Expertise: Apply the knowledge of mathematical fundamentals in the field of Computer Applications.

PO2. Computing Skills and Ethics: Identify, formulate, and solve the computational problems.

PO3. Lifelong Learning and Research: Design and develop algorithms, implement programs and evaluate the performance.
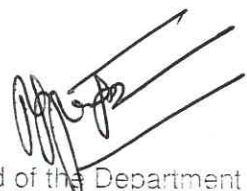
PO4. Complex problem Investigation: Investigate complex problems by employing research methods to arrive at valid conclusions.

PO5. Modern Tool Usage: Evaluate and use appropriate tools and techniques in developing application activities.

PO6. Societal contribution: Follow professional engineering practice by applying contextual knowledge to assess societal and legal issues.

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Head - OBE

PO7. Environment and Sustainability: Provide scientific solutions with due consideration of environmental and economic sustainability.

PO8. Ethics: Follow ethical principles and norm in developing applications.

PO9. Individual and Team work: Function effectively as an individual, team member or leader in diversified environments.

PO10. Communication: Communicate effectively through various modes for all application development activities

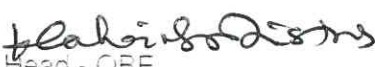**PO11. Project Management and Finance:** Apply development knowledge and management principles for effective project management in multi-disciplinary environments.

PO12. Life-long Learning: Recognize the need for and have the ability to engage in independent and lifelong learning in the context of technological change.

Programme Specific Outcomes (PSOs) - Regulations 2019
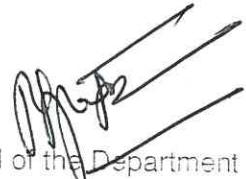
On successful completion of the programme the graduates will be able to:
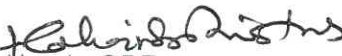
PSO1. Application Development: Apply software engineering principles in the design and development of web and mobile applications.

PSO2. Data management: Manage and analyze huge volume of data in real world problems.

OBE Coordinator

Programme Coordinator

Head of the Department

Head - OBE

Dr. MAHALINGAM
COLLEGE OF ENGINEERING AND TECHNOLOGY

Affiliated to Anna University, Chennai; Approved by AICTE ; Accredited by NAAC with Grade 'A++'

Accredited by NBA - Tier1 (Mech, Auto, Civil, EEE, ECE, E&I and CSE)

Udumalai Road, Pollachi - 642 003. Tel: 04259-236030/40/50 Fax: 04259-236070 www.mcet.in

Programme: Department of Computer Applications(MCA)
2019 Regulations
Curriculum for Semesters I & II

Semester I

Course code	Course title	Hours / week			Credits	Max marks 100
		L	T	P		
19CAFN1101	Probability and Statistics	3	2	0	4	100
19CACN1101	Web Technology	3	0	0	3	100
19CACN1102	Programming in C	3	0	0	3	100
19CACN1103	Data Structures and Algorithms	3	0	0	3	100
19CACN1104	Database Management Systems	3	0	0	3	100
19CACN2101	Programming in C Laboratory	0	0	3	2	100
19CACN2102	Data Structures and Database Management Systems Laboratory	0	0	3	2	100
19CACN3101	Mini Project–I	0	0	6	3	100
XXXXXXXXX	One credit Course	0	0	2	1	100
	TOTAL	**15**	**2**	**14**	**24**	**900**

Semester II

Course code	Course title	Hours / week			Credits	Max marks 100
		L	T	P		
19CACN1201	Computer Networks	3	0	0	3	100
19CACN1202	Software Engineering	3	2	0	4	100
19CACN1203	Python programming	3	0	0	3	100
19CACN1204	Java Programming	3	0	0	3	100
XXXXXXXXX	Professional Elective – I	3	0	0	3	100
19CACN2201	Python programming Laboratory	0	0	3	2	100
19CACN2202	Java Programming Laboratory	0	0	3	2	100
19CACN3201	Mini Project –II	0	0	6	3	100
XXXXXXXXX	One Credit Course	0	0	2	1	100
	TOTAL	**15**	**2**	**14**	**24**	**900**

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BOS Chairman

Semester III

Course code	Course title	Hours / week			Credits	Max marks 100
		L	T	P		
	Machine Learning	3	2	0	4	100
	Cloud Computing	3	0	0	3	100
	Big Data Analytics	3	0	0	3	100
	Professional Elective – II	3	0	0	3	100
	Professional Elective –III(Online)	3	0	0	3	100
	Software Testing Laboratory	0	0	3	2	100
	Cloud and Big Data Analytics Laboratory	0	0	3	2	100
	TOTAL	**15**	**2**	**6**	**20**	**700**

Semester IV

Course code	Course title	Hours / week			Credits	Max marks 100
		L	T	P		
PRACTICAL COURSES						
	Project Work	-	-	24	12	100

Total Credits: 80

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BOS Chairman

Professional Electives

Course Code	Course title	Hours / week			Credits	Max marks 100
		L	T	P		
Networking						
19CAEN1001	Security in Computing	3	0	0	3	100
19CAEN1002	Block Chain Management	3	0	0	3	100
Databases Technology						
19CAEN1003	Database Architecture and Administration	3	0	0	3	100
19CAEN1004	Data Mining and Data Warehousing	3	0	0	3	100
19CAEN1005	Information storage and Management	3	0	0	3	100
19CAEN1006	Information Retrieval Techniques	3	0	0	3	100
Software and Management						
19CAEN1007	Software Project Management	3	0	0	3	100
19CAEN1008	Resource Management Techniques	3	0	0	3	100
19CAEN1009	Human Values and Professional ethics	3	0	0	3	100
19CAEN1010	Agile Software Development	3	0	0	3	100
Latest Technologies						
19CAEN1011	Evolutionary computing	3	0	0	3	100
19CAEN1012	Semantic Web Technologies	3	0	0	3	100
19CAEN1013	Business Intelligence	3	0	0	3	100
19CAEN1014	Internet of Things	3	0	0	3	100
19CAEN1015	Web Mining and Social Networking	3	0	0	3	100
19CAEN1016	Artificial Intelligence	3	0	0	3	100

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	User Interface Design					
19CAEN1017	Human Computer Interface	3	0	0	3	100
19CAEN1018	Visualization Techniques	3	0	0	3	100
	Operating Systems					
19CAEN1019	Advanced Operating systems	3	0	0	3	100
19CAEN1020	Unix and Networking Programming	3	0	0	3	100

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BOS Chairman

Course Code: 19CAFN1101	Course Title: Probability And Statistics		
Course Category: Foundation Courses	Course Level: Introductory		
L:T:P (Hours/Week) 3: 2: 0	Credits:4	Total Contact Hours:60	Max. Marks:100

Pre-requisites

> NIL

Course Objectives

The course is intended to:
1. Understand the basic probabilistic random variables and illustrate their related applications
2. Understand the probability distributions
3. Apply the statistical method for classification of data and statistical measures
4. Apply the hypothesis for small and large samples
5. Analyze the analysis of variances for design of experiments

Unit I   Random Variables   12 Hours

sample spaces – events – probability definition – conditional probability – total probability – Baye"s theorem - Random variable - Distribution function – discrete, continuous random variables – Probability mass function – Probability density function.

Unit II   Probability Distributions   12 Hours

Expectation – moments - moment generating functions – Discrete Distributions: Bernoulli trials – Binomial distribution – Poisson distribution – Continuous distributions: Exponential distribution - Normal distribution.

Unit III   Classification Of Data And Statistical Measures   12 Hours

Classification-Tabulation-Graphical representation – Simple bar chart – Pie chart - Measures of central tendency: Arithmetic Mean, Median and Mode – Measures of variation: Range, Quartile deviation - Standard deviation and Coefficient of variation.

Unit IV   Tests Of Hypothesis   12 Hours

Statistical hypothesis – Type I and Type II errors – Testing of hypothesis: One-tailed and two tailed Tests –t test for single mean and difference of mean – F-Test - Chi-square test for independence of attributes.

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Unit V   Analysis Of Variance   **12 Hours**

Analysis of Variance (ANOVA) – Completely Randomized Design (CRD) – Randomized Block Design (RBD) – Latin Square Design (LSD).

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Understand the concepts of random variables in probability	Understand
CO2: Understand the problems under probability distributions	Understand
CO3: Apply the measures of central tendency and dispersion for analysis of data	Apply
CO4: Apply various tests in hypothesis testing for small samples	Apply
CO5: Analyse experiments based on one-way, two-way and Latin square classifications	Analyze

Text Book(s):

T1. Ravichandran. J, "Probability and Statistics for Engineers", 2nd Edition,Wiley India Publication, 2010.

T2. Veerarajen. T, "Probability, Statistics and Random Process",1st Edition Tata McGraw Hill, 2006.

Reference Book(s):

R1. Freund John, E and Miller, Irvin, "Probability and Statistics for Engineering", Duxbury Press; 6th edition, 2003.

R2. Ross, Sheldon. M, "Introduction to Probability and Statistics for Engineers and Scientists", 3rd Edition, Academic Press, 2009.

Web Reference(s):

1. http://nptel.ac.in/downloads/111101004
2. http://nptel.ac.in/downloads/111105041/10
3. http://nptel.ac.in/downloads/111104079

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BOS Convener   BOS Chairman

Course Code: 19CACN1101	Course Title: Web Technology		
Course Category: Professional Core	Course Level: Practice		
L:T:P (Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max. Marks:100

Pre-requisites

> NIL

Course Objectives

The course is intended to:

1. Understand the concept of World Wide Web

2. Design the Web Pages

3. Apply the scripting concepts to perform operations on webpages

4. Apply the JavaScript concepts

5. Design the Web Pages using Document Object Model

Unit I	**Introduction To World Wide Web**	**9 Hours**

Internet Standards – Introduction to WWW – WWW Architecture – SMTP – POP3 – File Transfer Protocol - Overview of HTTP, HTTP request – response — Generation of dynamic web pages.

Unit II	**UI Design**	**9 Hours**

Markup Language (HTML): Introduction to HTML - Formatting and Fonts–Commenting Code– Anchors – Backgrounds – Images – Hyperlinks – Lists – Tables – Frames - HTML Forms.
Cascading Style Sheet (CSS): Introduction to CSS–Basic syntax and structure -Inline Styles – Embedding Style Sheets - Linking External Style Sheets – Backgrounds – Manipulating text - Margins and Padding - Positioning using CSS.

Unit III	**JavaScript**	**9 Hours**

Introduction - Core features - Data types and Variables - Operators, Expressions, and Statements - Functions - Objects - Array, Date and Math related Objects - Document Object Model - Event Handling- Controlling Windows & Frames and Documents - Form handling and validations.

Unit IV	**Java script Response Web Design**	**9 Hours**

Menu – Tabs – Navigations – drop downs – Image operations – Buttons

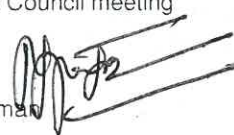| Unit V	**Advanced Response Web Design**	**9 Hours**

Forms- Filters – Tables –Tool tips – progress bars – count down timer - User ratings –Chat messages.

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BOS Chairman

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Understand the concept of WWW request & response for webpage development	Understand
CO2: Design the Webpages using HTML & CSS for real time applications	Apply
CO3: Apply the scripting operations on webpages for real time scenario	Apply
CO4: Apply javascript concepts for data processing	Apply
CO5: Design the webpages for dynamic operations using Document Object Model	Apply

Text Book(s):

T1. Harvey & Paul Deitel and Associates, Harvey Deitel and Abbey Deitel,‖ Internet and World Wide Web - How to Program‖, 5th Edition, Pearson Education, 2011.

T2. Thomas A Powell, Fritz Schneider,—JavaScript: The Complete Reference‖, 3rd Edition, Tata McGraw Hill, 2013.

Reference Book(s):

R1. Achyut S Godbole and AtulKahate,—Web Technologies‖, 2nd Edition, Tata McGraw Hill, 2012.

Web Reference(s):

1. http://nptel.ac.in/courses/106105084/
2. http://nptel.ac.in/video.php?subjectId=106105084

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BOS Convener

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BOS Chairman

Course Code: 19CACN1102	Course Title: Programming in C		
Course Category: Professional Core	Course Level: Practice		
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

 ➢ NIL

Course Objectives

The course is intended to:

1. Choose appropriate programming constructs
2. Construct programs using arrays and functions
3. Develop program using structures and unions
4. Apply the concepts of pointers
5. Develop program using file management

Unit I   Basics of C Language `   **9 Hours**

Overview of C Language - Constants, Variables and Data Types - Operators, Expressions and Assignment statements - Managing Input/Output Operations - Formatted I/O - Decision Making - Branching - IF, Nested IF - Switch - goto - Looping- while, do, for statements.

