M. Sc. Computer Science

Syllabus

(For the students admitted from 2018-2019 onwards)

BISHOP HEBER COLLEGE (AUTONOMOUS), TIRUCHIRAPPALLI-620 017
M. Sc., Computer Science
(Applicable to Candidates admitted from the Academic Year 2018-2019 onwards)

Sem	Course	Course Title	Course Code	Hours / Week	Credits	Marks		
						CIA	ESE	Total
I	Core I	Data and Visual Analytics	P18CS101	5	4	25	75	100
	Core II	Mobile Application Development	P18CS102	5	4	25	75	100
	Core III	Mathematical Foundation for Computer Science	P18CS103	5	4	25	75	100
	Elective I	1a) Managing Software Development 1b) Design and Implementation of Compilers 1c) Multimedia Systems and Design	P18CS1:1 P18CS1:2 P18CS1:3	5	4	25	75	100
	Core Practical I	Data and Visual Analytics Lab	P18CS1P1	5	3	40	60	100
	Core Practical II	Mobile Application Development Lab	P18CS1P2	5	3	40	60	100
II	Core IV	Machine Learning	P18CS204	4	4	25	75	100
	Core V	Real Time Web App Development	P18CS205	4	4	25	75	100
	Core VI	Cloud and Big Data Computing	P18CS206	4	4	25	75	100
	Elective II	2a) Network Management 2b) Web Services 2c) Client Server Computing	P18CS2:1 P18CS2:2 P18CS2:3	4	4	25	75	100
	Core Practical III	Machine Learning Lab	P18CS2P3	4	3	40	60	100
	Core Practical IV	Real Time Web App Development Lab	P18CS2P4	4	3	40	60	100
	NMEC	Internet Technology Office and Visual Basic Programming	P18CS2E1 P18CS2E2	4	2	25	75	100
	VLO	RI/MI	P18VL2:1 P18VL2:2	2	2	25	75	100
III	Core VII	Computer Vision	P18CS307	5	4	25	75	100
	Core VIII	Text and Web Mining	P18CS308	5	4	25	75	100
	Core IX	Human Computer Interaction Design	P18CS309	5	4	25	75	100
	Elective III	3a) Design and Implementation of Data Warehouse 3b) Mobile Computing 3c) Distributed Object Technology	P18CS3:1 P18CS3:2 P18CS3:3	5	4	25	75	100
	Core Practical V	Computer Vision Lab	P18CS3P5	5	3	40	60	100
	Core Practical VI	Text and Web Mining Lab	P18CS3P6	5	3	40	60	100
IV	Core X	Neural Networks and Deep Learning	P18CS410	5	5	25	75	100
	Core XI	Computer and Network Security	P18CS411	5	5	25	75	100
	Elective IV	4a) Supply Chain Management 4b) Linked Open Data and Semantic Web 4c) Advanced Microprocessors And Microcontrollers	P18CS4:1 P18CS4:2 P18CS4:3	5	4	25	75	100
	Core Project	Project	P18CS4PJ	---	6	---	---	100
				Total Credits	90			

Data and Visual Analytics

Course Objectives
This course introduces the python language and provide details about Numpy, Panda and matplotlib library details. Data visualization done through these libraries.

Learning Outcomes
Upon completion of this course, students should be able to:
- Appreciate the need of python and understands the basics of python.
- Write implementation through Panda, Numpy and Matplotlib libraries.
- Achieve the Data visualization using these packages.

UNIT – 1: Python – Preliminaries and Environment
Significance of python in Data Analysis -Installation and setting up Python-Discussion on the essential libraries of Python- An Example – "Counting Time Zones" -Basics of IPython: Commands.

Usage of Command history in Python : Interacting with Operating System using Shell commands-Software development tools used with PythonHTML Note books in IPython-Productive code development using IPython.

UNIT – 2 Numpy and Panda Libraries in Python
The Numpy n-d array, Basic Operations on Array-Boolean indexing, Fancy indexing, Transposing and swapping-Universal Functions: Element wise array functions-Data processing with arrays-File input and output with arrays. Ex: Random Walks.
Introduction to Panda Data structure: Essential panda functionalities -Computing and summarizing descriptive statistics-Handling Missing Data-Hierarchical indexing.

UNIT – 3 Data Loading and Wrangling in Python
Reading and writing data in text format- Exploring Binary data formats-Interacting with HTML Language Interaction with MongoDb -Merging and combining of Datasets-Reshaping and pivoting process in python.

Data Transformations: Different types of String Manipulations-Introduction to USDA Food Database Working with USDA Database.

