MASTER OF COMPUTER APPLICATIONS

SYLLABUS FOR CREDIT-BASED FLEXIBLE CURRICULUM
(Applicable for 2018-2019 onwards)

DEPARTMENT OF COMPUTER APPLICATIONS
NATIONAL INSTITUTE OF TECHNOLOGY
TIRUCHIRAPPALLI – 620 015
TAMIL NADU INDIA
SYLLABUS

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NATIONAL INSTITUTE OF TECHNOLOGY
TIRUCHIRAPPALLI-620 015
TAMIL NADU - INDIA
About us:

The Department of Computer Applications is one of the pioneering departments of the institution that offers the following degree programmes:

1. Three year Master of Computer Applications (MCA)
2. Two year Master of Science in Computer Science and
3. Two year Master of Technology in Data Analytics.

The Department of Computer Applications is one among the top five offering MCA courses in the country. It is committed to impart quality education in the sub-fields of IT, a field growing in leaps and bounds.

Vision:

Towards a school of Information Science and Technology conforming to international standards

Mission:

- To offer state-of-art education in Information Science and Technology
- To provide strong theoretical foundation complemented with extensive practical training
- To inculcate value-based, socially committed professionalism to the cause of overall development of students and society

MASTER OF COMPUTER APPLICATIONS

Objectives of the Programme:

1. Prepare graduates to become computer professionals with comprehensive knowledge and skills to produce software for emerging requirement
2. Prepare graduates to become continuous learner with aptitude for teaching and research with societal focus
3. Prepare graduates to become Consultant / Entrepreneurs in the IT and ITES industries with confidence in self-employment
The board of studies for Computer Applications Department includes the following members:

- **Chairman:**
  Dr. S.R.Balasundaram, Professor
  Head of the department

- **External Experts:**
  1. **Dr.V.S.Ananthanarayana , Dean(R&C)**
     Professor, Department of IT
     NIT K Surathkal
  2. **Mr.S.Parthasarathy,**
     Vice-president
     Systech Solutions Pvt. Ltd

- **Faculty Members:**
  1. Dr. N.P. Gopalan, Professor
  2. Dr. A.V. Reddy, Professor
  3. Dr. B. Ramadoss, Professor
  4. Dr.S.Nickolas, Professor
  5. Dr. Michael Arock, Professor
  6. Dr. P.J.A Alphonse, Professor
  7. Dr. S. Domnic , Associate Professor
  8. Dr. (Mrs) B.Janet, Assistant Professor
  9. Dr. (Mrs) S. Sangeetha, Assistant Professor
  10. Dr. (Mrs). R. Eswari, Assistant Professor
  11. Dr. U. Srinivasulu Reddy, Assistant Professor
  12. Dr. C.Sivaraj
  13. Dr. (Mrs). Adlin Suji
  14. Ms. Cynthia Devi
  15. Ms. Jenie Arock
  16. Mr.K.Vignesh
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| Grand Total | 70 | 5 | 40 | 105 |
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L: LECTURE | T: TUTORIAL | P: PRACTICAL | C: CREDITS
SEMESTER-I
CA711 DATA STRUCTURES AND APPLICATIONS

Course Objective:
- To introduce different data structures; searching and sorting techniques and their applications.

Linear data Structures – Arrays, Records, Linked Lists – Singly, Doubly, Circular linked lists - Stack: Definition and examples, Representing Stacks - Queues: Definition and examples, priority queue, Deque, IRD, ORD – Applications of Stack, Queue and Linked Lists- Hashing.


REFERENCES:

Outcomes:
Students will be able to
1. Write structured pseudo code for the given problem
2. Use linear and nonlinear data structures to solve real-time problems
3. Apply basic searching and sorting techniques in different application domains
CA713 MATHEMATICAL FOUNDATIONS OF COMPUTER APPLICATIONS

Objective:

- To learn the mathematical foundations applicable to computing.

Sets - Relations – Posets - Functions - Mathematical Inductions (Simple and strong) – Principles of Counting (Addition & Multiplication).


Recurrence Relations and Generating Functions - Homogeneous and non-homogeneous recurrences and their solutions - solving recurrences using generating functions.


Finite Automata – Context-Free Grammars – Chomsky’s Normal form -Griebach Normal Form - Push-down Automata - Equivalence of CFL’s and PDA’s - Non-context free languages.

REFERENCES:


2. NarsinghDeo, “Graph theory and applications to Engineering and Computer Science”, PHI, 1986.


Outcomes:

Students will be able to

1. Explain functions and related concepts and illustrate its direct application in Computer languages
2. Solve the problems using the concepts of Graphs, Trees
3. Deduce complex task by various Mathematical logic
4. Solve recurrence relations for a given problem
CA715 COMPUTER ORGANIZATION AND ARCHITECTURE

Objectives

- To understand the data representation in a digital computer and explain how operations are performed by computer circuits
- To study and analyze the internal components of a computer and evaluate the performance of CPU, memory and I/O operations
- Study and analyze the modern processor architecture

Number Systems - Binary Arithmetic - Boolean algebra - Map Simplifications - Gates - Combinational Circuits - Sequential Circuits.