Unit II   Arrays and Functions   **9 Hours**

Arrays - dynamic and multi-dimensional arrays - Character arrays and Strings - String handling Functions - User defined Functions - Categories of Functions - Recursion.

Unit III   Structures and Unions   **9 Hours**

Basics of Structures-Declaring a Structure - Array of Structures- passing Structures elements to Functions - Passing entire Structure to Function - Structures within Structures - Union - Union of Structures - Enumerated Data Types - typedef Statement.

Unit IV   Pointers   **9 Hours**

Pointers - Declaration - Accessing a variable - Dynamic memory allocation - Pointers versus Arrays- Array of pointers- Pointers to functions and structure Pointers.

Unit V   File Management   **9 Hours**

File Management in C - Data hierarchy- Files and Streams - Sequential access file- Random access file – Preprocessors.

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Course Outcomes	
At the end of this course, students will be able to:	Cognitive Level
CO1: Use appropriate data types, variables, statements for solving problems	Apply
CO2: Construct program using arrays and functions for given problem	Apply
CO3: Develop program using structure and union for given problem	Apply
CO4: Apply the pointer concepts in real time application	Apply
CO5: Develop program using file management for real time problem	Apply

Text Book(s):

T1. Stephen G.Kochen,‖Programming in C: A Complete Introduction to the C programming Language‖, Third Edition, Pearson Education, 2008.

T2. Al Kelley, Ira Pohl,‖A Book on C: Programming in C‖, Fourth Edition, Addison- Wesley Professional, 2010.

Reference Book(s):

R1. YashavantP.Kanetkar,‖Understanding Pointers in C‖, BPB Publications,New Delhi, 2009.

R2. Byron C Gottried,‖Programming with C‖, Schuams_ Outline series, 2nd Edition,2006 3, M.T. Somashekara, —Programming in C‖, Prentice-Hall of India Pvt.Ltd, 2005.

R3. Richard Johnsonbaugh,‖Applications Programming In ANSI C‖, 3rd edition, Pearson Education, 2003.

Web References:

1. https://www.eskimo.com/~scs/cclass/notes/top.html
2. https://www.cs.cf.ac.uk/Dave/C/CE.html
3. https://onlinecourses.nptel.ac.in/iitk_cs_101/preview

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BOS Convener

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BOS Chairman

Course Code: 19CACN1103	Course Title: Data Structures And Algorithms		
Course Category: Professional Core	Course Level: Mastery		
L:T:P(Hours/Week) :3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

> NIL

Course Objectives
The course is intended to:
1. Illustrate the data structures such as linked lists, Stacks
2. Apply the different choice of trees
3. Apply the Searching, Sorting and Heap algorithms
4. Apply graph computations in shortest path algorithms
5. Analyze the efficiency of algorithms

Unit I **Linear Data Structures**   **9 Hours**
ADT - Linked Lists (Singly, Doubly and Circular) Implementation – Array, Pointer- Stack: Definition and Examples, Representing Stacks - Queues: Queue and its Representation – Applications of Stack, Queue and list.

Unit II **Nonlinear Data Structures**   **9 Hours**
Trees – General- Binary Tree - Binary Search trees- AVL Trees, B-Trees – Implementations – Tree Traversals. Hashing – Separate Chaining – Open Addressing – Rehashing – Extendible Hashing.

Unit III **Sort with Heaps**   **9 Hours**
General Background: Shell Sort-. Heap –Binary Heap – Leftist Heaps – Binomial Heaps – Fibonacci Heaps – Skew Heaps.

Unit IV **Graphs And Their Applications**   **9 Hours**
Graphs – Representation – Topological Sort - Shortest Path Algorithm -Dijkstra's algorithm- Network Flow Problem – Minimum Spanning Tree – Prim's Algorithm - Kruskal's Algorithm – Graph Traversals– Applications of Depth–First Search.

Unit V **Algorithm Design Techniques**   **9 Hours**
Design Techniques – Greedy Algorithm- Divide and Conquer: Closest Point- The Selection Problem– Dynamic Programming: Ordering Matrix Multiplication-Optimal Binary Search Tree- Backtracking Algorithms: Turnpike reconstruction problem.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	

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CO1:	Illustrate the data structures such as linked lists, Stacks and Queues for real world applications	Understand
CO2:	Apply the different choice of trees that effectively model the information in a problem	Apply
CO3:	Apply the Sorting with Heaps for efficient management of data	Apply
CO4:	Apply graph computations in shortest path algorithms for real word problems	Apply
CO5:	Analyze the efficiency of algorithms of greedy, divide and conquer and dynamic programming for problem solving	Analyze

Text Book(s):

T1. M. A. Weiss,"Data Structures and Algorithm Analysis in C",2nd Edition, Pearson Education,2011.

T2. NarasimhaKarumanchi ,"Data Structures and Algorithms", Career Monk Publications, 5th Edition 2016.

Reference Book(s):

R1. Data Structures using C, ISRD Group, Second Edition, McGraw Hill 2013.

R2. T.H. Cormen, C. E. Leiserson, R. L. Rivest, and C. Stein," Introduction to Algorithms",3rd Edition, Prentice Hall of India Ltd, 2009.

R3. V. Aho, J. E. Hopcroft, and J. D. Ullman,"Data Structures and Algorithms" ,Pearson Education, Reprint Edition 2006.

Web References:

1. http://nptel.ac.in/courses/106104019/
2. https://www.coursera.org/specializations/data-structures-algorithms
3. https://online-learning.harvard.edu/course/data-structures-and-algorithms

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BOS Convener

BOS Chairman

Course Code: 19CACN1104	**Course Title: Database Management Systems**
Course Category: Professional Core	**Course Level: Mastery**
L:T:P(Hours/Week) **3: 0: 0**	**Credits:3**	**Total Contact Hours:45**	**Max Marks:100**

Pre-requisites

  > NIL

Course Objectives

The course is intended to:
1. Illustrate the basic concepts of database systems
2. Build the SQL queries and authorization mechanism
3. Construct a relational database using ER model and normalization
4. Apply the concepts of database storage structure and access techniques
5. Develop a web application with database connection

Unit I   Introduction to Relational Databases   9 Hours

Database System Applications – Purpose of Database systems – View of Data – Database Languages– Relational Databases – Database Design – Data Storage and Querying – Transaction Management – Database Architecture – Database Users and Administration - Structure of Relational Databases – Database Schema – Keys – Schema Diagrams – Relational Query Languages – Relational Operations.

Unit II   SQL   9 Hours

Overview of the SQL Query Language – SQL Data Definition – Basic Structure of SQL Queries- Additional Basic Operations - Aggregate Functions – Nested Sub queries – Set Operations - Modification of the Database - Join Expressions – Views – Transactions – Integrity Constraints – SQL data types and Schemas – Authorization – Accessing SQL from a programming language – Functions and procedures – Triggers – Relational Algebra – Tuple relational calculus – Domain relational calculus.

Unit III   Database Design   9 Hours

Entity Relationship model – constraints – Entity Relationship Diagrams – Features of Good Relational Designs – Atomic Domains and First Normal Form – Decomposition using Functional Dependencies – Functional Dependency Theory – Algorithms for Decomposition – Decomposition using Mutivalued dependencies.

Unit IV   Data Storage And Querying   9 Hours

RAID – Ordered Indices – B+ Tree Index Files – B+ Tree Extensions – Multiple Key Access – Static Hashing – Dynamic Hashing – Measures of Query Cost – Selection Operations – Sorting – Join Operations – Overview of Query Optimization – Transformation of Relational Expressions – Estimating Statistics of Expression Results – Choice of Evaluation Plans.

Unit V   Web Application with Database   9 Hours

C# and the .NET Framework - The .NET Platform- The .NET Framework- Compilation and the MSIL-
The C# Language- Programming Web Applicationswith Web Forms- Creating a Web Form- Adding
Controls- Data Binding- Connecting to the Database - Responding to Postback Events- ASP.NET and
C#.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Illustrate the principles of Database systems and fundamentals of relational model	Understand
CO2: Build the SQL queries and authorization mechanism in relational tables.	Apply
CO3: Construct relational database using ER model and normalization for real world problems .	Apply
CO4: Apply the concepts of database storage structure and access techniques	Apply
CO5: Develop a web application with database connection for real time scenario	Apply

Text Book(s):

T1. Abraham Silberschatz, HentryF.Korth and S.Sudharssan,"Database System Concepts", 6th Edition, Tata McGraw Hill, 2011(Unit I,II,III IV)

T2. Jesse Liberty ,"Programming C#",Second Edition, O'Reilly Media,2012.(Unit V)

Reference Book(s):

R1. Raghu Ramakrishna & Johannes Gerhrke, "Database Management System", McGrawHill,3rd Edition, 2010.

R2. C. J. Date,"An Introduction to Database Systems", Eigth Edition, Addison-Wesley, 2003.

R3. RamezElmasri and Shamkant B.Navathe,"Fundamental Database Systems",3rd Edition,Pearson Education,2010.

R4. Mario Szpuszta, Matthew MacDonald,"Pro ASP.NET 4 in C# 2010",3rd Edition, Apress,2010

Web References:

1. http://nptel.ac.in/courses/106106093/
2. https://www.classcentral.com/course/swayam-database-management-system-9914

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BOS Convener   BOS Chairman

Course Code: 19CACN2101	Course Title: Programming in C Laboratory	
Course Category: Professional Core	Course Level: Practice	
L:T:P(Hours/Week) 0: 0: 3	Credits:2	Total Contact Hours:45	Max Marks:100

Pre-requisites
 ➢ NIL

Course Objectives

The course is intended to:

1. Apply the concepts of looping statements.
2. Use decision statements and functions concepts
3. Implement applications using Arrays and Pointers.
4. Apply Structure and Files for developing applications
5. Develop applications using Functions and Files

List of Excersises:

1. Develop Programs using Input, output, assignment statements and looping statements
2. Develop Programs using Functions and decision statements
3. Implement Programs using arrays and pointers for sorting the values
4. Design application using structures and file for storing, retrieving data in the form of reports
5. Develop applications using Functions and file for text processing

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply the concepts of looping statements for performing string manipulations	Apply
CO2: Use decision statements and functions for date manipulation functions	Apply
CO3: Implement applications using arrays and pointers	Apply
CO4: Apply Structure and Files for generation of reports	Apply
CO5: Develop applications using Functions and file for text processing	Apply

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BOS Convener   BOS Chairman

Text Book(s):

T1. Stephen G.Kochen,‖Programming in C: A Complete Introduction to the C programming Language‖, 3rd Edition, Pearson Education, 2008.

T2. Al Kelley, Ira Pohl,‖A Book on C: Programming in C‖, 4th Edition, Addison- Wesley Professional, 2010.

Reference Book(s):

R1. YashavantP.Kanetkar,‖Understanding Pointers in C‖, BPB Publications,New Delhi, 2009.

R2. Byron C Gottried,‖Programming with C‖, Schuams_ Outline series, Second Edition,2006 3, M.T. Somashekara, ―Programming in C‖, Prentice-Hall of India Pvt.Ltd, 2005.

R3. Richard Johnsonbaugh,‖Applications Programming In ANSI C‖, Third edition, Pearson Education, 2003.

Web References:

1. https://www.eskimo.com/~scs/cclass/notes/top.html
2. https://www.cs.cf.ac.uk/Dave/C/CE.html
3. https://onlinecourses.nptel.ac.in/iitk_cs_101/preview

Passed in Board of Studies meeting

BOS Convener

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BOS Chairman

Course Code: 19CACN2102	Course Title: Data Structures And Database Management Systems Laboratory		
Course Category: Professional Core	Course Level: Practice		
L:T:P(Hours/Week) 0: 0: 3	Credits:2	Total Contact Hours:45	Max Marks:100

Pre-requisites

> NIL

Course Objectives

The course is intended to:

1. Design and implement linear and nonlinear data structures
2. Choose graph traversal for real time problems
3. Design a web based application provided with exceptions and cursors
4. Apply the concept of triggers with database connectivity

List of Exercises

1. Develop applications using stack and Queue
2. Implement applications using various lists
3. Apply the graph to find shortest path
4. Develop a web-based database application system using the concept of exceptions
5. Design and implement a database application using the concept of cursors
6. Develop a real time application with database connectivity using triggers

Course Outcomes	
At the end of this course, students will be able to:	Cognitive Level
CO1: Design and implement linear and nonlinear data structures for solving problems	Apply
CO2: Choose graph traversal to find the shortest Path Problems.	Apply
CO3: Design a web based application provided with exceptions and cursors	Apply

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	for the real time scenario	
CO4:	Apply the concept of triggers with database connectivity for web based application	Apply

Text Book(s):

T1. M. A. Weiss,"Data Structures and Algorithm Analysis in C",2nd Edition, Pearson Education,2011.