UNIT – 4 Plotting, Visualization, Data Aggregation and Group operations
Introduction to Matplotlip API   - Plotting functions used in Panda-Python visualization and Tool Eco-System-Usage of Group-by mechanics in Python-Data Aggregation-Group wise operations and transformations-Quantile and bucket analysis- Filling Missing Values
Working Example: Random Sampling and Permutation-Pivot tables and Cross tabulation.

UNIT – 5 Time series, Financial and Data Applications
Date and Time data types - Basics of Time Series-Data Ranges, Frequencies and shifting-Time Zone Handling-Period and Period Arithmetic-Resampling and Frequency Conversion-Data Mingling basics.
Introduction to group transforms and analysis: Signal Frontier Analysis Future Contract Rolling

Text book(s):
1. Wes. Mc Kinney , "***Python for Data Analysis***", First Edition,[O'Reilly], 2013 **(Chapters 1,2,3,4,5,6,7,8,9,10,11)**

Reference Book(s):

1. Cyrille Rossant. Learning I "*Python for interactive Computing and data visualization"*,
    First edition [Packt]

Mobile Application Development

Course Objectives
Develop a working knowledge of Android app development tool. Identify need and opportunity in app markets.

Learning Outcomes
Upon completion of this course, students should be able to:
*   Understand mobile devices and mobile platforms
*   Demonstrate earn wireless communication standards and data transmission standards
*   Setup programming tools for a mobile application developer

UNIT I: Fundamentals mobile app
Mobile app basics - Creating an Android project - Navigating in Eclipse - Laying out the user Interface - From Layout XML to view objects - Wiring up widgets - Android build tools - Creating a new class - Adding an Icon - Logging the activity life cycle.

UNIT II: Mobile app manipulation
Debugging Android apps - The DDMS perspective - Android specific debugging - Setting up a second activity - Compatibility and Android programming - The need for UI flexibility - Hosting a UI fragment - Creating a UI fragment - Adding a UI fragment to the fragment manager - The reason all our activities will use fragments.

UNIT III: User Interfaces with layouts and widgets
 XML layout attributes - Using the Graphical layout tool - Creating a list fragment - An abstract activity for hosting a fragment - Starting an activity from a fragment - Fragment arguments - Creating crime pager activity - Creating a dialog fragment - Passing data between two fragments - More dialogs.

UNIT IV: Audio playback using media player
Adding resources - Creating hello moon fragment - Audio playback - Rotation and retained fragments - Options menus - Saving and loading data in criminal Intent - Using the camera API - Taking a picture - Using implicit Intents - Styles and Includes.

UNIT V: Mobile app back ground services
Creating an Intent service - Controlling your alarm - Waking up on Boot - Filtering foreground notifications - Setting up the Drag and Draw project - Creating a custom view - Tracking the device's location - Local Databases with SQlite - Adding the maps API to Run tracker - Showing the user's location on a map.

Text Book(s):
1. Android Programming *"THE BIG NERD RANCH GUIDE",* BILL PHILLIPS and BRAIN HARDY, Pearson Technology Group, First edition, September 2013, ISBN-13 978-0321804334

Reference Book(s):
1. Donn Felker and Joshua Dobbs, *"Android Application Development – For Dummies"*, Wiley Publishing Inc., 2011.

Mathematical Foundation for Computer Science

Course Objectives
This course provides foundation to Mathematical models that are used in most areas of Computer Science. The topics include Logic, Basics of Combinations and Permutations, Relations, Graphs, Trees and Modeling Computations.

Learning Outcomes
Upon completion of this course, students should be able to:
- Comprehend and evaluate mathematical arguments revolving around computation.
- Understand the basics of Combinations and Permutations.
- Apply the knowledge on Graphs and Trees to real world applications.
- Demonstrate the working of Grammars and Languages.

Unit I : The foundations: Logic and Proofs
Propositions – Conditional statements – Converse contrapositive and inverse – Bi Conditionals and Implicit Bi conditionals – Truth tables – Operators – Translating English statements – system specification – Boolean searches and Logic puzzles – Logical equivalence and De Morgans law –Constructing new logical equivalence – Propositional satisfiability – Predicates and Quantifiers –Nested Quantifiers – Valid arguments in propositional logic – Rules of inference – Using rules of inference to build arguments – Rules of inference for quantified statements.

Unit II : Counting's and Advanced counting Techniques
The basics of Countings – The Pigeonhole Principle – Permutations – Combinations – Generalized Permutation and Combinations – Generating Permutation and Combinations – Applications of Recurrence Relations – Divide and Conquer Algorithms and Recurrence Relations – Generating functions – Inclusion - Exclusion.

Unit III : Relations
Relations and their properties – n-ary Relations and their applications – Representing relations using Matrices – Representing relations using digraphs – Closures – Paths in directed graphs and transitive closures – Warshall's Algorithm – Equivalence Relations – Equivalence classes – Partial Orderings.