CPU: Arithmetic And Logic Unit - Instruction Sets - RISC - CISC - Instruction pipeline - Addressing modes and formats - Register organization - Control Unit Operation - Processor organization.

External Devices: I/O modules - Programmed I/O - Interrupt Driven I/O - Direct Memory Access - I/O Channels - Asynchronous Data Transfer.

Processors: Parallel – Multi-core – Mobile – Embedded – GPU and TPU.

REFERENCES:


Outcomes:

1. Define binary number system and arithmetic operations. Design Boolean circuit for a given problem
2. Analyze the different types of memory and their organization
3. Describe the functional units of the CPU and its organization
4. Discover the working and organization of I/O Devices
5. Evaluate the different modern processor architecture
CA717 ACCOUNTING AND FINANCIAL MANAGEMENT

Objective:

- To learn the fundamentals of accounting and financial management


Depreciation – Methods - Inventory methods, Sources of working capital, Fund flows, Cash flows – Financial Statement analysis- Case studies.


Variable costs – Fixed costs – Cost Volume Profit Analysis – Break even marginal and full costing contribution, Standard costing - Analysis of variance - Computer accounting and algorithms.

Characteristics of Budgets - Forecasting – Long term, Short term – Methods of capital investment decision making, Sensitivity Analysis, Cost of capital.

REFERENCES:


Outcomes:

Students will be able to:

1. Prepare and analyse the final accounts of the firm
2. Prepare and analyse the funds & cash flow statements of the firm
3. Perform basic analysis of financial statements and write a report on the financial performance, conditions and effectiveness of the firm
4. Analyse and evaluate costing systems
5. Prepare different types of budgets and policies
Objective:

- To learn the fundamentals of probability and statistical methods


Test of Hypothesis- Testing for Attributes – Mean of Normal Population – One-tailed and two-tailed tests, F-test and Chi-Square test – Analysis of Variance- Nonparametric test.

REFERENCES:


Outcomes:

Students will be able to

1. Explain basic probabilistic and statistical models and illustrate their related applications
2. Estimate the likelihood of events from population
3. Propose, test and evaluate hypothesis
CA701 DATA STRUCTURES LAB USING C

Exercises for learning basic features of C and exercises to implement various data structures for real world applications

Outcomes:

Students will be able to:

1. Write C programs for solving any problems.
2. Implement linear and nonlinear data structures to solve real-time problems
3. Perform searching and sorting techniques to different application domains
4. Implement different design strategies to solve complex problems

CA703 BUSINESS COMMUNICATION

Objective:

- Introduce the dynamics of Communication in the Business world.
- Help to familiarize and practice the different kinds of communication tools
- Give practice in the nuances of spoken communication
- Expose to the different forms of Business communication.


Technology and Communication: Practice in telephone etiquette – Limitations & possibilities of E mail - Use of Power point- Role of mass media in business communication.

REFERENCES:


Outcomes:

1. Students will be able to communicate in the business world using different communication tools
SEMESTER -II

CA710 DESIGN AND ANALYSIS OF ALGORITHMS

Pre Requisite: CA711, CA713

Course Objective:

- To learn about Complexity Analysis and various algorithmic design methodologies


REFERENCES:


Outcomes:

1. Students will be able to:
2. Analyze the complexity of polynomial algorithms.
3. Apply various design strategies for solving problems
4. Distinguish NP hard and NP complete problems from other problems
CA712 DATABASE SYSTEMS

Pre Requisites: CA711, CA713

Objective:
- To learn different database models and design of databases and to study query languages and transaction management


REFERENCES:

Outcomes:
Students will be able to:
1. Illustrate the features of DBMS & Models for designing databases
2. Describe the nuances of Data retrieval methods
3. Apply normalization techniques in DB design
4. Perform concurrency and Transaction Management operations
CA714 OPERATING SYSTEMS

Pre Requisite: CA715

Objective:

- To introduce basic concepts and features of OS with case study on different operating systems


Files and Directories - Files System structure- Implementation –File allocation methods-Free space management- Virtualization – Containers.


Protection and security -Case Study-Linux, Windows, Mac OS and Mobile OS.

REFERENCES:


Outcomes:

Students will be able to:

1. Use system calls to interact with OS
2. Synchronize multiple processes and handle issues in synchronization
3. Implement memory management techniques
4. Implement algorithms in secondary storage and file management techniques
CA716 OBJECT ORIENTED PROGRAMMING

Objective:
- To learn the basic principles of object-oriented programming paradigm using C++


Class templates and generic classes – Function templates and generic functions – Overloading function templates – power of templates – Exception Handling – Derived class Exception – over handling generic functions – Exception handling Functions.