T2.Abraham Silberschatz, HentryF.Korth and S.Sudharssan,"Database System Concepts", 6th Edition, Tata McGraw Hill, 2011.

Reference (s):

R1. Structures using C, ISRD Group, 2nd Edition, McGraw Hill 2013.

R2. Data Structures And Database Management system Laboratory–Manual.

R3. Raghu Ramakrishna & Johannes Gerhrke, "Database Management System", McGrawHill,3rd Edition, 2010.

Web References:

1. http://nptel.ac.in/courses/106106093/
2. https://www.coursera.org/specializations/data-structures-algorithms

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Course Code: 19CACN1201	Course Title: Computer Networks		
Course Category: Professional Core	Course Level: Mastery		
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

> NIL

Course Objectives

The course is intended to:

1. Explain the basic components of networks model
2. Utilize the error detection techniques and network architecture provided in the data link layer
3. Apply the routing algorithm to find the best route
4. Select the suitable transport layer protocol and congestion control mechanism
5. Apply the concepts of application layer protocols and services provided in the network

Unit I   Data Communications   **9 Hours**

Data Communications –Components –Data flow – Physical structures – Network types – Network Models ISO/OSI model–TCP/IP Model –Line Coding- Transmission Media

Unit II   Data Link Layer   **9 Hours**

Error – Detection and Correction – Data Link Control-Flow control-Simple Protocol-Stop and Wait Protocol – Ethernet- IEEE 802.3- 802.11 – Connecting Devices –VLAN.

Unit III   Network Layer   **9 Hours**

Services –Switching concepts – Circuit switching – Packet switching –IP-Datagram-Ipv4 Address–Subnetting- Network Address Translation (NAT)-Ipv6–ICMP-Routing Algorithms – Distance-Vector Routing- Link-State Routing-BGP.

Unit IV   Transport Layer   **9 Hours**

Transport layer –services –Connection establishment – Flow control – Transmission control protocol – Congestion control and avoidance – User datagram protocol. –Transport for Real Time Applications (RTP).

Unit V   Application Layer   **9 Hours**

Applications – DNS – SMTP – FTP –WWW – SNMP- Security –RSA- DES –Web security –SSL --PGP-Firewall.

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Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Explain the basic components of networks model for data communication	Understand
CO2: Utilize the error detection techniques and network architecture provided in the data link layer for a given scenario.	Apply
CO3: Apply the routing algorithm suitable for a given network.	Apply
CO4: Select the suitable transport layer protocol and congestion control mechanism for a given traffic scenario.	Apply
CO5: Apply the concepts of application layer protocols and services provided in the network based on the requirements of an application	Apply

Text Book(s):
T1. BehrouzA.Forouzan ," Data Communications and Networking", 5th Edition, McGraw Hill, 2013.

Reference Book(s):
R1. William Stallings, Data and Computer Communications, 9th Edition, Prentice Hall, 2011.
R2. Larry L. Peterson & Bruce S. Davie, Computer Networks – A systems Approachll, 4th Edition, Harcourt Asia / Morgan Kaufmann, 2008.
R3. Andrew S.Tannenbaum David J. Wetherall, Computer Networksll 5th Edition, Pearson Education 2011.
R4. James F. Kurose, Keith W. Ross, Computer Networking: A Top-down Approach, Pearson Education, Limited, 6th Edition,2012.

Web References:
1. https://nptel.ac.in/courses/106/106/106106091/
2. https://www.classcentral.com/course/fundamentals-network-communications-9267

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Course Code: 19CACN1202	Course Title: Software Engineering		
Course Category: Professional Core	Course Level: Mastery		
L:T:P(Hours/Week) 3: 2: 0	Credits:4	Total Contact Hours:60	Max Marks:100

Pre-requisites

> ➢ NIL

Course Objectives

The course is intended to:

1. Understand the concepts of linear Generic & Prescriptive Process, Agile Process & Extreme Programming.
2. Understand the software requirements and design
3. Draw the diagrams using notations unified modeling language.
4. Analyze the various testing strategies and SCM.
5. Analyze the software quality management

Unit I   Introduction   **12 Hours**

Introduction to Software Engineering – Prescriptive Process Models: Waterfall, Incremental, Prototyping, and Spiral Model – Agile Development: Agile Process – Scrum.

Unit II   Software Requirements & Design   **12 Hours**

Requirements Modeling: Scenario–Based, Data- based, Class–Based, Flow–Oriented, Behavioral Modeling. Software Design: Design Models.

Unit III   Unified Modeling Language   **12 Hours**

Introduction – Use case – Class diagram - Sequence Diagram -Package Diagram - State Machine Diagram - Activity Diagram - Collaboration Diagram – Interaction Diagram.

Unit IV   Testing And Maintenance   **12 Hours**

Test Strategy for Conventional Software: unit testing – Integration Testing. Validation Testing: validation test criteria –Alpha and Beta Testing. System Testing- Recovery Testing – stress Testing- performance Testing. Testing Conventional Applications: White box testing – Black box testing. Software Configuration Management: SCM Repository –SCM Process.

Unit V   Quality Management   **12 Hours**

Review techniques: cost impact of software defects - review metrics and their use- formal technical reviews. Software quality assurance: sqa tasks, goals, and metrics - software reliability.

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Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Understand the concepts of linear Generic & Prescriptive Process, Agile Process & Extreme Programming for software life cycle.	Understand
CO2: Understand the software requirements and design for real time projects.	Understand
CO3: Draw the diagrams using notations unified modelling language for real time projects.	Apply
CO4: Apply the various testing strategies and SCM for real time projects	Apply
CO5: Analyze the software quality management for real time projects	Apply

Text Books:
T1. Roger Pressman S," Software Engineering: A Practitioner's Approach", Tata McGraw Hill, 7th Edition, 2010.
T2. Martin Fowler,"UML Distilled" ,Pearson Education, 3rd Edition,2003.(Reprint)

Reference Books:
R1. Ian Sommerville,"Software Engineering", Pearson Education, 9th Edition, 2010.
R2. Pfleeger and Atlee,"Software Engineering", Pearson Education, 4th Edition, 2009

Web References:
1. http://nptel.ac.in/courses/106105087/
2. http://nptel.ac.in/courses/106101061/

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Course Code: 19CACN1203	Course Title: Python Programming		
Course Category: Professional Core	Course Level: Mastery		
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

➢ 19CACN1102 Programming in C

Course Objectives

The course is intended to:
1. Demonstrate the basic features of the python language.
2. Apply the data structure concepts in python.
3. Apply the object oriented features and GUI designing using tkinter in python.
4. Apply the concepts of web development in python using Django framework.
5. Apply the python libraries and data visualization concepts in data analysis.

Unit I   Introduction to Python   9 Hours

Variables, Expressions and Statements – Functions - Interface Design-Conditionals and Recursion Fruitful Functions- Iteration.

Unit II   Data Structures in Python   9 Hours

Strings - Word Play – Lists – Dictionaries - Tuples- Data Structure Selection - Files.

Unit III   Oops Concepts in Python   9 Hours

Classes and Objects - Classes and Functions - Classes and Methods – Inheritance - Tkinter: GUI - Buttons and Callbacks - Canvas Widgets-Coordinate Sequences - More Widgets - Packing Widgets - Menus and Callable – Binding.

Unit IV   Web Development in Python   9 Hours

Django on web-creating a Django project-Hello world with Django-Working with templates-Working with models-working with Django forms.

Unit V   Data Analysis in Python   9 Hours

Data analysis and processing – Overview of libraries in data analysis-Python libraries in data analysis Numpy arrays and vectorized computation-Data analysis with Pandas-Data visualization.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Demonstrate the basic features of the python language using variables, expressions and functions.	Apply

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CO2: Apply the data structure concepts in python for an application using list, tuples and dictionaries.	Apply	
CO3: Apply the object oriented features using tkinter in python for GUI based application.	Apply	
CO4: Apply the concepts of web development in python using Django framework for website development.	Apply	
CO5: Apply the python libraries and data visualization concepts in data analysis for real time scenario.	Apply	

Text Book(s):

T1. Allen Downey, "Think Python" ,Second Edition, Green Tea Press, 2012(Unit I,II,III)

T2.Samuel Dauzon, AidasBendoraitis, ArunRavindran, "Django:Web Development with python",packt,2016(Unit IV)

T3. Phuong Vo.T.H,MartinCzygan,"Getting started with python Data Analysis",packt publishing,2015(Unit V)

Reference Book(s):

R1. Laura Cassell, Alan Gauld, "Python Projects", Wrox Publication,2015

R2. Jeffrey Elkner, Chris Meyers Allen Downey, "Learning with Python",Fourth Edition Dream Tech Press Publication,2015

R3. Adrian Holovaty, Jacob Kaplan-Moss, et al,"TheDjango Book" Release 2.0,2013

R4. Wes McKinney,"Python for Data Analysis", First Edition, O'Reilly Publication, 2013.

Web References:

1. https://www.coursera.org/learn/python
2. https://pythonprogramming.net/design-bootstrap-django-python-tutorial/
3. https://pythonprogramming.net/data-analysis-python-pandas-tutorial-introduction/

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Course Code: 19CACN1204	Course Title: Java Programming		
Course Category: Professional Core		Course Level: Mastery	
L:T:P(Hours/Week) 3: 0:0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

> 19CACN1102 Programming in C

Course Objectives
The course is intended to:
1. Apply the operators, control structures, classes and objects
2. Apply the exception handling and multithreading
3. Apply the various collections.
4. Apply the various string manipulation functions.
5. Apply the AWT concepts.

Unit I   Java Fundamentals & Classes   9 Hours
Java Fundamentals: Introduction – Overview of Java virtual machine- Data types, variable, arrays, expressions, operators, and control structures. Classes and Objects: Classes – Objects – Abstract classes- Static classes- Inner classes- Method Overloading- Inheritance, Constructors and Method Overriding.

Unit II   Packages , Exceptions And Threads   9 Hours
Packages - Packages and Access Protection Exception Handling: try and catch block - Multiple catch block -Nested try - finally block - throw keyword - Exception Propagation - throws keyword - Custom Exception. Multithreading:Life Cycle of a Thread - Creating Thread- Thread Scheduler - Sleeping a thread - Thread priorities and synchronization – inter-thread communication –Multi-threading.

Unit III   Java Utilities   9 Hours
Collections overview - classes and interfaces - Iterator and User-defined classes - comparators and collection algorithms- Arrays, generic collections, legacy classes and interfaces - String tokenizer.

Unit IV   Input Output Streams   9 Hours
Java I/O classes and Interfaces - File Concepts - Stream class: byte stream and character stream – Serialization - String handling: String operations - String comparison: Searching, Modifying and Conversion.

Unit V   AWT and Event Handling   9 Hours
Applet class: Basics and Architecture - HTML tags - Event handling - Event listener interfaces - - AWT classes and Window fundamentals – AWT controls.

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Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply the operators, control structures, classes and objects in the given problem	Apply
CO2: Apply the exception handling and multithreading in given problem	Apply
CO3: Apply the collection classes and interfaces in given applications.	Apply
CO4: Apply the string and string buffer classes in the given problem.	Apply
CO5: Develop an application using AWT controls	Apply

Text Book(s):
T1. H. M.Deitel, P. J. Deitel,"Java How to Program", 9th Edition, Prentice Hall, 2014.
T2. H. M.Deitel, P. J. Deitel, S. E. Santry," Advanced Java 2 Platform How to program", Prentice Hall, 2007.

Reference Book(s):
R1. Antonio Goncalves, "Beginning Java EE 7", Apress publication, 2013.
R2. Herbert Schildt,"The Complete Reference JAVA2", 9th edition, Tata McGraw-Hill, 2014.