Unit IV : Graphs and Trees
Graphs and Graph models – Graph terminology and special types of graphs – Representing Graphs and Graph Isomorphism – Connectivity – Euler and Hamilton paths – Shortest path problems – Planar Graphs – Introduction and applications of Trees – Tree Traversal – Spanning Trees and Minimum Spanning Trees.

Unit V : Modeling Computation
Languages and Grammars – Types of Grammars and Definitions – Derivation trees – Bacus Normal Form(BNF) – Finite state machines with output – Finite state machines with No output – Constructing NFA – Constructing DFA – Definition of Turing Machine and Turing Machine to recognize sets – Computing functions with Turing Machine and types.

Text Book(s):
1. Kenneth H. Rosen, " Discrete Mathematics and Its Applications", The Mc Graw- Hill companies, &th edition, 2012.

References Book(s):
1. Mahima Ranjan Adhikari and Avishek Adhikari, *"Basic Modern Algebra with Applications"*, Springer 2014.
2. Kolman, Busby and Ross, *"Discrete Mathematical Structures"*, 6th edition,PHI.2009.

Elective 1a) Managing Software Development

Couse Objectives
- To acquire knowledge and skills necessary to lead a project team
- To understand the relationship of software development to overall project engineering

Learning Outcomes
Upon completion of this course, students should be able to:
- Learn to estimate time and costs
- Learn to understand the software process
- Specialize in management techniques especially in the areas of estimating and scheduling

Unit 1: Software, Software Engineering & The Software Process
Introduction to Software: The nature of Software – The changing nature of Software
Software Engineering: Defining the discipline – The software process – Software Engineering practice – Software development myths.
Agile development: What is Agility? – Agility and the cost of change – What is an Agile process? – Extreme programming – Other Agile process models.

Unit 2: Modeling
Understanding requirements: Requirements Engineering – Establishing the groundwork – Eliciting requirements – Developing Use Cases – Building the analysis model – Negotiating requirements.
Requirements modelling for Scenario-based methods: Requirements analysis – Scenario-based modelling – UML models that support the Use Case.

Unit 3: Quality Management
Quality concepts: What is Quality? – Software Quality – The software quality dilemma – Achieving software quality.
Review techniques: Cost impact of software defects – Review metrics and their use – Reviews: A formality spectrum – Informal reviews – Formal technical reviews – Post-Mortem evaluations
Software Quality Assurance: Elements of Software Quality Assurance – SQA Tasks, Goals and Metrics – Statistical Software Quality Assurance – Software reliability – The ISO 9000 Quality standards – The SQA plan.

Unit 4: Managing Software Projects – I
Project Management concepts: The Management spectrum – People – The Product – The Process – The Project – The W^5HH principle
Process and Project Metrics: Metrics in the process and project domains – Software measurement – Metrics for software quality – Metrics for small organizations
Estimation for software projects: Observations on estimation – The Project planning process – Software scope and feasibility – Resources – Software Project Estimation – Decomposition techniques – The Make/Buy decision.

Unit 5: Managing Software Projects – II
Project Scheduling: Basic concepts – Project scheduling – Defining a task set for the software project – Defining a task network – Scheduling – Earned Value Analysis
Risk Management: Reactive versus Proactive Risk Strategies – Software Risks – Risk Identification – Risk Projection – Risk Refinement – Risk Mitigation, Monitoring and Management – The RMMM plan.
Text Book(s):
1. Roger S. Pressman, Bruce R. Maxim, *"Software Engineering, A practitioner's Approach"*, Eighth edition, McGraw Hill, 2015.

Reference Book(s):
1. Tsui and Karam (T&K), *"Essentials of Software Engineering",* Third Edition, Jones and Barrlet Publishing, 2013.

Elective 1b) Design and Implementation of Compilers

Objectives:
> To impart knowledge on various phases of a compiler.

UNIT I

Introduction to compilers.- Compilers and Translators - Assembly language Macros - Structure of compilers - Compiler writing tools - Boot strapping. Lexical analysis - Role of lexical analyzer - Regular expression - Finite Automata - Implementation of lexical analyzer -context free grammars - Derivation and parse trees.

UNIT II

Parser - Shift reduce parsing - Operator precedence parsing -Top down parsing - Predictive parsers - LR Parsers - Constructing SLR Parsing tables - Constructing canonical LR Parsing tables - Constructing LALR Parsing tables - Using ambiguous grammar.

UNIT III

Syntax directed translation schemes - Implementation of syntax directed translation schemes - Intermediate code - Postfix notation - Parse tree and Syntax tree Three address code - Quadruples and Tuples - Translation of assignment statements Boolean expression.