REFERENCES:

Outcomes:

Students will be able to:
1. Identify classes with attributes and functions for given problem
2. Analyze the relationship between the classes link them using appropriate concepts
3. Design and implement abstract data types.
4. Devise generic classes capable of manipulating primitive and user defined data types.
5. Perform object oriented analysis on the given problem and design a complete system to solve it.
CA718 RESOURCE MANAGEMENT TECHNIQUES

Pre Requisite: CA713

Objective:

- To learn different resource management techniques


Queuing theory - notation and assumptions – characteristics of queue – Poisson input process – exponential service times – Queuing models – M/M/1 – M/M/C – M/M/1/N – M/M/C/N

REFERENCES:


Outcomes:

Students will be able to:

1. Formulate and solve LP /NLP /DP Problems
2. Identify appropriate model for given inventory problems and solve the problems
3. Solve queuing problems using queuing models
CA072 DATABASE SYSTEMS LAB

Pre-requisite: CA 712

Exercises / case studies that require table design, normalization and query building.

Outcomes:

Students will be able to:

1. Design Database for real time applications
2. Implement database functionalities
3. Do project by applying database design techniques and queries

CA074 Operating System Lab

Pre-requisites: CA714

Exercises to learn various commands, system calls in operating system and understand the working principles of OS algorithms

Outcomes:

Students will be able to:

1. Work with various commands in operating systems
2. Work with system calls
# SEMESTER-III
## CA721 DATA MINING TECHNIQUES

**Pre-requisites:** CA712, CA719

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<tbody>
<tr>
<td>To introduce concepts of data mining techniques and its applications in knowledge extraction from databases</td>
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</tbody>
</table>


Data Preprocessing: Summarization - Data cleaning - Data Integration and Transformation - Data Reduction - Discretization and Concept Hierarchy Generation.

Mining Frequent Patterns – Frequent Item set Mining Methods. Classification: Classification by Decision Tree Induction – Bayesian Classification – Rule based Classification - Prediction– Accuracy and Error Measures.


**REFERENCES:**
3. K.P.Soman, ShyamDiwakar, V.Ajay, “Insight into Data Mining Theory & Practice, Prentice
4. Hall India, 2012
5. G.H.Gupta, “Introduction to Data Mining with Case Studies”, 2nd Edition, PHI.

<table>
<thead>
<tr>
<th>Outcomes:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students will be able to:</td>
</tr>
<tr>
<td>1. Explain the concepts in data mining and KDD, recognizing issues in Data Mining</td>
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<tr>
<td>2. Practice the preprocessing operations of Data</td>
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<tr>
<td>3. Define the methodologies in Data interpretation, transformation and reduction</td>
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<tr>
<td>4. Perform Association Rule Mining, Classify and Cluster the data sets into groups</td>
</tr>
<tr>
<td>5. Implement star schema through ETL tools</td>
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</tbody>
</table>
CA723 PYTHON AND R PROGRAMMING

Pre-requisites: CA716, CA719

Objectives:

- To acquire knowledge in Python and R programming
- To develop Python programs with conditionals and loops and data structures
- To learn how to design and program Python applications
- To learn how to build and package Python modules for reusability

INTRODUCTION TO PYTHON PROGRAMMING: Python interpreter and interactive mode; values and types variables, expressions, statements, tuple assignment, Order of operations, comments, debugging; modules and functions: function Calls, adding new functions, Definitions and Uses, flow of execution, parameters and arguments, Fruitful functions. Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, range, break, continue, pass; recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays.

LISTS, TUPLES, DICTIONARIES: Lists: Traversing a List, list operations, list slices, list methods, Map, Filter and Reduce, list loop, mutability, aliasing, cloning lists, list parameters; Dictionaries: operations and methods; advanced list processing - list comprehension; Tuples: tuple assignment, tuple as return value.

FILES, MODULES, PACKAGES: Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages: PANDAS, NUMPY, SCIKIT-LEARN;

INTRODUCTION TO R PROGRAMMING: Introduction and Preliminaries, numbers and vectors, Objects, their modes and attributes, Ordered and unordered factors, Arrays and matrices, Lists and data frames, Grouping, loops and conditional execution, functions.

STATISTICAL MODELS, GRAPHICAL PROCEDURES, PACKAGES: Statistical models: Defining statistical models; formulae, Linear models, Generic functions for extracting model information, Analysis of variance and model comparison, Updating fitted models, Generalized linear models, Nonlinear least squares and maximum likelihood models; Graphical procedures: High-level and low-level plotting commands, graphics parameters and list, Dynamic graphics. Packages: Standard packages, Contributed packages and CRAN, Namespaces.

REFERENCES:


**Outcomes:**

1. Problem solving and programming capability
2. Construct and execute basic programs in Python
3. Use external libraries and packages with Python
4. Construct and execute basic programs in R using elementary programming techniques
5. Use external R-packages in statistics and graphics
CA729 OBJECT ORIENTED ANALYSIS AND DESIGN

Pre-requisites: CA716, CA710

Objective:

- To learn the concepts of Object Oriented Analysis and Design; exposing the development of OOAD based applications


Process of design, design principles, architectural patterns, design document, difficulties and risks in design - Frameworks: reusable subsystem. Design patterns – Singleton, observer, adapter, Façade, proxy with examples. - Pattern Categories - Relationships between patterns - Pattern descriptions – Patterns based Applications – Object Oriented Database.


REFERENCES:


Outcomes:

Students will be able to:

1. Define the fundamentals of OO approach
2. Design OO Application using design patterns
3. Solve real world problems by applying OOAD principle
4. Acquire expertise in Java Programming
Objectives:

- To impart concepts of a comprehensive study on the theories, processes, methods, and techniques of building high-quality software in cost-effective ways.