Web References:
1. http://www.tutorialspoint.com/java

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Course Code: 19CACN2201	Course Title: Python Programming Laboratory		
Course Category: Professional Core	Course Level: Practice		
L:T:P(Hours/Week) 0: 0:3	Credits:2	Total Contact Hours:45	Max Marks:100

Pre-requisites

➢ 19CACN1102 Programming in C

Course Objectives

The course is intended to:

1. Apply the tkinter package in python
2. Implement the packages using Django framework
3. Develop a project using django with database connection
4. Build the numpy packages in python
5. Apply the pandas library in python

List Of Exercises

1. Develop a simple GUI database application using tkinter package.
2. Install and configure the packages required to develop a website using Django.
3. Develop a Django project working with database connection.
4. Implement the numpy packages for arrays in python.
5. Experiment with pandas library to perform data analysis in python.

Course Outcomes	Cognitive
At the end of this course, students will be able to:	Level
CO1: Apply the tkinter package in python for GUI application	Apply
CO2: Implement the packages using Django framework for website development.	Apply
CO3: Develop a django project with database connection for real time application	Apply
CO4: Build the numpy packages for arrays in python.	Apply
CO5: Apply the pandas library for data analysis in python	Apply

Text Book(s):

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T1. Allen Downey, "Think Python" ,Second Edition, Green Tea Press, 2012(Unit I,II,III)

T2.Samuel Dauzon, AidasBendoraitis, ArunRavindran, "Django:Web Development with python",packt,2016(Unit IV)

T3. Phuong Vo.T.H,MartinCzygan,"Getting started with python Data Analysis",packt publishing,2015(Unit V)

Reference Book(s):

R1. Laura Cassell, Alan Gauld, "Python Projects", Wrox Publication,2015

R2. Jeffrey Elkner, Chris Meyers Allen Downey, "Learning with Python",Fourth Edition Dream Tech Press Publication,2015

R3. Adrian Holovaty, Jacob Kaplan-Moss, et al,"TheDjango Book" Release 2.0,2013

R4. Wes McKinney,"Python for Data Analysis", First Edition, O'Reilly Publication, 2013.

Web References:

1. https://www.coursera.org/learn/python
2. https://pythonprogramming.net/design-bootstrap-django-python-tutorial/
3. https://pythonprogramming.net/data-analysis-python-pandas-tutorial-introduction/

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Course Code: 19CACN2202	Course Title: Java Programming Laboratory		
Course Category: Professional Core	Course Level: Practice		
L:T:P(Hours/Week) 0 : 0 : 3	Credits:2	Total Contact Hours:45	Max Marks:100

Pre-requisites

> 19CACN1102 Programming in C

Course Objectives

The course is intended to:

1. Develop an application using control structures and OOPS concepts.
2. Develop an application using Multithread
3. Develop an application using Collection and Exception handling
4. Develop an application using Event handling
5. Develop an application using JDBC

List of Experiments:

1. Develop an application using custom Package
2. Develop an application using Multithreading with synchronization
3. Develop an application using Collection and Exception Handling
4. Develop an application using AWT controls and Event Handling functions.

5. Develop an application with JDBC

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply the various OOPS concepts in a real time application	Apply
CO2: Develop an application using Multithreading for real time problem.	Apply
CO3: Develop an application using Collections for real time problem.	Apply
CO4: Develop an application using Event Handling for real time problem.	Apply
CO5: Develop an application using JDBC for real time problem.	Apply

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Text Book(s):

T1. H. M.Deitel, P. J. Deitel,"Java How to Program", 9th Edition, Prentice Hall, 2014.
T2. H. M.Deitel, P. J. Deitel, S. E. Santry," Advanced Java 2 Platform How to program", Prentice Hall, 2007.

Reference Book(s):

R1. Antonio Goncalves, "Beginning Java EE 7", Apress publication, 2013.
R2. Herbert Schildt,"The Complete Reference JAVA2", 9th edition, Tata McGraw-Hill, 2014.

Web References:

    1.   http://www.tutorialspoint.com/java

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List Of Professional Electives

Course Code: 19CAEN1001	Course Title: Security In Computing		
Course Category: Professional Elective	Course Level: Mastery		
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Prerequisites
  ➤ 19CACN1201 Computer Networks

Course Objectives
The course is intended to:
1. Apply the encryption standards and symmetric cipher techniques.
2. Apply the public key Encryption Algorithm.
3. Develop the Digital Signatures and Hash Algorithm.
4. Build the Key Generation and Distribution Algorithm.
5. Apply the concepts of Computer Security.

Unit I   **Introduction to Security and Encryption Techniques**   **9 Hours**
Overview - Computer Security Concepts - the OSI security architecture –Security Attacks-Security Services-Security Mechanisms - Classical Encryption techniques- Block Ciphers and the Data Encryption Standard.

Unit II   **Public Key Encryption Algorithms**   **9 Hours**
Number Theory - Public-Key cryptography and RSA – Diffie-Hellman Key Exchange – ElGamal Cryptographic system- Elliptic Curve arithmetic - Elliptic Curve Cryptography (ECC).

Unit III   **Digital Signatures And Hash Algorithms**   **9 Hours**
Cryptographic Hash functions-Message authentication codes-Security of MACs-MAC based on Hash Functions:HMAC-MACs based on Block cipher:DAA and CMAC-Digital Signatures.

Unit IV   **Key Management and Distribution**   **9 Hours**
Symmetric Key Distribution Using Symmetric Encryption- Symmetric Key Distribution Using Asymmetric Encryption-Distribution of Public Keys-X.509 Certificates-Public-Key Infrastructure-User Authentication.

Unit V   **Security At Layers And Computer Security**   **9 Hours**
Network Access control-Data Protection in the cloud-Cloud security as a Service-Transport layer security-HTTPS-Secure Shell(SSH)-Wireless Security - Mobile Device Security-Pretty Good Privacy-IP Security.

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Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply the encryption standards and symmetric cipher techniques for the given input text	Apply
CO2: Apply the public key Encryption Algorithm to solve the given problem	Apply
CO3: Develop the Digital Signatures and Hash Algorithm for the given input message	Apply
CO4: Build the Key Generation and Distribution Algorithm for a real time application	Apply
CO5: Apply the concepts of Computer Security for data communication	Apply

Text Book(s):
T1. William Stallings,"Cryptography and Network Security", 6th Edition, Pearson Education, March 2014.

Reference Book(s):
R1. Charles P Pfleeger and Shari Pfleeger, "Security in Computing", Pearson Education, 2009
R2. Bruce Schneier, "Applied Cryptography", John Wiley, 2008.
R3. Douglas R Simson "Cryptography – Theory and practice", Third Edition, CRC Press, 2006.
R4. Man Young Rhee, "Internet Security: Cryptographic Principles", "Algorithms and Protocols", Wiley Publications, 2003.

Web References:
1. http://nptel.ac.in/courses/106105031/
2. http://williamstallings.com/Cryptography/
3. https://www.cse.iitk.ac.in/users/braman/cs425/slides/security-overview.pdf

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Course Code: 19CAEN1002	Course Title: Block Chain Management		
Course Category: Professional Elective	Course Level: Mastery		
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Prerequisites

➢ 19CACN1201 Computer Networks

Course Objectives

The course is intended to:
1. Understand the fundamentals of Block chain management
2. Understand the block chain contracts.
3. Understand the block chain 3.0
4. Apply the block chain management learning for applications
5. Apply the emerging technologies in advanced concepts

Unit I   Block Chain Currency 1.0   **9 Hours**

Technology stack : block chain, Protocol, currency – How a crypto currency works- summary: Relation to fat currency- Regulatory status.

Unit II   Block Chain 2.0 :Contracts   **9 Hours**

Financial Services- Crowd funding – Bitcoin markets- Smart property –smart contracts –wallet Development Projects – Block Development Platforms and API.

Unit III   Block Chain 3.0   **9 Hours**

Namecoin -Digital Identify verification- Digital Art –Block chain Government.

Unit IV   Block Chain 3.0   **9 Hours**

Global public health –block chain genomics- block health – block chain learning – block academic publishing.

Unit V   Advanced Concepts   **9 Hours**

Terminology and concepts –currency, token, tokenizing –currency multiplicity –Demurrage currencies.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Understand the fundamentals of Block chain management for real applications.	Understand
CO2: Understand the block chain contracts for real applications.	Understand
CO3: Understand the block chain 3.0 for real applications.	Apply
CO4: Apply the block chain management learning for real applications.	Apply
CO5: Apply the emerging technologies in advanced concepts for real applications.	Apply

Text Book(s):
T1. Melanie Swan," Block Chain",O Reilly publisher ,2015.
Reference Book(s):
R1. Manav Gupta, "Block chain for dummies" IBM Limited Edition,2017.
R2. Sainul Abideen ,"Block chain Expert– E-Book", Cybrosys technologies, 2014.
Web References:
1. https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-cs01/

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Course Code: 19CAEN1003	Course Title: Database Architecture And Administration		
Course Category: Professional Elective	Course Level: Mastery		
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Prerequisites

> 19CACN1104 Database Management Systems

Course Objectives

The course is intended to:
1. Explain the Oracle 11g Database architecture.
2. Describe the logical, memory, and physical structures of a Database.
3. Infer the Monitoring space usage.
4. Execute the Transactions with undo table spaces and Tuning
5. Apply the backup and recovery operations

Unit I   Oracle 11g Architecture   8 Hours

An Overview of Databases and Instances - Oracle Logical Storage Structures - Oracle Logical Database Structures.

Unit II   Physical & Memory Structures   9 Hours

Oracle Physical Storage Structures - Multiplexing Database Files - Oracle Memory Structures - Backup/Recovery overview.

Unit III   Monitoring Space Usage   9 Hours

Common Space Management Problems - Oracle Segments, Extents, and Blocks - Data Dictionary Views and Dynamic Performance Views.

Unit IV   Managing Transactions With Undo Table Spaces &Tuning   9 Hours

Transaction Basics - Undo Basics - Rollback - Managing Undo Table spaces - Database Tuning: Tuning Application Design - Tuning SQL - Tuning Memory Usage.

Unit V   Backup And Recovery Options & RMAN   10 Hours

Logical Backups - Physical Backups - Using Data Pump Export and Import - Data Pump Import Options - Integration of Backup Procedures - Using Recovery Manager (RMAN): RMAN Features and Components - Overview of RMAN Commands and Options - Backup Operations - Recovery Operations.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	

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CO1:	Explain the Oracle 11g Database architecture.	Understand
CO2:	Describe the logical, memory, and physical structures of a database.	Understand
CO3:	Infer the Monitoring space usage in a Database administration.	Understand
CO4:	Execute the Transactions with undo table spaces and Tuning for administration of databases.	Apply
CO5:	Apply the Backup and Recovery Operations for administration of databases.	Apply

Text Book(s):

T1. Bob Bryla , Kevin Loney, "Oracle Database 11g DBA Handbook", Oracle Press, McGraw-Hill Edition 2008.

Reference Book(s):

R1. Thomas Kyte, "Expert Oracle Database Architecture 9i and 10g Programming Techniques and Solutions", Apress, 2010.

R2. Iggy Fernandez, "Beginning Oracle Database 11g Administration from Novice to Professional", Apress 2009.

R3. John Watsonoca, "Oracle Database 11g:Administration 1 Exam guide", Tata McGraw Hill,Editon 2008.

Web References:

1. http://www.oracle-dba-online.com/
2. http://nptel.ac.in/courses/106106093/

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Course Code: 19CAEN1004		Course Title: Data Mining And Data Warehousing	
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Prerequisites

➢ 19CACN1104 Database Management Systems

Course Objectives

The course is intended to:

1. Explain the architecture of data warehousing
2. Explain the various pre-process steps in data mining
3. Develop the classification algorithms in data mining
4. Apply the various clustering algorithms in data mining
5. Apply data mining techniques in spatial data analysis.

Unit I   Introduction To Data Warehouse   9 Hours

Data Warehousing and Business Analysis: - Data warehousing Components –Building a Data warehouse – Mapping the Data Warehouse to a Multiprocessor Architecture – DBMS Schemas for Decision Support – Data Extraction, Cleanup, and Transformation Tools –Metadata – reporting – Query tools and Applications – Online Analytical Processing (OLAP) – OLAP and Multidimensional Data Analysis.

Unit II   Data Mining & Data Preprocessing   9 Hours

Data Mining: - Data Mining Functionalities – Data Preprocessing – Data Cleaning – Data Integration and Transformation – Data Reduction – Data Discretization and Concept Hierarchy Generation. Association Rule Mining: Efficient and Scalable Frequent Item set Mining Methods – Mining Various Kinds of Association Rules – Association Mining to Correlation Analysis – Constraint-Based Association Mining.