UNIT IV

Symbol table - Contents of symbol table - Data structures for symbol tables Implementation of simple stack allocation scheme - Implementation of block structure languages - Storage allocation in FORTRAN - Storage allocation in block structured language Errors - Lexical phase errors - Syntactic phase errors - Semantic errors.

UNIT V

Code optimization: The Principle sources of optimization - Loop optimization - DAG Representation in basic blocks Code generation - Problem in code generation - A simple code generator - Register allocation and assignment - Code generation from DAG's - Peephole optimization.

Text Book:

1. *"The Principles of Compiler Design",* A.V. Aho And Jd Ullman Narosa Publishing House, 2002.

Reference Book:
1. "*Compiler Principles, Techniques And Tools",* A.V. Aho, Ravi Sethi and Jeffry D Ullman, Pearson Education Asia, 2002.

Elective 1c) Multimedia Systems And Design

Objectives:

To impart knowledge on multimedia hardware, multimedia tools and multimedia documentation.

Unit 1:

Introduction to Multimedia – Definitions, CD-ROM and the Multimedia highway. Uses of Multimedia – Introduction to making multimedia, Multimedia skills.

Unit 2:

Multimedia Hardware – Macintosh versus windows, Networking Macintosh and windows computers, Connections, Memory and storage devices, Input devices, Output hardware, Communication devices. Basic Software Tools – Text editing and word processing tools, Painting and Drawing tools, 3-D modeling and animation tools, Image editing tools, Sound editing tools, Animation, Video and Digital movie tools. Multimedia authoring tools.

Unit 3:

Text – Fonts and Faces, Using Text in Multimedia, Computers and Text, Sounds-Multimedia System Sounds, Digital Audio, Making MIDI Audio, Audio File formats, MIDI Versus Digital Audio, Production Tips. Images – Making Still images, Color – Understanding natural light and color, computerized color, color palettes, Animation – The principles of Animation, Animation by computer.

Unit 4:

Video – Using video, How video works, Broadcast video standards, Analog video, Digital video, Shooting and Editing video, Optimization video files for the CD-ROM. Tools for the World Wide Web – Web servers, Web Browsers, Web page makers and site builders. Plug-ins and delivery vehicles. Designing for the World Wide Web – Working on the web, Text for the web, Images for the web, Sound for the web, Animation for the web.

Unit 5:

Planning and Costing – The process of making multimedia, scheduling, estimating Designing and Producing, Content and Talent – Using content created by others – Using content created for a project, Using Talent, Delivering – Testing, Preparing for Delivery Delivering on CD ROM, Delivering on world wide web.

Text Book:

1. *"Multimedia: Making It Work",* Tay Vaughan, TATA McGraw-Hill Edition, Sixth Edition 2004.

Reference Books:

1. *"Multimedia in Action",* James E. Shuman,– Vikas Publishing House.
2. *"Multimedia An Introduction",* Casanova John Villamil, Molina. Louis,– Prentice Hall of India Pvt. Ltd., Eastern Economy Edition.

Data and Visual Analytics Lab

Course Objectives

This lab course provides students programming experience to solve data analysis problems using Python, NumPy, Pandas and Matplotlib. The main emphasis is given to data-oriented examples and exercises utilizing real world use cases.

Learning Outcomes
Upon completion of this course, students should be able to:
* Use Jupyter Notebook for interactive computation
* Practice Python features such as lists, dictionary and files for the given problem
* Use NumPy functions for array processing
* Apply Pandas Dataframe for data wrangling
* Generate graphs for the given data using Matplotlib