Introductory concepts – The evolving role of software – Its characteristics, components and applications - A layered technology – the software process – Software process models – Software development Life cycle- Software process and project metrics – Measures, Metrics and Indicators- ethics for software engineers.


REFERENCES:


Outcomes:

Students will be able to:

1. State the proven principles/techniques/tools, current standards, and best practices of software Engineering
2. Estimate cost, effort and risk involved in a project
3. Choose a suitable design model for software development
4. Develop a software using formal software engineering approaches
5. Describe the principles of re-engineering and reverse engineering
CA727 COMPUTER NETWORKS

Pre-requisites: CA714

Objective:

- To learn various network architectures and protocols and the functions of different layers in line with IEEE standards.


Error Detection and Correction – VRC – LRC - CRC- Checksum – Hamming Distance for Error Correction – simulator development to capture various packets flowing in the Data Link Layer.


Domain Name Service (DNS) – Email - SMTP – MIME – HTTP – SNMP-TELNET-FTP.

REFERENCES:


Outcomes:

Students will be able to:

1. List the functionalities of networking layers of both OSI and TCP/IP reference model
2. Explain design issues of DLL and techniques to resolve it
3. Describe the principles of switching and routing algorithms
4. Distinguish TCP and UDP related formats and procedures
CA705 NETWORKS LAB

Pre-requisites: CA727

- Exercises to practice installation and configuration to understand network architecture and build a network
- Exercises to implement network principles

Outcomes:
Students will be able to:
1. Install and configure networks
2. Build the network according to the requirement
3. Implement network principles

CA707 DATA MINING LAB

Pre-requisite: CA 721

Exercises to

- Understand the data sets and data preprocessing using ETL tools
- Demonstrate the working of algorithms for data mining tasks such association rule mining, classification, clustering and regression

Outcomes:
Students will be able to:
1. Work with ETL tools
2. Demonstrate the classification, clustering and etc. in large data sets.
3. Ability to add mining algorithms as a component to the exiting tools.
4. Ability to apply mining techniques for realistic data.
SEMESTER-IV

CA728 WEB TECHNOLOGY AND ITS APPLICATIONS

Pre-requisites: CA716

Objective:

- To learn the concepts web technologies; develop and deploy effective web applications

Web essentials – W3C - Clients – Servers - Communication – Markup Languages – XHTML – Simple XHTML Pages Style Sheets – CSS.

Client side programming – Java script language – Java Script Objects – Host Objects Browsers And The DOM.


REFERENCES:


Outcomes:

Students will be able to:

1. Develop client side and server side applications
2. Design and develop enterprise applications
3. List the various middleware technologies and use them to develop applications
CA724 INFORMATION SECURITY

Pre-requisite: CA 713, CA727

Course Objectives

- To understand and apply the models of information security
- To study and analyze cryptographic and forensic methods
- Analyze and simulate the network and application security
- Explore the nature and logic behind security threats on the web as an ethical hacker


Cryptography: Classical Cryptography, Symmetric Cryptography, Public Key (Asymmetric cryptography), Modern Cryptography. Forensics: DRM technology (including watermarking and fingerprinting), Steganography, Biometrics.


REFERENCES:


Outcomes:

1. Identify the information security models and their characteristics
2. Analyze the different types of cryptographic and forensic methods
3. Study the network security issues
4. Discover the layers of application security
5. Identify different threats and suggest fixes in data and cyber security.

Industrial component:

Expert Lectures on Security Related Issues from Ethical Hackers.
CA726 DISTRIBUTED TECHNOLOGY

Pre-requisites: CA727, CA712

Objective:

- To learn the various distributed objects and technologies.

Introduction- Different Forms of Computing- Architecture - Inter-process Communications: IPC Program Interface-Event Synchronization-Timeouts and Threading-Deadlocks and Timeouts-Data Representation- Data Encoding- Text-Based Protocols-Request-Response Protocols-Event Diagram - Sequence Diagram- Connection-Oriented Vs Connectionless IPC.


Case Studies – A Distributed System In A Room – Geographically Distributed Nodes, Centralized Control. Site Replication for Disaster Protection- searching Heterogeneous and Distributed Databases-Distributed Database Case Study on Google’s Big Tables.

REFERENCES:


Outcomes:

Students will be able to:

1. Explain the principles and issues in Inter Process Communication
2. Use the concepts of client/server in developing applications
CA722 ORGANIZATIONAL BEHAVIOR

Pre-requisite: CA 703

Objective:
- To learn the leadership skills and group behavior


Conflicts - Individual conflict, Interpersonal conflict, Inter-group conflict– Conflict Resolution - Negotiation

Foundations of Organization Structure - Organizational Culture – Feedback – performance Appraisal- Organizational Dynamics

REFERENCES:

Outcomes:
Students will be able to:
1. Identify their personality type and behavioral pattern
2. Identify the basic skills of leadership
3. Apply the principles of conflict resolution and learn about group behavior
4. Adapt to the organization culture, structure and dynamics

Industrial Component:
A series of tutorials on Organization Development
CA706 WEB TECHNOLOGY AND ITS APPLICATIONS LAB

Pre-requisite: CA 728

Exercises / Case Studies on HTML, XML, PHP, JSP etc. – Designing Web Portals

Course Outcome

With HTML, XML, PHP, JSP, students will be able to

1. Develop client side and server side applications
2. Design and develop enterprise applications
3. Implement the various middleware technologies and use them to develop applications

CA708 INFORMATION SECURITY LAB

Pre-requisite: CA 724

Exercises to learn information security related programming using tools.