Unit III   Classification & Prediction   9 Hours

Classification and Prediction: - Issues Regarding Classification and Prediction – Classification by Decision Tree-Bayesian Classification – Rule Based Classification – Classification by Back propagation – Support Vector Machines – Associative Classification – Lazy Learners – Other Classification Methods – Prediction – Accuracy and Error Measures – Evaluating the Accuracy of a Classifier or Predictor – Ensemble Methods – Model Section.

Unit IV   Clustering   9 Hours

Cluster Analysis: - Types of Data in Cluster Analysis – A Categorization of Major Clustering Methods – Partitioning Methods – Hierarchical methods – Density-Based Methods – Grid-Based Methods – Model-Based Clustering Methods – Clustering High Dimensional Data – Constraint-Based Cluster Analysis – Outlier Analysis.

Unit V   Spatial Data Analysis   9 Hours

Mining Object, Spatial, Multimedia, Text and Web Data: Multidimensional Analysis and Descriptive Mining of Complex Data Objects – Spatial Data Mining – Multimedia Data Mining – Text Mining – Mining the World Wide Web.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Describe the various architectures and main components of a data warehouse	Understand
CO2: Explain the data mining pre-process steps for solving real time problems	Understand
CO3: Develop the classification algorithms for analyze a given data set.	Apply
CO4: Apply the various clustering techniques for partition a given data set.	Apply
CO5: Apply data mining techniques for analyze the spatial, multimedia, text and web data.	Apply

Text Book(s):

T1. Jiawei Han and Micheline Kamber, Data Mining: Concepts and Techniques, Third Edition, Morgan Kaufmann Publishers, 2011.

Reference Book(s):

R1. Alex Berson and Stephen J. Smith, Data Warehousing, Data Mining & OLAP, Tata McGrawHill, 2008.

R2. Sean Kelly, Data Warehousing in Action, John Wiley & Sons Inc., 2007.

R3. Ralph Kimball, The Data Warehouse Life Cycle Toolkit, John Wiley & Sons, Second Edition, 2008.

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Course Code: 19CAEN1017	Course Title: Human Computer Interface		
Course Category:Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Prerequisite

> 19CACN1101 Web Technology
> 19CACN1204 Java Programming

Course Objectives

The course is intended to:
1. Understand the foundations & design of hci with evaluation techniques
2. Apply the Multimedia UI Design with its architecture, navigation and media selection
3. Understand the Mobile architecture, applications and mobile elements
4. Apply the concepts of front end Web designing interfaces
5. Analyze the aspects of advanced Web designing interfaces

Unit I   Foundations & Design Of HCI   10 Hours

Interaction Models – Frameworks – Ergonomics – Styles – Elements – Interactivity Paradigms. HCI in software process – Software life cycle – Prototyping – Evaluation Techniques- Universal Design.

Unit II   Multimedia UI   9 Hours

Interactive Design basics – process – scenarios – navigation – screen design – Iteration and prototyping. Multimedia UI :Multimedia User Interface Design - Information Architecture - Media Selection and Combination - Interaction and Navigation.

Unit III   Mobile HCI   9 Hours

Mobile Ecosystem: Platforms, Application frameworks- Types of Mobile Applications: Widgets-Applications- Games- Mobile Information Architecture- Mobile 2.0.

Unit IV   Web Interface Design   8 Hours

Drag & Drop- Direct Selection- Contextual Tools- Overlays & its types- Inlays && its types - Virtual Pages.

Unit V   Advanced Web Interface Design   9 Hours

Process Flow – Google blogger –Interactive single page process- Inline assistant process- dialog overlay process-static single page process.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Describe the type and behavior for given agent.	Understand
CO2: Analyze the efficiency of various searching techniques for solving a problem.	Apply
CO: Apply inference rules to the given knowledge Base for theorem Proving.	Apply
CO4: Choose the appropriate planning technique to solve the given problem.	Apply
CO5: Explain the application of artificial Intelligence techniques in Real World System	Apply

Text Book(s):

T1. Stuart Russell, Peter Norving ,"Artificial Intelligence-A Modern Approach", Prentice Hall, 3rd Edition, 2010.

Reference Book(s):

R1. Elaine Rich And Kevin Knight,"Artificial Intelligence", Tata McGraw Hill, 2nd Edition, 2003.

R2. Patrick Henry Winston,"Artificial Intelligence", Pearson Education /PHI,3rd Edition, 2004.

Web References

1. http://www.people.fas.harvard.edu/~lib215/lectures/
2. https://www.tutorialspoint.com/AI

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Course Code: 19CAEN1016		Course Title: Artificial Intelligence	
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Prerequisites

> 19CAFN1101 Probability and statistics

Course Objectives
The course is intended to:

1. Describe the agent type and behavior
2. Analyze the efficiency of various searching techniques
3. Apply Inference rules to the given knowledge Base
4. Choose the appropriate planning technique
5. Explain the application of artificial Intelligence techniques

Unit I   Intelligent Agents   9 Hours
Foundation and history of artificial intelligence – Agents and Environments-Nature of environments-Structure of Agents.

Unit II   Problem And Searching   9 Hours
Problem solving agents – Measuring Problem Solving Performance- Uninformed Search Strategies : BFS, DFS, DLS, IDS, Bidirectional Search – Informed Search Strategies : Greedy BFS- A* Search – Heuristic function – Local search algorithms- Online Search Agent – Constraint Satisfaction Problem – Backtracking Search for CSP – Adversarial Search.

Unit III   Knowledge And Reasoning   9 Hours
Logical Agents – Propositional Logic – Reasoning Patterns- Resolution – Forward And Backward chaining- First order Logic – Syntax And Semantics of FOL – Using first order logic_ knowledge engineering in FOL-Inference in FOL – Unification and lifting- Forward and Backward chaining – Resolution.

Unit IV   Planning   9 Hours
Classical Planning – Planning As state space search- Planning and acting in Real world and Non Deterministic domains- Hierarchical Planning- Multiagent Planning.

Unit V   Applications   9 Hours
Natural Language Processing – Language Model- Text classification –Information retrieval   –   Information   extraction-   Speech   recognition.

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Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Explain various models and concepts to retrieve the relevant information from databases or servers	Understand
CO2: Explain various techniques in web search to retrieve the relevant information from web servers	Understand
CO3: Apply the various algorithms for social network analysis.	Apply
CO4: Apply the Web crawler techniques for discovering information from the Web.	Apply
CO5: Apply the Wrapper methods for extracting structured data from the Web pages	Apply

Text Book(s):

T1. Bing Liu, Web Data Mining: Exploring Hyperlinks, Content, and Usage Data, 2nd Edition, , Springer, 2011.

T2. Xu, Guandong, Zhang, Yanchun, Li, Lin, "Web Mining and Social Networking: Techniques and Applications", Springer, 2011.

Reference Book(s):

R1.   Yates Ricardo Baeza; Neto Berthier Ribeiro, Modern Information Retrieval, Pearson, 2016.

R2.   Aggarwal Charu C, Social Network Data Analytics, Springer, 2015.

Web References

1. https://www.cs.uic.edu/~liub/WebMiningBook.html
2. https://nlp.stanford.edu/IR-book/information-retrieval-book.html
3. https://www.cs.utexas.edu/users/mooney/ir-course/

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BOS Convener

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BOS Chairman

Course Code: 19CAEN1015	Course Title: Web Mining and Social Networking		
Course Category: Professional Elective	Course Level: Mastery		
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

> 19CACN1104 Database Management Systems

> 19CAEN1004 Data Mining and Data Warehousing

Course Objectives

The course is intended to:

1. Explain various models and concepts in information retrieval system

2. Explain various techniques in Web search

3. Apply the various algorithms for social network analysis

4. Apply the web crawler techniques in Web

5. Apply the Wrapper methods in Web pages

Unit I	Information Retrieval	9 Hours

Basic Concepts of Information Retrieval - Information Retrieval Models - Relevance Feedback - Evaluation Measures - Text and Web Page Pre-Processing - Inverted Index and Its Compression.

Unit II	Information Retrieval And Web Search	9 Hours

Latent Semantic Indexing - Web Search - Meta-Search - Web Spamming

Unit III	Social Network Analysis	9 Hours

Social Network Analysis - Co-Citation and Bibliographic Coupling – PageRank – HITS

Unit IV	Web Crawling	9 Hours

A Basic Crawler Algorithm - Implementation Issues - Universal Crawlers - Focused Crawlers - Topical Crawlers - Evaluation.

Unit V	Structured Data Extraction	9 Hours

Preliminaries - Wrapper Induction - Instance-Based Wrapper Learning - Automatic Wrapper Generation: Problems - String Matching and Tree Matching - Multiple Alignment - Building DOM Trees.

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Real world design constraints - Asset management - Industrial automation - Smart grid - Commercial building automation - Smart cities - participatory sensing

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Explain the fundamental concepts of Internet of Things for real time issues	Understand
CO2: Apply the domain specific Internet of Things in various Industry domains.	Apply
CO3: Apply the concepts of M2M to IoT for defining market driven systems	Apply
CO4: Illustrate the concepts of M2M and IoT technology & architecture reference model.	Understand
CO5: Apply the concepts of IoT in various Real-World Applications.	Apply

Text Book(s):
T1. ArshdeepBahga, Vijay Madisetti, "Internet of Things —A hands-on approach", Universities Press, 2017.
T2. Jan Ho ller, VlasiosTsiatsis, Catherine Mulligan, Stamatis, Karnouskos, Stefan Avesand David Boyle, "From Machine-to-Machine to the Internet of Things -Introduction to a New Age of Intelligence", Elsevier, 2014.

Reference Book(s):
R1. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), "Architecting the Internetof Things", Springer, 2011.
R2. Tutorialspoint, "Internet of Things", Tutorials Point (I) Pvt. Ltd, 2016.
R3. Peter Waher, "Learning Internet of Things", packt publishing, Birmingham Mumbai, 2015.
R4. Honbo Zhou, "The Internet of Things in the Cloud: A Middleware Perspective", CRC Press, 2012.
R5. Olivier Hersent, David Boswarthick, Omar Elloumi , "The Internet of Things —Key applications and Protocols", Wiley, 2012

Web References:
1. https://www.tutorialspoint.com/internet_of_things/internet_of_things_overview.htm
2. http://kartolo.sby.datautama.net.id/PacktPub/9781783553532learning_internet_of_thing.pdf
3. https://www.codeproject.com/Learn/IoT/

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BOS Convener

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BOS Chairman

Course Code: 19CAEN1014	Course Title: Internet Of Things			
Course Category: Professional Elective	Course Level: Mastery			
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45		Max Marks:100

Prerequisites

> 19CACN1201 Computer Networks

Course Objectives

The course is intended to:
1. Explain the fundamentals of Internet of Things.
2. Apply the various domain specific Internet of Things.
3. Describe the concepts of M2M to IoT.
4. Explain the concepts of M2M and IoT technology & architecture.
5. Apply the concepts of IoT in Real-World Applications

Unit I	IOT Introduction	9 Hours

Overview: Key features – Advantages – Disadvantages - IoT Hardware - IoT Software - IoT Technology and Protocol. Introduction: Definition & Characteristics of IoT – Physical Design of IoT – Logical Design of IoT – IoT enabling Technologies - IoT Levels & deployment Templates.

Unit II	Domain Specific IOTS	9 Hours

Introduction: Home Automation – Cities – Environment – Energy – Retail – Logistics – Agriculture – Industry – Health & Lifestyle. IoT and M2M: Introduction – M2M – Difference between IoT and M2M – Software Defined Networking (SDN) and Network Function Virtualization (NFV) for IoT. IoT System Management with NETCONF-YANG: Need for IoT System Management – SNMP – Network Operator Requirements – NETCONF – YANG – IoT System Management with NETCONF-YANG

Unit III	M2M to IOT	9 Hours

M2M to IoT-the Vision: Introduction - From M2M to IoT – M2M towards IoT - the Global context. M2M to IoT - A Market Perspective: Introduction – Definition - M2M value chains - IoT value chains - An emerging industrial structure for IoT. M2M to IoT-an Architectural Overview: Building architecture - Main design principles and needed capabilities - An IoT architecture outline - Standards considerations

Unit IV	M2M AND IOT Technology & Architecture	9 Hours

M2M and IoT Technology Fundamentals: Devices and gateways - Local and wide area networking - Data management - Business processes in IoT - Everything as a service (XaaS) - M2M and IoT analytics - Knowledge management. Architecture Reference Model: Introduction - Reference model and architecture - IoT domain model - Information model - Functional model - Functional model - Safety, privacy, trust, security model.