1a). Practice using the Python interpreter / Jupyter Notebook as a calculator:
i.   The volume of a sphere with radius r is 4/3πr3. What is the volume of a sphere with radius 5?
ii. Suppose cover price of a book is INR 24.95, but a bookstore offers a 40% discount. Shipping costs INR 3.00 for the first copy and 75 Paise for each additional copy. What is the total wholesale cost for 60 copies?
iii. If I leave my house at 6:52 am and run 1 km at an easy pace (8:15 per km), then 3 km at tempo (7:12 per km) and 1 km at easy pace again, what time do I get home for breakfast?
1b). Develop an application in Python that repeatedly reads numbers until the user enters "done". Once "done" is entered, print out the total, count, and average of the numbers. If the user enters anything other than a number, detect their mistake using try and except and print an error message and skip to the next number.
2a). Develop a Python function front_x(). Given a list of strings, return a list with the strings in sorted order, except group all the strings that begin with 'x' first. Eg. ['mix', 'xyz', 'apple', 'xanadu', 'aardvark'] yields ['xanadu', 'xyz', 'aardvark', 'apple', 'mix']. Hint: this can be done by making 2 lists and sorting each of them before combining them.
2b). Develop a Python function sort_last(). Given a list of non-empty tuples, return a list sorted in increasing order by the last element in each tuple. E.g. [(1, 7), (1, 3), (3, 4, 5), (2, 2)] yields [(2, 2), (1, 3), (3, 4, 5), (1, 7)]. Hint: use a custom key= function to extract the last element form each tuple.
2c). Develop a Python function remove_adjacent(). Given a list of numbers, return a list where all adjacent same elements have been reduced to a single element, so [1, 2, 2, 3] returns [1, 2, 3]. List [2, 2, 3, 3, 3] returns [2, 3]. List [ ] returns [ ]. You may create a new list or modify the passed in list.
3a). Develop an application in Python to open the file (say, romeo.txt) and read it line by line. For each line, split the line into words using the split function. For each word, check to see if the word is already in a list. If the word is not in the list, add it to the list. When the program completes, sort and print the resulting words in alphabetical order.
3b). Develop an application in Python to read through the email data and when you find line that starts with "From", you will split the line into words using the split function. We are interested in who sent the message, which is the second word on the From line: From stephen.marquard@uct.ac.za Sat Jan 5 09:14:16 2008. You will parse the From line and print out the second word for each From line, then you will also count the number of From (not From:) lines and print out a count at the end.
4a). [NumPy]: Read a CSV file with 10 numbers in each row (5 rows), and store them in numpy array, print the values and maximum and minimum value of the array. Also save the same array in another file in TSV format
4b). [NumPy]: Create a small dataset of floating point numbers with 10 rows and 5 columns in ARFF format with proper header values. Read the files and store the numbers in numpy array. Reshape the array to 5 rows and 10 columns using numpy. Print the following

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properties of the array for both before and after reshaping. Print number of dimensions, shape of the array, size of the array, data type of the array and item size of the array.

5a). [NumPy]: Create a 3*3 matrix A [1 1 1, 2 2 2, 3 3 3] and B [4 4 4, 5 5 5, 6 6 6]. Print the following values. 1. Add A and B, 2. Subtract A from B, 3. Element wise multiplication A and B, 4. Divide B by A. 5. Square root of B, 6. Square of A.

5b). [NumPy]: Create a 4*4 matrix A [1 1 1 1, 2 2 2 2, 3 3 3 3, 4 4 4 4] in numpy. Print the following matrix operations using built-in numpy functions. 1. Determinant of the matrix, 2. Inverse of a matrix, 3. Transpose of the matrix A, 4. Scalar multiplication with number, 5. Matrix multiplication with matrix B [2 2 2 2], 6. Dot product between rows of A and matrix B [2 2 2 2]. 7. Determinant of the matrix A.

6a). [NumPy]: Create a 3*3 matrix A [4 5 6, 1 2 3, 7 8 9]. Flat the matrix into an array and print the sorted array in ascending and descending order using numpy functions. Print the mean, standard deviation and variance of the sorted array.

6b). [Pandas]: Create an array of 10 records of cities and their population and write them to a CSV file using pandas. Read the same CSV and store it in pandas dataframe. Print the values inside the dataframe and print information about the pandas dataframe variable using pandas builtin function. Print the first 3 and last 4 records using pandas functions. Print the indices of the cities with maximum and minimum population.

7a). [Pandas]: Create an array of 10 records of people names and their ages and write them to a TXT file using pandas. Read the same TXT file and store it in pandas variable. Give the column names as "Name" and "Age" for pandas variable. Print the description of the Name and Age using pandas functions. Sort and print the records in ascending order based on "Name". Sort and print the records in descending order based on "Age".

7b). [Pandas]: Read the data using pandas. Transpose the dataframe and save it to another file in JSON format. Read the JSON file and print the transposed dataframe values.

8a). [Pandas]: Read the text "You cannot end a sentence with because because because is a conjunction" from a text file. Find the unique words and their frequency from the text and store it in pandas variable with 2 columns "Words" and "Frequency". Do the following using pandas builtin functions, 1). Number of rows, 2). Sum of "Frequency", 3). Mean "Frequency", 4). standard deviation of "Frequency", 5). Upper case of "Words", 6). Lower case of "Words".

8b). [Pandas]: Generate a dataframe in pandas with two columns "Name", "Mark 1". Insert 5 records to the dataframe. Print the dataframe values. Insert one more column "Mark 2" with randomly generated integer numbers between range 50 to 100. Print the dataframe values after insertion. Compute the total of Mark 1 and Mark 2 and insert to dataframe as "Total" and print the dataframe. Compute average from "Total" and insert it as "Avg" and remove "Total" from dataframe. Print the dataframe values after deletion.

9a). [Matplotlib]: Create array of 20 numbers representing sin function using numpy, similarly arrays for cos function and tan function. Plot the sin and cos functions as green and red colored lines using matplotlib. Give the labels to the lines and the axes in the plot.