Outcomes:

Students will be able to:

1. Implement cryptography techniques to data
2. Simulate the various network security issues
3. Experiment with application security
4. Explore the nature and logic behind the various security threats on the web
SEMESTER-V
CA731 ARTIFICIAL INTELLIGENCE

Objectives:
- To know about basic concepts of NLP and Machine Learning
- To obtain a thorough knowledge of various knowledge representation schemes
- To have an overview of various AI applications
- To study about various heuristic and game search algorithms
- To know about various Expert System tools and applications

Introduction: Introduction to AI applications and AI techniques, Production systems, control strategies, reasoning - forward and backward chaining. Intelligent Agents: Definitions of a rational agent, reflex, model-based, goal-based, and utility-based agents, the environment in which a particular agent operates.

Searching Techniques and Game Playing: Breadth first search, depth first search, iterative deepening, uniform cost search, hill climbing, simulated annealing, genetic algorithm search, heuristic search, Best first search, A* algorithm, AO* algorithm, Minimax and game trees, refining minimax, Alpha – Beta pruning, constraint satisfaction.

Knowledge Representation: First order predicate calculus, resolution, unification, natural deduction system, refutation, logic programming, PROLOG, semantic networks, frame system, value inheritance, conceptual dependency, Ontologies. Planning: basic representation for planning, symbolic-centralized vs. reactive-distributed, partial order planning algorithm.


Applications of Artificial Intelligence- Natural Language Processing, Speech recognition, Computer vision, Expert systems.

REFERENCE:

Outcomes:
Students will be able to:
1. Know how to build simple knowledge-based systems
2. Apply knowledge representation and machine learning techniques to solve real-world problems
3. Apply Artificial Intelligence techniques to solve real-world problems
CA733 CLOUD COMPUTING

Pre-requisites: CA727, CA726

**Objective:**
- To learn the various concept of Distributed and Cloud computing and to study the Architecture and service models in Cloud computing.


**REFERENCES:**

**Outcomes:**
Students will be able to:
1. Acquire Knowledge on the features and development of Cloud Computing.
2. Define the principles of virtualization
3. Use various performance criteria to evaluate the quality of the cloud architecture
4. Identify the Service-Oriented Architecture for Distributed Computing workflow.

**Industrial component:**
Expert Lecture on current advancement in cloud and cloud support models.
CA709 ARTIFICIAL INTELLIGENCE LAB

**Pre-requisite:** CA 731

Exercises to
- Understand fundamentals of knowledge representation
- Acquire knowledge on the basic concepts and techniques of Machine Learning
- Gain knowledge on the basics of computational Intelligence techniques

**Outcomes:**

Students will be able to:

1. Apply knowledge representation and machine learning techniques to solve real world problems
2. Apply Computational Intelligence techniques to solve real-world problems

CA749 MINI PROJECT WORK

**Pre-requisites:** CA711, CA728, CA725

**Outcomes:**

Students will be able to:

1. Identify the problem related to the project work
2. Implement the case studies using the concepts and the techniques learnt in the curriculum

CA750 PROJECT WORK

**Pre-requisites:** CA711, CA728, CA725

SIX Months internal/external project work with submission of reports for the project work and viva-voce examination.

**Outcomes:**

Students will be able to:

1. Implement the solution for the chosen problem using the concepts and the techniques learnt in the curriculum.
2. Developing software applications
3. Record the research results for a given problem
**ELECTIVES**

**CA7A1 BUSINESS INTELLIGENCE**

**Pre-requisite:** CA721

**Objective:**
- To know the BI as expert information, knowledge and technologies efficient in the management of organizational and individual business.

Decision Support and Business intelligence - Changing Business environments and computerized decision support, managerial decision making and support for decision making - DSS concept and framework Business intelligence - Major tools and techniques of managerial decision support - BI architectures.

Essentials of Business Intelligence-Origins and drivers of business intelligence, successful BI implementation, characteristics of BI-Architecting the Data, Enterprise Data Model and its Benefits, Granularity of Data in Data Warehouse and Role of Metadata.

Advanced Data Warehousing principles- Data warehousing architectures, DW development, real time DW and DW Administration and security issues-Visualization of Dimension model-Star, snowflake and other advanced models-Aggregated Fact tables -Relational DBMS Support for Dimensional Modeling- Advanced Topics in Dimensional Modeling - Selecting a Modeling Tool - Populating Data Warehouse.