Unit V	Case Studies And Real-World Applications	9 Hours

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1:Understand the basic rudiments of business intelligencesystem.	Understand
CO2:Understand the modelling aspects for Knowledge Delivery.	Understand
CO3:Choose the CCR Algorithm for efficiency measures.	Apply
CO4:Apply the various models for business intelligence applications.	Apply
CO5:Apply the emerging technologies in business intelligence applications.	Apply

Text Book(s):

T1. Efraim Turban, Ramesh Sharda, Dursun Delen,"Decision Support and Business Intelligence Systems",9th Edition, Pearson Education,2011.

Reference Book(s):

R1. Larissa T. Moss, S. Atre, "Business Intelligence Roadmap:The Complete Project Lifecycle of Decision Making", Addison Wesley, 2003.

R2. Carlo Vercellis, "Business Intelligence:Data Mining and Optimization forDecision Making", Wiley Publications,2009.

R3. David Loshin Morgan, Kaufman,"Business Intelligence:The SavvyManager's Guide", 2nd Edition,2012.

R4. Cindi Howson,"Successful Business Intelligence: Secrets to Making BI a Killer App", McGraw- Hill,2007.

R5. Ralph Kimball , Margy Ross , Warren Thornthwaite, Joy Mundy, Bob Becker,"The Data Warehouse Lifecycle Toolkit", Wiley PublicationInc.,2007.

Web References:

1. http://www.umsl.edu/~sauterv/DSS4BI

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BOS Convener

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BOS Chairman

Course Code: 19CAEN1013	Course Title: Business Intelligence		
Course Category: Professional Elective	Course Level: Mastery		
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

> ➢ 19CACN1104 Database Management Systems
> ➢ 19CAEN1004 Data Mining and Data Warehousing

Course Objectives

The course is intended to:
1. Understand the basic rudiments of business intelligencesystem.
2. Understand the modellingaspects.
3. Choose the CCRalgorithm
4. Apply the business intelligencemodels.
5. Apply the emerging technologies in businessintelligence.

Unit I   Business Intelligence   9 Hours

Data, information and knowledge – Role of mathematical models – Business intelligence architectures: Cycle of a business intelligence analysis – Enabling factors in business intelligence projects – Development of a business intelligence system – Ethics and business intelligence.

Unit II   Knowledge Delivery   9 Hours

The business intelligence user types, Standard reports, Interactive Analysis and Ad Hoc Querying, Parameterized Reports and Self-Service Reporting, dimensional analysis, Alerts/Notifications, Visualization: Charts, Graphs, Widgets, Scorecards and Dashboards, Geographic Visualization, Integrated Analytics, Considerations: Optimizing the Presentation for the Right Message.

Unit III   Efficiency   9 Hours

Efficiency measures – The CCR model: Definition of target objectives- Peer groups – Identification of good operating practices; cross efficiency analysis – virtual inputs and outputs – Other models. Pattern matching – cluster analysis, outlier analysis.

Unit IV   Business Intelligence Applications   9 Hours

Marketing models – Logistic and Production models – Case studies.

Unit V   Future of Business Intelligence   9 Hours

Future of business intelligence – Emerging Technologies, Machine Learning, Predicting the Future, BI Search & Text Analytics – Advanced Visualization – Rich Report, Future beyond Technology.

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BOS Chairman

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Understand the evolution of Semantic Web.	Understand
CO2: Build an engineering process for Ontology language.	Apply
CO3: Understand the services of Semantic Web.	Understand
CO4:Apply the software tools in semantic web for reasoning features.	Apply
CO5:Develop the concepts of Semantic Web in real world applications like Art.	Create

Text Book(s):

T1. Semantic Web Concepts: Technologies and Applications, K.K.Breitman, Marco Antonio Casanova and Walter Truszowski, Springer, 2007

Reference Book(s):

R1. Grigoris Antoniou, Frank Van, "Semantic Web Primer", MIT Press.
R2. LiyangYu , "Introduction to the Semantic Web and Semantic web services" ,Chapman &Hall/CRC, Taylor & Francis group, 2007
R3. Peter Mika, "Social networks and the Semantic Web", Springer, 1st edition 2007.
R4. Foundations of Semantic Web Technologies, Pascal Hitzler, Sebastian Rudolph, Markus Krotzsch, Chapman & Hall/CRC, 2009.

Web References:

1. https://www.w3.org/RDF
2. www.webcivics.org/resource.html
3. https://www.w3.org/RDF

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BOS Convener

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BOS Chairman

Course Code: 19CAEN1012	Course Title: Semantic Web Technologies		
Course Category:Professional Elective	Course Level: Mastery		
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

 ➢ 19CACN1101 Web Technology

Course Objectives
The course is intended to:
1. Understand the evolution of Semantic Web
2. Build an engineering process for Ontology
3. Understand the web services in Semantic Process
4. Apply the Software Tools in Semantic Web
5. Apply the concepts of Semantic Web in real world applications

Unit I   Evolution of Semantic Web   9 Hours
Introduction - Syntactic Web and Semantic Web – Ontology-Taxonomies, Thesauri and Ontologies-Classification of Ontologies-Web Ontology Description Language - Inference Problems- RDF & RDF Schema.

Unit II   Ontology Web Language   9 Hours
Requirements-Properties-Classes-Individual-Data   Types-Rule   Languages-RuleML SWRL-TRIPLE.

Unit III   Semantic Web Services   9 Hours
Web Service Essentials-OWL –S Service Ontology-Ontology Development: Uscholdand King Method-Toronto Virtual Enterprise Method.

Unit IV   Semantic Web Software Tools   9 Hours
Ontology   Sources: Metadata-Upper   Ontologies-Ontology   Libraries-Metadata   and Ontology Editors-Reasoners.

Unit V   Applications   9 Hours
Software Agents-Semantic Desktop-Ontology Applications in Art-Geospatial Semantic.

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BOS Convener

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BOS Chairman

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Understand the fundamentals of Evolutionary Algorithm with the applications	Understand
CO2: Understand the fitness, selection, and population management strategies for evolutionary computing.	Understand
CO3 : Apply the methodological issues in Evolutionary computing for real time applications	Apply
CO4: Apply the Ant Colony Optimization with its procedures for real time examples	Apply
CO5 : Apply the Particle Swarm Optimization with its procedures for real time applications	Apply

Text Book(s) :

T1. Kenneth A DeJong, "Evolutionary Computation A Unified Approach", Prentice Hall of India, New Delhi, 2006.

T2. Marco Dorigo and Thomas Stutzle, "Ant Colony optimization", Prentice Hall of India, New Delhi 2005.

T3. Jun Sun, Choi-Hong Lai and Xiao-Jun Wu, "Particle Swarm Optimisation: Classical and Quantum Perspectives", Taylor and Francis, USA, 2012.

Reference Book(s) :

R1. Eiben A.E and Smith J.E," Introduction to Evolutionary Computing" Springer, 2008.

R2. Dervis Karaboga, Bahriye Akay," A comparative study of Artificial Bee Colony algorithm" Applied Mathematics and Computation 214, Elsevier Publications, 2009.

R3. Frank Neumann and Carsten Witt, "Bio-inspired Computation in Combinatorial Optimization", Springer, New York, 2010.

R4. Carlos A Coello Coello, Gary B Lamont and David A Van Veldhuizen, "Evolutionary Algorithms for Solving Multi-Objective Problems", Springer, New York, 2007.

Web references:

1. https://onlinecourses.nptel.ac.in/noc21_me43/preview
2. https://nptel.ac.in/content/storage2/courses/105108127/pdf/Module_8/M8L5slides.pdf

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BOS Convener

Approved in Academic Council meeting

BOS Chairman

Course Code:19CAEN1011	Course Title:	Evolutionary computing	
Course Category: Professional Elective	Course Level: Mastery		
L:T:P(Hours/Week) :3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

> 19CAEN1008 Resource Management Techniques
> 19CAEN1004 Data Mining and Data Warehousing

Course Objectives

The course is intended to:
1. Understand the fundamentals of Evolutionary Algorithm with the applications
2. Understand the fitness, selection, and population management strategies for Evolutionary computing
3. Apply the methodological issues in Evolutionary computing
4. Apply the Ant Colony Optimization with its procedures
5. Apply the Particle Swarm Optimization with its procedures

Unit I   Evolutionary Algorithm   **9 Hours**
Introduction on Evolutionary Algorithm - COMPONENT of Evolutionary Algorithms – Example Applications: The Eight-Queens Problem -The Knapsack Problem –operations of Evolutionary algorithm - Evolutionary Computing, Global Optimization, and Other Search Algorithms.

Unit II   Fitness, Selection, And Population Management   **9 Hours**
Population Management Models- parent selection - Evolutionary Algorithm Variants: Genetic algorithm - Evolutionary strategies - Evolutionary programming - Genetic programming -. Particle swarm optimization.

Unit III   Methodological Issues   **9 Hours**
Parameters and parameter Tuning- Evolutionary Algorithm parameters – EA and EA Instances – Designing Evolutionary Algorithms – Tuning problems – Tuning Methods- Parameter control- Examples of changing parameters.

Unit IV   Ant Colony Optimization   **9 Hours**
Ant foraging behavior - Theoretical considerations – Convergence proofs – ACO Algorithm – ACO and model based search – Variations of ACO: Elitist Ant System (EAS), MinMax Ant System (MMAS) and Rank Based Ant Colony System (RANKAS).

Unit V   Particle Swarm Optimization   **9 Hours**
Principles of bird flocking and fish schooling – Evolution of PSO – Operating principles – PSO Algorithm – Neighborhood Topologies – Convergence criteria – Variations of PSO: Binary, weighted, repulsive, combined effect PSO .

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BOS Chairman

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Understand the Agile Methods and its classifications	Understand
CO2: Apply the extreme programming with its values principles	Apply
CO3: Apply the concepts of SCRUM Technology for various job roles.	Apply
CO4: Apply the concepts of SCRUM in agile-based software development including practices, individuals and team work	Apply
CO5: Apply about the scrum specifications and user stories in product development.	Apply

Text Book(s):
T1. James Shore and Shane Warden,"The Art of Agile Development",O'Reilly Media,2007. (Unit I & II).
T2. Mike Cohn,"Succeeding with Agile: Software Development Using Scrum", Addison-Wesley Professional, 1st Edition, 2009. (Unit III to V.)

Reference Book(s):
R1.Craig Larman,"Agile and Iterative Development A Manager's Guide",Pearson Education 2004.
R2. Alistair,"Agile Software Development series",Cockburn - 2007
R3. Elisabeth Hendrickson,"Agile Testing ",Quality Tree Software Inc 2008.

Web References
1.   http://nptel.ac.in/courses/106101061/26

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BOS Convener

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BOS Chairman

Course Code:19CAEN1010	Course Title: Agile Software Development
Course Category: Professional Elective	Course Level: Mastery
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

> 19CACN1202 Software Engineering

Course Objective

The course is intended to:
1. Understand about the extreme programming and its practicing
2. Understand the Scrum concepts with different job roles
3. Apply the concepts of Scrum in teamwork with real time scenarios
4. Apply the aspects of scrum specifications and user stories

Unit I   Agile Methodology   8 Hours

Understanding Success-Beyond deadlines-importance of Organizational Success-Agile model - classification of agile methods.

Unit II   Extreme Programming(XP)   10 Hours

Method overview – lifecycle – XP Team-XP concepts –practicing XP –Thinking collaborating-Releasing-Development .Mastering Agility :XP values and principles: commonalities – About values, principles AND PRACTICES.

Unit III   Scrum Practices And Individuals   10 Hours

Individual Roles – Scrum Master – Product Owner – Changed Roles: Analysts, Project Managers, Architects, Functional Managers, Programmers, DB Administrators, Testers, User Experience Designers - Technical Practices –Test-driven development –Collective Ownership – Continuous Integration – Pair Programming .

Unit IV   Scrum Teamwork   8 Hours

Team Structures – Small Team Productivity – Feature Teams – Component Teams – Guidelines for Good Team Structure – Team Responsibility – Foster Team Learning – Self Organizing Team – Influencing Evolution: Selecting Environment, Defining Performance, Manage Meaning, Energizing the System.