9b). [Matplotlib]: Plot a histogram plot with bars in red color. Present the the mean and standard deviation of the values in the graph.

10a). [Matplotlib]: Populate Pandas Dataframe with two columns "Date" and "Temperature". Generate dates 01.01.2017 to 31.01.2017 and generate random temperature from 20 to 40 degrees for each day. Plot the data using matplotlib and mark the maximum and minimum temperature of the week in the line graph. Give proper data labels and legend titles.

10b). [Matplotlib]: Create a dataset of 20 records with 4 columns for persons' "Name", "Age", "Height", "Weight". The height and weight can be linearly increasing as the age increases. Plot the dataset in Scatterplot using matlplotlib with x axis for "age", y-axis for "height" and the size of the datapoints representing the "weight" of each person. Give proper labels to the axes in the plot.

10c). [Matplotlib]: Generate a dataset of 5 rows representing students, each row with 10 columns representing marks in 10 exams. Compute the standard deviation of each student's marks and plot the individual students in box plot using matplotlib representing the range of marks and standard deviation.

Mobile Application Development Lab

Course Objectives

Create a simple application that runs under the Android OS. Access and work with the Android file system. Create an application that uses multimedia under the Android OS

Learning Outcomes

Upon completion of this course, students should be able to:

- Install and configure Android application development tools
- Design and develop user Interfaces for the Android platform
- Apply Java programming concepts to Android application development

1. Develop a native calculator mobile app for arithmetic operations
2. Develop an application that makes use of student database for end semester mark list
3. Design a mobile app for hotel menu card using list view activity
4. Develop a mobile app for expense tracker monitoring system of monthly budget
5. Implement a mobile app for digital diary for creating alert message for our day to day activity
6. Develop a mobile app for bus ticket reservation system
7. Develop an application that draws basic graphical primitives (Line, Circle, Rectangle, ellipse) on the screen
8. Implement an application to change the back ground activity using multi threading
9. Develop an application that writes data to the SD card
10. Design a mobile app for marriage Invitation that uses GUI components, Font and colors

Machine Learning

Course Objectives
This course introduces various machine learning algorithms to the user to build a classifier. It also introduces about development of web application with machine learning.

Learning Outcomes
Upon completion of this course, students should be able to:
*   Appreciate the need of building classifier using machine learning algorithms.
*   Embed the Machine learning algorithm to the Web Application.

UNIT – 1 Machine Learning Algorithm - Training
Three different types of Machine Learning Algorithms-Predictions with supervised learning-Predicting with Class labels-Regression for predicting continuous outcomes-Introduction to basic terminology and notations used in Machine Learning
Building Machine Learning Systems: Preprocessing, Training, Selection and Evaluation Of Model-Installing Python Package, Artificial Neurons: A glimpse into the early history of Machine Learning-Implementation of Perceptron learning algorithm in Python-Adaptive linear neurons and the Convergence of Learning-Implementation of Adaptive linear neuron in Python.

UNIT – 2 Machine Learning Classifier
Training a perceptron via Scikit-Learn-Modeling class probabilities through logistic regression-Support vector machine for maximum margin classification-Solving Non-Linear problems using a kernel SVM

Learning Decision Tree-A Lazy learning Algorithms – K-Nearest Neighbors -Data Preprocessing: Dealing with missed and Categorical data-Data Preprocessing: Dealing with Data set Testing and Training-Selection of Meaningful features-Selection of meaningful sparse solutions with L1 regularization

UNIT – 3 Dimensionality Reduction and Model Evaluation
Unsupervised Dimensionality reduction using P.C.A [Principal Component Analysis]-Supervised data compression via Linear Discriminant analysis-Using Kernel principal component analysis for N-L-M-Streamlining workflows with pipeline-Using K-Fold cross-validation to assets model performance
Debugging algorithms with learning and validation-Different performance evaluation metrics-Implementing simple majority vote classifier-Tuning the ensemble classifier-Weak Learners Vs Adaptive Boosting.

UNIT – 4 Cluster Analysis
Grouping objects by similarity using K-Means-Organizing Clusters as a hierarchical tree. -Training Artificial Neural Network for image recognition-Modeling Complex functions with Artificial Neural Network-Classifying Hand Written Digits
Training an Artificial Neural Network-Developing initiation for Back Probagation-Debugging Neural Network with Gradient Checking-Convergence in Neural Network-Architecture of Neural Network

UNIT – 5 Embedding a Machine Learning Model into a Web Application
Serializing fitted Scikit-learn estimators-Setting up SQL-LITE database for data storage-Developing a Web application with FLASK-First FLASK Web application-Form Validation and Rendering-Turning the movie classifier into a web application-Deploying the web application to a public server-Updating the movie review Classifier

Text book(s):
1. Sebastian Raschka, *"Python Machine Learning"*, First Edition, [PACKT] , 2015.