Dimensional modeling in BI environment - Dimensional Modeling - Modeling considerations - Dimensional model design life cycle - Case studies - Business Analytics and data Visualization - Business analytics overview, reports and queries. Advanced business analytics, data visualization, Real time BI, Business analytics and web intelligence - Structure of mathematical models for decision support and visual interactive simulation.

Business performance Management - Business Intelligence Applications: Marketing models, Logistic and production models and Data Development analysis.

**REFERENCES:**

**Outcomes:**

Students will be able to:
1. Explain the concepts of decision support and framework for Business Intelligence
2. Identify the practical implications and functions of BI
3. Design & construct data mart and data warehouse
4. Describe dimensional modelling and analytics involved in BI
CA7A2 UNIX AND SHELL PROGRAMMING

Pre-requisite: CA714

Objective:
To learn the UNIX operating system concepts and shell programming


REFERENCES:

Outcomes :

Students will be able to :

1. Explain the concepts of UNIX Operating System
2. Use various file and directory commands in UNIX Operating System
3. Write shell scripts for various tasks
CA7A3 VISUAL PROGRAMMING

Pre-requisite: CA716

Objective:
Understand the principles of graphical user interface design and develop desktop applications and web services using .NET


REFERENCES

Outcomes:

Students will be able to:
1. Define the basics of .NET framework
2. Use components in .NET to solve various application related problems
3. Design and develop web applications with ASP.NET

Industrial Component:
A series of lectures on the latest trends and technology
CA7A4 SOFTWARE ARCHITECTURE AND PROJECT MANAGEMENT

**Pre-requisite:** CA725

**Objective:**

- To know the issues related to the design of complex software and to learn the project management concepts and the use of tools.


Design Patterns - Evolution patterns - Software artifact evolution processes - Case studies - Java Beans.


REFERENCES:


**Outcomes:**

Students will be able to :

1. Explain various design and evaluation methods
2. Employ design patterns in the software architecture
3. Apply various phases of life cycle models
4. List various process models and describe issues related with quality assurance
5. Apply engineering activities involved in various project management phases

**Industrial Component**

Presentation of Case studies on the design & development of complex software and current practices of successful project management activities by professionals from leading industries.
CA7A5 BUSINESS ETHICS

Pre-requisite: CA722

Objective:
- To introduce business ethics and its practices


Environmental Pollution and Society - Marketing Ethics (in Products, Pricing, Promotion and Place) and Consumer protection – Ethics in Human Resources management (Recruitment and promotion policies, Working Conditions, Down Sizing Workforce), Ethical issues at the top management, Ethics in financial markets and investor protection – Ethical responsibility towards competitors and business partners.

A Historical Perspective from Industrial Revolution to Social Activism – Current CSR practices of the firms in India and abroad. Conflicts in decision making from ethical and economic point of view - Ethical Dilemma - Solving ethical dilemma - Managerial integrity and decision making.


REFERENCES:

Outcomes:
Students will be able to:
1. Define the principles of ethics and morals of business
2. Convey ethical response with respect to Competitors & Business Partners
3. Enhance the leadership skills with respect to decision making & business management
CA7B3  INTERNET OF THINGS

Objectives
- To understand the fundamentals of Internet of Things
- To learn about the basics of IOT protocols
- To build a small low cost embedded system using Raspberry Pi.
- To apply the concept of Internet of Things in the real world scenario

Introduction - Physical and Logical Design- Enabling Technologies - Levels & Deployment Templates - Domain Specific IoTs - NETCONF-YANG- IoT Platforms Design Methodology.


REFERENCES:

Outcomes:
Students will be able to:
1. Analyze various protocols for IoT
2. Develop web services to access/control IoT devices.
3. Design a portable IoT using Raspberry Pi
4. Deploy an IoT application and connect to the cloud.
5. Analyze applications of IoT in real time scenario
CA7B4 MARKETING MANAGEMENT

Pre-requisites: CA717, CA722

Objective:
To facilitate understanding of the conceptual framework of marketing and its applications in decision making under various environmental constraints.

Introduction to marketing, scope of marketing, core marketing concepts, new marketing realities, production concept, product concept, selling concept, marketing concept, Relationship Marketing, Integrated Marketing, Performance Marketing, new 4P’s.


Promotion: Communication Process; Promotion mix – advertising, personal selling, sales promotion, publicity and public relations, direct marketing; Determining advertising budget; Copy designing and testing; Media selection; Advertising effectiveness; Sales promotion – tools and techniques.

Market control: Annual plan control, sales analysis market share analysis, profitability control, marketing profitability analysis, efficiency control and strategic control. Trends in marketing, socially responsible marketing, internal marketing, green marketing, cause marketing, cause related marketing.

REFERENCES:

Outcomes:
Students will be able to:
1. Define the fundamentals of marketing
2. List the issues related to buying and target marketing
3. Apply the new product development strategies
4. Use product promotional techniques
5. Familiar with trends in analysis & control in marketing
CA7B5 SOFT COMPUTING

Pre-requisites: CA711, CA719

Objective:
- To introduce the techniques of soft computing
- To explain the hybridization of soft computing systems which differ from conventional AI and computing in terms of its tolerance to imprecision and uncertainty.