Unit V   Scrum Specification   9 Hours

Product Backlog – Documents to Discussions – Written Documentation Disadvantages – User Stories Progressively Refine Requirements – Emergent Requirements – Backlog Iceberg .

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and Privacy – Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis – Reducing Risk.

Unit V   Computer Technologies Accessibility Issues   9 Hours

Introduction – Principle of Equal Access – Obstacles to Access for Individuals – Professional Responsibility – Empowering Computers in the Workplace – Introduction – Computers and Employment – Computers and the Quality of Work – Computerized Monitoring in the Work Place – Telecommuting – use of artificial intelligence and expert systems - Social, Legal and Professional Issues.

Course Outcomes	
At the end of this course, students will be able to:	**Cognitive Level**
CO1: Explain the concepts of ethics and professional skills in working environment.	Understand
CO2: Identify the threats in computing environment on ethical Hacking.	Apply
CO3: Make use of computer crime and intellectual property rights for free and open source software.	Apply
CO4: Solve the ethicaland professional issues in internet technologies and privacy for the assessment of safety and Risk.	Apply
CO5: Experiment with the intricacies of technical accessibility issues in designing the software project.	Apply

Text Book(s):

T1. M.Govindarajan, S.Natarajan and V.S.SenthilKumar,‖Professional Ethicsand Human Values‖, PHI Learning Pvt. Ltd,2013

T2.Penny Duquenoy, Simon Jones and Barry G Blundell, ―Ethical, legaland Professional Issues in Computing‖, Middlesex University Press, 2008.

Reference Book(s):

R1. Mike Martin and Roland Schinzinger, ―Ethics in Engineering‖, McGraw-Hill, New York 1996.

R2. George Reynolds,‖Ethics in Information Technology‖, Cengage Learning, 2011.

R3. Caroline Whitback,‖Ethics in Engineering Practice and Research‖,CambridgeUniversityPress 2011

R4. Sara Baase, ―A Gift of Fire: Social, Legal, and Ethical Issues for Computing and the Internet‖,3rd Edition, Prentice Hall, 2008.

Web References:

1.   http://nptel.ac.in/courses/109104032/
2.   http://nptel.ac.in/syllabus/syllabus.php?subjectId=109104033

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BOS Convener   BOS Chairman

Course Code: 19CAEN1009	Course Title: Human Values And Professional Ethics		
Course Category: Professional Elective	Course Level: Mastery		
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

> NIL

Course Objectives

The course is intended to:
1. Explain the concepts of ethics and professional skills
2. Identify the threats in computing environment
3. Make use of computer crime and intellectual property rights
4. Solve the ethical and professional issues in internet technologies and privacy
5. Experiment with the intricacies of technical accessibility issues

Unit I   **Human Values and Engineering Ethics**   **9 Hours**

Morals, Values and Ethics – Integrity – Work Ethics – Service Learning – Civic Virtue – Respect for others – Living Peacefully – Caring – Sharing – Honesty –Courage – Value time – Co-operation – Commitment – Empathy – Self-confidence – Spirituality- Character - Engineering Ethics: The History of Ethics-Purposes for Engineering Ethics-Engineering Ethics- Consensus and Controversy –Professional and Professionalism –Professional Roles to be played by an Engineer –Self Interest, Customs and Religion-Uses of Ethical Theories- Professional Ethics-Types of Inquiry – Engineering and Ethics-Kohlberg"s Theory – Gilligan"s Argument –Heinz"s Dilemma.

Unit II   **Computer Hacking**   **9 Hours**

A General Introduction – Computer Ethics: An Overview – Computer Hacking – Introduction – Definition of Hacking – Destructive Programs – Hacker Ethics – Professional Constraints – BCS Code of Conduct – To Hack or Not To Hack – Ethical Positions on Hacking.

Unit III   **Computer Crime and Intellectual Property Rights**   **9 Hours**

Aspects of Computer Crime Introduction – What is Computer Crime – Computer Security Measures – Professional Duties and Obligations – Intellectual Property Rights – The Nature of Intellectual Property– Intellectual Property – Patents, Trademarks, Trade Secrets, Software Issues, Copyright – The Extent and Nature of Software Piracy – Ethical and Professional Issues – Free Software and Open Source Code

Unit IV   **Regulating Internet Content, Technology and Safety**   **9 Hours**

Introduction – In Defense of Freedom Expression – Censorship – Laws Upholding FreeSpeech – Free Speech and the Internet – Ethical and Professional Issues – Internet Technologies

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Unit V   Queueing Theory   **9 Hours**

Markovian models- M/M/1, M/M/C, finite and infinite capacity- M/M/1 queues- Finite source model-M/G/1 queue (steady state solutions only).

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Understand the opportunity package for solving linear programming models of using various programming and software integer.	Understand
CO2: Apply the complex mathematical models in management science, industrial engineering and transportation science.	Apply
CO3: Apply the methodology for the solution of linear programs and integer programs.	Apply
CO4: Solve network models like the shortest path, minimum spanning tree, and maximum flow problems.	Apply
CO5: Utilize optimality conditions for single and multiple variable unconstrained and constrained non-linear optimization problems, and corresponding solution methodologies.	Apply

Text Book(s):
T1. Taha H. A. —Operations Research- An Introduction‖, 7th Edition, Pearson Education, Delhi,2002.
T2. Winston, —Operations Research‖, Thomson Learning, 2003.
Reference Book:
R1. P K Gupta and D S Hira,‖Operations Research‖, S Chand & Co., 2003.
Web References:
1.   http://nptel.ac.in/courses/111105039/
2.   http://nptel.ac.in/courses/Webcourse-contents/IISc-BANG

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BOS Convener   BOS Chairman

Course Code: 19CAEN1008	Course Title: Resource Management Techniques		
Course Category: Professional Elective	Course Level: Mastery		
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

> 19CAFN1101 Probability and statistics

Course Objectives

The course is intended to:

1. Understand the opportunity of using various software package
2. Apply the complex mathematical models
3. Apply the methodology for the solution of linear programs
4. Apply the network models to find shortest path
5. Utilize optimality conditions for single and multiple variables

Unit I   Linear Programming Solving   9 Hours

Principal components of decision problem - Modeling phases - LP Formulation and graphical solution –Simplex method – Big M method.

Unit II   Transportation and Assignment Models   9 Hours

Mathematical formulation of transportation problem- Methods for finding initial basic feasible solution- Optimal solution- Degeneracy- Mathematical formulation of Assignment models- Hungarian algorithm- Variables of the assignment problems.

Unit III   Integer Programming   9 Hours

Cutting plan algorithm- Branch and bound methods, Multistage (Dynamic) Programming.

Unit IV   Scheduling By Pert And Cpm   9 Hours

Network construction - Critical path method - Project Evaluation and Review Technique - Resource Analysis in Network scheduling.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO 1: Understand the process of project management and stepwise project planning for delivering successful software projects. .	Understand
CO 2: Apply the evaluation techniques and forecasting involved in Software projects development with various cost benefit analysis.	Apply
CO 3 : Apply the techniques available for software effort estimation and activity planning for smooth progress of project development	Apply
CO4: Apply the risk management analysis techniques to quantify efficiency and monitoring & control.	Apply
CO5 : Apply the project control metrics and its effect on changing /updating the project.	Apply

Text Book(s):

T1. Bob Hughes & Mike Cotterell, "Software Project Management", Tata McGraw- Hill Publications, Fifth Edition, 2012. (Unit I - IV)

T2. Walker Royce,"Software Project Management–A unified Framework", Pearson Education, 2005. (Unit –V)

Reference Book(s) :

R1. S. A. Kelkar," Software Project Management", PHI, New Delhi, Third Edition, 2013.

R2. Roger Pressman S., "Software Engineering: A Practitioner's Approach", Tata McGraw Hill, Seventh Edition, 2010

Web References:

1.http://nptel.ac.in/syllabus/106101061/

2.http://www.nptelvideos.com/video.php?id=918

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BOS Convener

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BOS Chairman

Course Code:19CAEN1007			Course Title: Software Project Management	
Course Category: Professional Elective			Course Level: Mastery	
L:T:P(Hours/Week) 3: 0: 0	Credits:3		Total Contact Hours:45	Max Marks:100

Pre-requisites

➢ 19CACN1202 Software Engineering

Course Objectives

The course is intended to:

1. Understand the process of project management and stepwise project planning
2. Apply the evaluation techniques and forecasting involved in Software projects development
3. Apply the techniques available for software effort estimation
4. Apply the risk management analysis techniques
5. Apply the project control metrics

Unit I   Introduction To Software Project Management   8 Hours
Project Definition – Contract Management – Activities Covered by Software Project Management – Overview   of   Project   Planning   –   Stepwise   Project   Planning.

Unit II   Project Evaluation   9 Hours
Strategic Assessment – Technical Assessment – Cost Benefit Analysis –Cash Flow Forecasting – Cost Benefit Evaluation Techniques – Risk Evaluation.

Unit III   Software Effort Estimation   10 Hours
Problems with over and under estimates - Software effort estimation techniques – Function Point-Object Point –COCOMO Parametric Model.
Activity Planning: Objectives – Project Schedule – Sequencing and Scheduling Activities –Network Planning Models – Forward Pass – Backward Pass – Activity Float – Shortening Project Duration.

Unit IV   Risk Management   9 Hours
Nature of Risk – Managing Risk – Risk Identification – Risk Analysis – Reducing the Risk –Evaluating risks to the schedule.
Monitoring And Control: Creating Framework – Collecting the Data – Visualizing Progress – Cost Monitoring –Earned Value – Prioritizing Monitoring – Getting Project Back to Target – Change Control

.Unit V   Project Control Metrics   9 Hours
The seven core metrics -management indicators -quality indicators -life cycle expectations – pragmatics software metrics - metrics automation.
Change Metrics: Overview –Metrics Derivation –Pragmatic Metrics.

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CO4: Apply various information retrieval techniques for emphasis multimedia IR and web search	Apply
CO5: Develop the applications of information retrieval for the given scenario.	Create

Text Book(s):

T1. Ricardo Baeza-Yates, Bethier Ribeiro-Neto,"Modern Information Retrieval", Second Edition, ACM Press Books, 2011.

Reference Book(s):

R1. Christopher D. Manning, Prabhakar Raghavan and Hinrich Schütze,"Introduction to Information Retrieval",Cambridge University Press, 2008.

R2. D.A. Grossman, O. Frieder,"Information Retrieval: Algorithms and Heuristics", Springer,2004

R3. Stefan Buttcher, Charles L.A.Clarke, "Information Retrieval, Implementing and Evaluating search Engines", Massachusetts Institute of Technology, 2010

Web References:

1. http://nlp.stanford.edu/IR-book/
2. http://www.math.northwestern.edu/~mlerma/courses/cs310-05s/

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BOS Chairman

Course Code: 19CAEN1006	Course Title: Information Retrieval Techniques	
Course Category: Professional Elective	Course Level: Mastery	
L:T:P(Hours/Week) 3: 0: 0	Credits:3 Total Contact Hours:45	Max Marks:100

Prerequisites

> 19CACN1103 Data Structures and Algorithms

Course Objectives

The course is intended to:
1. Understand the basics of information retrieval with pertinence to modeling
2. Apply the information retrieval with query operations
3. Apply the text operations like text classification, clustering and indexing
4. Apply various information retrieval techniques
5. Develop the applications of information retrieva

Unit I   Introduction   **9 Hours**

Basic concepts – Retrieval process – Classic Information retrieval – set probabilistic models – Structured Text Retrieval models –Retrieval evaluation.

Unit II   Querying   **9 Hours**

Languages –Keyword based querying –Pattern Matching –Structural Queries –Query Operations – User Relevance Feedback- Text and Multimedia language.

Unit III   Text Operations and User Interface   **9 Hours**

Document preprocessing –Clustering –Text Compression –Indexing and searching –Inverted files – Boolean Queries –User Interface and Visualization –Query Specification.

Unit IV   Multimedia Information Retrieval   **9 Hours**

Data Models – Query Languages –Spatial Access Methods –Generic Approach –Two Dimensional Color Images –Feature Extraction.

Unit V   Applications   **9 Hours**

Searching the web – Challenges – Browsing-Meta-searchers –Parallel Information Retrieval – Distributed Information retrieval.