Reference Book(s) :
1. Joel Grus, *"Data Science from Scratch"*, First Edition, O'Reilly,2015
2. Gavin hacekling, "*Mastering machine learning with scikit-learn"*, First Edition, [PACKT] , 2014

Real Time Web App Development

Course Objectives

This course will cover the practical aspects of web full stack application development. The aim of this course is to introduce the students to the basics of full stack application development. Important topics are to introduce the features of Node.js, Express.js, AngularJS and to be familiar with MongoDB and Mongoose.

Learning Outcomes
Upon completion of this course, students should be able to:
- Design and Develop Web Applications using Node.js, Express.js, AngularJS.
- Understand MongoDB and Mongoose and its applicability.
- Implement various server side web application tools and middleware technologies and use them to develop web applications.

Unit I : Web App Development using Node.js
Three-tier web application development – Introducing NPM: Using NPM – Introduction to Node.js : JavaScript event-driven programming, Node.js event-driven programming – JavaScript closures – Node modules : CommonJS modules , Node.js core modules – Node modules : Node.js third-party modules, Node.js File modules, Node.js folder modules – Developing Node.js web applications: Meet the Connect module – Developing Node.js web applications: Connect middleware – Developing Node.js web applications: Understanding the order of Connect middleware – Developing Node.js web applications: Mounting Connect middleware.

Unit II : Built Web App using Express.js and MongoDB
Introduction to Express, Creating your First Express application – The application, request, and response objects, External middleware – Implementing the MVC pattern: Application folder structure, Horizontal folder structure, Vertical folder structure, File-naming conventions, Implementing the horizontal folder structure – Configuring an Express application: Environment configuration files – Rendering views: Configuring the view system, Rendering EJS views,Serving static files, Configuring sessions – MongoDB: Introduction to NoSQL, Introducing MongoDB – Key features of MongoDB: The BSON format, MongoDB ad hoc queries, MongoDB indexing, MongoDB replica set, MongoDB sharding – MongoDB shell, MongoDB databases, MongoDB collections – MongoDB CRUD operations: Creating a new document, Creating a document using insert(), Creating a document using update(), Creating a document using save(), Reading documents, Finding all the collection documents, Using an equality statement – MongoDB CRUD operations: Using query operators, Building AND/OR queries, Updating existing documents, Updating documents using update(), Updating documents using save(), Deleting documents, Deleting all documents.

Unit III : Understand the features of Mongoose
Introducing Mongoose: Connecting to MongoDB – Understanding Mongoose schemas: Creating the user schema and model, Registering the User model – Understanding Mongoose schemas: Creating new users using save(), Finding multiple user Documents using Find(), Advanced querying using Find(), Reading a single user document using FindOne()– Understanding Mongoose schemas: Updating an existing user document, Deleting an existing user document – Extending your Mongoose schema: Defining default values, Using schema modifiers – Extending your Mongoose schema: Predefined modifiers, Custom setter modifiers, Custom getter modifiers – Extending your Mongoose schema: Adding virtual attributes, Optimizing queries using indexes – Defining custom model methods: Defining custom static methods, Defining custom instance methods – Model validation: Predefined validators, Custom validators – Using Mongoose middleware: Using pre middleware, Using post middleware, Using Mongoose DBRef:

Unit IV : Key concepts of AngularJS

Introducing AngularJS – Key concepts of AngularJS: The core module of AngularJS, The angular global object – AngularJS modules: Application modules, External modules, Third-party modules – Two-way data binding, Dependency injection: Dependency injection in AngularJS – AngularJS directives:Core directives, Custom directives – Bootstrapping an AngularJS application: Automatic bootstrap, Manual bootstrap – Structuring an AngularJS application, Bootstrapping your AngularJS application, AngularJS MVC entities: AngularJS views, AngularJS controllers and scopes – AngularJS routing: Installing the ngRoute module, Coniguring the URL scheme, AngularJS application routes – AngularJS services: AngularJS prebundled services, Creating AngularJS services, Using AngularJS services – Managing AngularJS authentication: Rendering the user object, Adding the Authentication service, Using the Authentication service.