Neural Network (NN), Biological foundation of Neural Network, Neural Model and Network Architectures, Perceptron Learning, Supervised Hebbian Learning, Back-propagation, Associative Learning, Competitive Networks, Hopfield Network, Computing with Neural Nets and applications of Neural Network.

Fuzzy Sets, Operations on Fuzzy sets, Fuzzy Relations, Fuzzy Measures, Applications of Fuzzy Set Theory to different branches of Science and Engineering.

Neuro Fuzzy and Soft Computing, Adaptive Neuro-Fuzzy Inference System Architecture, Hybrid Learning Algorithm, Learning Methods that Cross-fertilize ANFIS and RBFN.


REFERENCES:

Outcomes:
Students will be able to:
1. Explain the basics of soft computing and their suitable industry related applications
2. Apply neural network principles and algorithms for given problems
3. Apply the principles of fuzzy algorithms for real time applications

Industrial Component:
A series of tutorials on MATLAB.
CA7B6 ADVANCED DATABASE TECHNOLOGY

Pre-requisites: CA712, CA721

**Objective:**
- To learn advanced database models and design of databases


REFERENCES:

**Outcomes:**
Students will be able to:
1. Apply the principles of query optimization to a database schema
2. Design parallel and object database for real life application
3. Use distributed database management system
CA7B7 MODELING AND COMPUTER SIMULATION

Pre-requisites: CA713, CA719, CA723

Objective:
1. To understand the techniques of random number generations and testing randomness.
2. To design simulation models for various case studies like inventory, traffic flow networks, etc.
3. To practice on simulation tools and impart knowledge on building simulation systems.

Simulation and Simulation Software - Systems – Models – Types, Components, Steps in Modeling – Simulation of statistical queuing, manufacturing and material handling.


REFERENCES:

Outcomes:
Students will be able to:
1. Practice simulation tools and build simulation systems
2. Assess the techniques of random number generations and testing its randomness
3. Design various simulation models for real time situation
CA7B8 COMPUTER VISION

Pre-requisites: CA713

Objective:

- To understand the fundamental concepts related to image processing, feature extraction, pattern analysis etc.
- To apply the concepts to solve computer vision problems of different fields.


Edges - Canny, LOG, DOG; Line detectors (Hough Transform), Corners - Harris and Hessian Affine, Orientation Histogram, SIFT, SURF, HOG, GLOH.

Image Segmentation: Region Growing, Edge Based approaches to segmentation, Graph-Cut, Mean-Shift, Texture Segmentation; Object detection.

Motion analysis: Background Subtraction and Modeling, Optical Flow, KLT, Spatio-Temporal Analysis, Dynamic Stereo; Motion parameter estimation.

Object tracking, Mean shift tacking, Object categorization, content based image retrieval, action recognition.

Textbooks


Outcomes:

Students will be able to:

1. Apply fundamental algorithms in Image Processing and analyse their applicability for real time problems.
CA7C1 HUMAN COMPUTER INTERACTION

Pre-requisites: CA716, CA725

Objective:

- To learn the concepts (basic to advanced levels) of user oriented aspects of product designs (physical to software); providing in depth study on Human Centric and Human oriented features in developing systems.

Importance of user Interface – definition, importance of good design. Benefits of good design. A brief history of Screen design. The graphical user interface – popularity of graphics, the concept of direct manipulation, graphical system, Characteristics, Web user – Interface popularity, characteristics- Principles of user interface. Design process – Human interaction with computers, importance of human characteristics human consideration, Human interaction speeds, and understanding business junctions.


HCI and related fields – Cognition Theory – A.I. – Accessibility Issues – Assistive Technologies - Technologies for HCI – Research Directions in HCI.

REFERENCES:
7. SorenLauesen ,”User Interface Design”, Pearson Education

Outcomes: To enable students to understand HCI principles and practice them in product designs

Industrial Component: Providing exposure to HCI based software development products.
CA7C2 BIOINFORMATICS

Pre-requisite: CA7B5

Objective:
- To understand Genomic data acquisition and analysis, comparative and predictive analysis of DNA and protein sequence, Phylogenetic inference etc.

Introduction to bioinformatics, classification of biological databases, Biological data formats, application of bioinformatics in various fields. Introduction to single letter code of amino acids, symbols used in nucleotides, data retrieval – Entrez and SRS.

Introduction to sequence alignment, substitution matrices, scoring matrices – PAM and BLOSUM. Local and Global alignment concepts, dot plot, dynamic programming methodology, Multiple sequence alignment – Progressive alignment. Database searches for homologous sequences – FASTA AND BLAST versions.

Evolutionary analysis: distances - clustering methods – rooted and unrooted tree representation – Bootstrapping strategies.

Fragment assembly-Genome sequence assembly - Gene finding method, Gene prediction - Analysis and prediction of regulatory regions.


REFERENCES:

Outcomes:
Students will be able to:
1. Describe user oriented aspects of product design
2. Analyze the screen designing principles
3. Apply HCI principles in product designs
CA7C3 DEEP LEARNING

**Pre-requisites:** CA727, CA731

**Objective:**
- To understand and apply the Machine learning principles
- To study the deep learning architectures
- Explore and create deep learning applications with tensor flow


Convolution Neural Network – Feature Selection – Max Pooling – Filters and Feature Maps – Convolution Layer – Applications.