Course Outcomes At the end of this course, students will be able to:	Cognitive Level
CO1:Understand the basics of information retrieval with pertinence to modeling.	Understand
CO2:Apply the information retrieval with query operations.	Apply
CO3: Apply the text operations like text classification, clustering and indexing.	Apply

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CO1:	Identify the storage technology used for information storage management.	Understand
CO2:	Select from various storage technologies to suit for required application	Apply
CO3:	Deploy the storage networking technologies for effective data retrieval	Apply
CO4:	Apply the networked storage technologies used in virtualized environment	Apply
CO5: Apply security measures to safeguard storage of the applications		Apply

Text Book(s):

T1. Somasundaram Gnanasundaram, Alok Shrivastava," Information Storage and Management", EMC2 John Wiley & Sons, Inc., Second Edition, 2012.

T2. Tom Clark," "Storage Virtualization: Technologies for Simplifying Data Storage and Management", Addison-Wesley, 2005

Reference Book(s):

R1. Marc Farley, "Building Storage Networks" Tata McGraw Hill, Osborne, 2001.

R2. Robert Spalding, "Storage Networks: The Complete Reference" Tata McGraw Hill, 2010
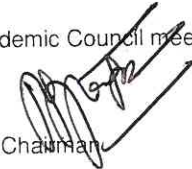
Web References:

1. https://nptel.ac.in/courses/106108058/
2. https://nptel.ac.in/courses/106105175/25
3. www.e-learningcenter.com/courses/emc-information-storage-and-management- ism-v2

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BOS Convener

BOS Chairman

Course Code: 19CAEN1005	Course Title: Information Storage and Management		
Course Category: Professional Elective	Course Level: Mastery		
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Prerequisites

> 19CACN1104 Database Management Systems

Course Objectives

The course is intended to:
1. Identify the storage technology
2. Select from various storage technologies.
3. Deploy the storage networking technologies
4. Apply the networked storage technologies
5. Apply security measures to safeguard storage

Unit I   Storage Technology   9 Hours

Introduction to Information Storage-Evolution of Storage Architecture - Data Center Infrastructure Virtualization and Cloud Computing-Data Center Environment-Application-Database Management System.

Unit II   Storage Systems Architecture   9 Hours

RAID Implementation Methods-RAID Array Components-RAID Techniques-RAID Levels-RAID Impact on Disk Performance-Intelligent Storage Systems-Components-Storage Provisioning.

Unit III   Storage Networking Technologies   9 Hours

Fibre Channel Storage Area Networks- Fibre Channel: Overview-SAN and Its Evolution-Components of FC SAN-FC Connectivity-Virtualization in SAN-iSCSI-FCIP-FcoE.

Unit IV   Networked Storage   9 Hours

Servers versus NAS Devices-Benefits of NAS File Systems and Network File Sharing-Components of NAS-NAS I/O Operation-File-Level Virtualization -Object-Based Storage Devices- Content-Addressed Storage.

Unit V   Case Study   9 Hours

Introduction to Business Continuity-Information Availability-BC Terminology - BC Planning Life Cycle-Failure Analysis-Business Impact Analysis-Information Security Framework-Risk Triad-Storage Security Domains.

Course Outcomes	Cognitive
At the end of this course, students will be able to:	Level

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R4. Usama M. Fayyad, Gregory Piatetsky, Shapiro Padhrai Smyth & Ramasamy Uthurusamy, Advances In Knowledge Discovery and Data Mining, The M.I.T Press, 2012.

R5. Pang-Ning Tan, Michael Steinbach and Vipin Kumar Introduction to Data Mining, Pearson Education, 2007.

Web References:

1. https://nptel.ac.in/courses/106106093/31
2. https://nptel.ac.in/courses/110105076/28
3. https://www.tutorialspoint.com/dwh/
4. https://www.tutorialspoint.com/data_mining/

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Course Outcomes	Cognitive
At the end of this course, students will be able to:	Level
CO1: Understand the foundations & design of HCI with evaluation techniques.	Understand
CO2: Apply the Multimedia UI Design with its architecture, navigation and media selection for website.	Apply
CO3: Apply the Mobile architecture, mobile elements and applications for development.	Apply
CO4: Apply the concepts of front end web designing interfaces for real websites.	Apply
CO5: Apply the aspects of advanced web designing interfaces for transactions.	Apply

Text Book(s):

T1. Alan Dix,Janet Finlay, Gregory Abowd,RussellBeale,"Human Computer Interaction", 3rd Edition, Pearson Education, 2004. (Reprint)

T2. Brian Fling,"Mobile Design and Development, O'Reilly Media Inc., 1st Edition , 2009

T3. Bill Scott and Theresa Neil, "Designing Web Interfaces", O'Reilly, 1st Edition, 2009.

Reference Books:

R1. Andrew Sears, Julie A. Jacko,"The Human Computer Interaction Handbook", 2nd Edition,Lawrence Erlbaum Associates, New York, 2008.

Web References:

1. http://nptel.ac.in/courses/106103115/
2. http://iiscs.wssu.edu/drupal/node/4607

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BOS Convener

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BOS Chairman

Course Code: 19CAEN1018	Course Title: Visualization Techniques		
Course Category: Professional Elective	Course Level: Mastery		
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

> 19CACN1202 Software Engineering

Course objectives

The course is intended to:

1. Outline the foundation of datavisualization
2. Explain the visual perception and attention pertaining tovisualization
3. Choose the concepts of Patterns,Visual objects and Spaceperception
4. Apply the interaction withvisualization.
5. Make use of DOM and Webtechnologies

Unit I   Foundations Of Datavisualization   8 Hours

A Model of Perceptual processing - Types of Data – Environment - Eye - Optimal display-Luminance, Brightness, lightness and Gamma.

Unit II   Visual Information   8 Hours

Color Standards- Appearance and Applications in Visualization - Visual Attention and Information - Visual field- Iconic Buffer-Gabor Model- Texture in Visualization,-glyphs and Multivariate Discrete data.

Unit III   Patternsandobjects   10 Hours

Static and Moving Patterns-Gestalt laws-Contours-Patterns in Motion - Visual Objects and Data Objects- Image-Based Object recognition-Structure-based Object Recognition- Geon diagram-Depth Cue Theory - Task Based SpacePerception.

Unit IV   Interactingwith Visualizations   9 Hours

Interacting with Visualizations- Data Selection and Manipulation loop- Exploration and Navigation loop- Memory systems -Eye movements -Problem Solving withVisualizations.

Unit V   Visualization Techniquesand Systems   10 Hours

Structural Analysis - Statistical Exploration- Practical problems in conducting user studies-Data Driven Documents(D3)Technology Fundamentals- web DOM - web CSS -web JavaScript - Data for visualization.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Outline the foundation of Data Visualization.	Understand
CO2: Explain the visual perception and Attention pertaining to Visualization.	Understand

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CO3: Choose the concepts of Patterns, Visual Objects and Space Perception.	Apply
CO4: Apply the interaction with visualization for the given scenario.	Apply
CO5: Make use of DOM and Web Technologies for developing Visualization Systems.	Apply

Text Book(s):

T1. Colin Ware, "Information Visualization: Perception for Design", Morgan Kaufmann, 2004. (Unit1,2,3,4,5)

T2. Scott Murray,"Interactive Data Visualization for the Web-An Introduction to Designing with D3", O'Reilly, 2013(Unit5)

Reference Book(s):

R1. Ben Fry,"VisualizingData",1st Edition, O'Reilly,2008

R2. Stephen Few,"Now you see it: Simple Visualization techniques for quantitative analysis",Analytics Press,2009.

Web References:

1. https://www.coursera.org/learn/datavisualization/
2. https://www.udacity.com/course/data-visualization-and-d3js--ud507

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Course Code: 19CAEN1019	Course Title: Advanced Operating Systems	
Course Category: Professional Elective	Course Level: Mastery	
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45 Max Marks:100

Prerequisites
> NIL

Course Objectives
The course is intended to:

1. Understand process management, CPU scheduling, memory management and file system
2. Apply synchronization and Dead Lock
3. Apply the memory management algorithms
4. Analyze the disk scheduling and directory methods
5. Interpret the concepts in Mobile Operating Systems

Unit I   Introduction   **9 Hours**

Evolution of OS - Operating Systems Structures: System Components – Operating System Services – Process Concepts –Process & Cooperating Process – Inter Process Communication – Threads.

Unit II   Scheduling & Deadlock   **9 Hours**

CPU Scheduling– Scheduling Algorithms – Process Synchronization: Critical Section Problems – Semaphores.Deadlock - System Model – Deadlock Characterization – Methods for Handling Deadlocks - Deadlock Prevention – Deadlock Avoidance – Deadlock Detection –- Recovery from Deadlocks.

Unit III   Memory Management   **9 Hours**

Memory Management - Background – Swapping – Contiguous Memory Allocation – Paging – Segmentation – Virtual Memory: Demand Paging – Replacement Algorithms – Thrashing.

Unit IV   File Management   **9 Hours**

File Concept-Access Methods-Directory Structure-File System Structure Implementation of File System & Directory - Allocation Methods-Free Space Management- Disk Structure & Scheduling.

Unit V   Mobile Operating System   **9 Hours**

Mobile Operating Systems: ARM and Intel architectures - Power Management – Mobile OS Architectures - Kernel structure and native level programming - Runtime issues-Approaches to power management.

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Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Outline the Importance of personal computers and internal components of a computer.	Understand
CO2: Assemble the computer with the help of hardware components	Apply
CO3: Experiment the Installation of Operating Systems in computer	Apply
CO4: Identify the components in Laptop and Mobile devices	Apply
CO5: Experiment the installation of Printers and troubleshooting of systems	Apply

Text Book(s):

T1. AviSilberschatz, P.B.Galvin, G.Gagne,"Operating System Concepts",9th Edition, Wiley& Sons, 2013.

Reference Book(s):

R1. William Stallings,"Operating Systems: Internals and Design Principles", 8th Edition,Pearson Education, 2014.

R2. H M Deitel, P J Deitel and D R Choffnes,"Operating Systems" ,3rd edition, Pearson Education,2011.

R3. Source Wikipedia,"Mobile Operating Systems", General Books LLC, 2010.

Web References

1. https://www.tutorialspoint.com/operating_system/index.htm
2. http://www.nptel.ac.in/courses/106108101/

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BOS Convener

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BOS Chairman

Course Code: 19CAEN1020	Course Title: Unix and Networking Programming		
Course Category: Professional Elective	Course Level: Mastery		
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

> 19CACN1201 Computer Networks

Course Objectives

The course is intended to:
1. Understand the environment of UNIX.
2. Apply Process Control and Creation of Sessions.
3. Apply the Interprocess communication in Pipes & Semaphores.
4. Apply the TCP & UDP Sockets in UNIX.
5. Develop programs using the Client-Server Model.

Unit I   Introduction to UNIX and File System   9 Hours

Unix Architecture and Command Usage - General Purpose Utilities – File System – Handling Ordinary Files – Basic File Attributes – File I/O – Files and Directories – System Data Files and Information: Password File – Group File – Login Accounting.

Unit II   Process   9 Hours

Process Environment – Process Control – Process Relationships: Terminal Logins – Network Login –Process Groups – Session – Signals.

Unit III   Interprocess Communication   9 Hours

Introduction – Message Passing (SVR4) – Pipes – FIFO – Message Queues – Semaphores – Shared Memory.

Unit IV   Sockets   9 Hours

Introduction – Transport Layer – Socket Introduction – Elementary TCP Sockets – UDP Sockets –Socket Options – Name and Address conversions.

Unit V   Applications   9 Hours

Debugging Techniques – TCP Echo Client Server – UDP Echo Client Server – Ping – Trace Route – Client Server Applications like File Transfer and Chat.

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Course Outcomes	Cognitive
At the end of this course, students will be able to:	Level
CO1: Understand the environment of UNIX and implement the concepts of file system.	Understand
CO2: Apply Process Control and Creation of Sessions for session Management.	Apply
CO3: Apply the interprocess communication in Pipes & Semaphores of a process.	Apply
CO4: Apply the TCP & UDP Sockets in UNIX Environments	Apply
CO5: Develop programs using the Client-Server Model.	Create

Text Book(s):
T1. W. Richard Stevens, Advanced Programming in the UNIX Environment, Addison Wesley, New Delhi, 2013.
T2. Unix Network Programming, The Sockets Networking API, Volume-1, Addison-Wesley Professional, 2011.

Reference Book:
R1. Maurice J. Bach, Design of the Unix Operating System Prentice Hall, New Delhi,2007.

Web References:
1. http://www.people.fas.harvard.edu/~lib215/lectures/
2. https://www.tutorialspoint.com/unix
3. http://www.people.fas.harvard.edu/~lib215/lectures/

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