Recurrent Neural Network – Memory cells – sequence analysis – word2vec- LSTM - Memory augmented Neural Networks – NTM—Application.

Reinforcement Learning – MDP – Q Learning – Applications.

**REFERENCES:**


**Outcomes:**

Students will be able to:

1. Analyze the architecture for Mobile computing platform
2. Identify and be able to use recent and advanced GSM architecture with emerging technologies
3. Explore, Evaluate different mobile computing methodologies
4. Apply the concepts of pervasive computing in real life problems
CA7C4 MULTI-CORE ARCHITECTURE

Pre-requisites: CA715, CA727

Objective:

- To learn different multi-core programming techniques.

Multi-core – Definition and hybrid architectures – The software developer’s viewpoint – the bus connection – from single core to multi-core – Four effective multi-core designs.

Challenges of multi-core programming – Sequential model – definition – Concurrency – Definition – challenges pertaining to software development – Processor architecture challenges – Operating system’s role.


Communication and synchronization – synchronizing concurrency – Thread strategy approaches – Decomposition and encapsulation of work- Approaches to application design – PADL and PBS.


REFERENCES:


Outcomes:

Students will be able to:

1. List the features of multi core systems and assess the challenges of multi core programming
2. Apply process techniques
3. Identify the approaches to application design
4. Describe the communication and fine issues
CA7C5 MEAN Stack Web Development

Pre-requisites: CA728

Objective:

- To create modern web applications and layout how to use the MEAN (Mongo, Express, AngularJS, and Node.js) set of tools
- To create a web application, from installation and setup of the tools to debugging and deploying app.


REFERENCES:


Outcomes:
Students will be able to
1. Get a complete knowledge on JavaScript-based application stack to build, test, and deploy web applications or mobile apps.
CA7C6 BIG DATA MANAGEMENT

Pre-requisites: CA712, CA721, CA726

Objective:
- To gain ability to design high scalable systems.

Big Data – Unstructured Data - Introduction to data analytics, big data analytics, big data management.

Data Management Techniques: Storage of large data – Analyze of large data –Extraction of business relevant, social relevant information.

Columnar databases - Map Reduce as a tool for creating parallel algorithms -Processing very large amounts of data.

Big Data applications -Columnar stores -Distributed databases –Hadoop -Locality Sensitive Hashing (LSH) –Dimensionality reduction –Data streams –Unstructured data processing, NoSQL-NewSQL.

Mining massive datasets - Socio-Business intelligence using big-data.

REFERENCES:

Outcomes:

Students will be able to:

1. Explain the concepts of big data analysis
2. Identify the various Big data management, processing techniques
3. Analyse performance of big data analysis in Hadoop environment
Objective:
To provide evolutionary Computation and global optimization techniques.

Evolutionary computing: Biological foundation of Evolutionary computing, Introduces evolutionary algorithms, a class of stochastic, population-based algorithms inspired by natural evolution theory, capable of solving complex problems for which other techniques fail.


Swarm Intelligence (SI): Biological foundation of SI, SI Techniques: Ant Colony Optimization (ACO) and Particle Swarm optimization (PSO). General steps in ACO, the "Invisible Manager" (Stigmergy), the Pheromone, Ant Colonies and Optimization, Ant Colonies and Clustering, Applications of Ant Colony Optimization. Applications of ACO.

PSO: Social Network Structure: The Neighborhood Principle, PSO Algorithm, Fitness Calculation, Convergence, PSO System Parameters, Particle Swarm Optimization versus Evolutionary Computing and Applications of PSO.

Mimetic algorithm, Firefly Algorithm, multi objective algorithms.

REFERENCES:

Outcomes:
Students will be able to:
1. Describe the Evolutionary algorithms and solve complex problem using evolutionary algorithms.
2. Identify the issues in design and implementation of genetic algorithm.
3. Explain the concepts of Swarm Intelligence techniques.
4. Describe the social network structure.
CA7C8 SOCIAL NETWORK ANALYSIS

Pre-requisites: CA713, CA721

Objective:
To introduce the concepts and methods of social network analysis.

Social network concepts – Development of social network and analysis - Online social networks – Social Network Data - Issues and challenges.

Linked-based and structural analysis - Content-based analysis - Static and dynamic analysis Mathematical Representation of social networks.

Social networking systems and API - Statistical Analysis of Social Networks- Community Detection in Social Networks - Node Classification in Social Networks -Evolution in Dynamic Social Networks.

Social Influence Analysis -Link Prediction in Social Networks -Data Mining in Social Media Text Mining in Social Networks - Social Tagging -Building social services.

Tools for Social network analysis: UCINET – PAJEK– NETDRAW – StOCNET - SPlus - R – NodeXL- SIENA and RSIENA - Real-world networks (Facebook graph, Twitter networks, etc.)

REFERENCES:

Outcomes:
Students will be able to:
1. Describe the issues and challenges in social network functions
2. Mathematically represent social networks for analysis
3. Use various tools for social network analysis