Unit V : Creating a MEAN CRUD Module

Introducing CRUD modules, Setting up the Express components: Creating the Mongoose model, Setting up the Express controller – Setting up the Express components: The error handling method of the Express controller, The create() method of the Express controller, The list() method of the Express controller, The read() middleware of the Express controller – Setting up the Express components: The update() method of the Express controller, The delete method of the Express controller – Setting up the Express components: Implementing an authentication middleware, Implementing an authorization middleware – Setting up the Express components: Wiring the Express routes, Configuring the Express application – Introducing the ngResource module: Installing the ngResource module, Using the $resource service – Implementing the AngularJS MVC module: Creating the AngularJS module service, Setting up the AngularJS module controller – – Implementing the AngularJS MVC module: The create() method of the AngularJS controller, The Find() and FindOne() methods of the AngularJS controller – Implementing the AngularJS MVC module: The update() method of the AngularJS controller, The delete() method of the AngularJS controller, Implementing the AngularJS module views, The create-article view, The view-article view, The edit-article view, – Implementing the AngularJS MVC module: The list-articles view, Wiring the AngularJS module routes – Finalizing your module implementation.

Text Book(s):
1. Amos Q Vaviv, "***MEAN Web Development***", Packt Publishing Ltd, Sep 2014.

References Book(s):
1. Shane A Stillwell. "***Mastering MEAN web app development"***: Expert fullstack Javascript, PACKT Publishers, 2016. ISBN 9781785882159

Cloud and Big Data Computing

Course Objectives
This course introduces the basics of Cloud Computing and its characteristics, its architecture, virtualization, elements of Bigdata and Hadoop.

Learning Outcomes
Upon completion of this course, students should be able to:
- Describe cloud computing, its characteristics and architecture.
- Describe various deployment models and service delivery models.
- Illustrate Load Balancing, hypervisors and AWS.
- Describe Big Data its Characteristics, Hadoop and its Components.

Unit I : Cloud Computing Fundamentals
CLOUD COMPUTING: Definition, Types. – Cloud Deployment models – Service Delivery Models – Characteristics of Cloud Computing: Basic characteristics. – Characteristics of Cloud – Computing: Essential characteristics – Benefits of cloud computing. – Disadvantages of cloud computing. – Measuring the cloud value: Measuring cloud computing cost. – Measuring the cloud value: Computing the total cost of ownership. – Specifying Service Level Agreements (SLA).

Unit II : Cloud Architecture and Services
CLOUD COMPUTING STACK: Composability, Infrastructure – CLOUD COMPUTING STACK: Platform, Virtual Appliances – CLOUD COMPUTING STACK: Communication Protocols and Applications. – Defining Infrastructure as a Service (IaaS) – Defining Platform as a Service (PaaS) – Defining Software as a Service (SaaS) and its characteristics. – Open SaaS and Service Oriented Architecture (SOA) – Defining Identity as a Service(IDaas), – IDaas interoperability – Defining Compliance as a Service (CaaS).

Unit III : Abstraction and Virtualization
Using virtualization technologies. – Load Balancing and Virtualization. –Advanced Load Balancing. – Understanding Hypervisors. – Virtual machine types. – Using Amazon Web Services: Understanding Amazon Web Services. – Amazon Web Service Components and Services – Working with the Elastic Compute Cloud (EC2): Creating an account and instance on EC2. – Working with Amazon Storage Systems: Amazon Simple Storage System (S3). – Working with Amazon Storage Systems: Amazon Elastic Block Store (EBS) and Cloud front.

Unit IV : Big Data: Characteristics, use cases and applications
Big Data: From the Business Perspective. – Defining Big Data. – Characteristics of Big Data:The Volume and Variety of Data. – Characteristics of Big Data:The Velocity and Veracity of Data. – Data in Warehouse and Data in Hadoop. Why is Big Data Important – Considering Big Data Solutions. – Big Data Use Cases: Patterns for Big Data Deployment. – Big Data Use Cases:IT for IT Log Analytics, The Fraud Detection Pattern. – Risk: Patterns for Modeling and Management. – Big Data and the Energy Sector.

Unit V : Big Data: From the Technology Perspective
The History of Hadoop – Components of Hadoop – The Hadoop Distributed File System – The Basics of MapReduce – Hadoop Common Components – Application Development in Hadoop: Pig and PigLatin – Application Development in Hadoop: Hive – Getting Data into Hadoop – Other Hadoop Components: ZooKeeper, HBase and Oozie. – Other Hadoop Components: Lucene and AVRO.

Text Book(s):
1. *"Cloud Computing Bible"*. Barrie Sosinsky, Wiley Publishing, 2011.
2. *"Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data"*. Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis and Paul Zikopoulos. McGrawHill Publishing, 2012

References Book(s):
1. *"Distributed and Cloud Computing"*. Kai Hwang. Elsevier India Pvt Ltd, 1ed, 2012. ISBN 978-9381269237.
2. *"Cloud Computing: Concepts, Technology & Architecture"*. Thomas Erl, Ricardo Puttini, and Zaigham Mahmood. Prentice Hall, 2013.

Elective 2a) Network Management

Course Objectives
This Course provides information related to network management, architecture, and protocols.

Learning Outcomes
Upon completion of this course, students should be able to:
- Learn Protocols in Network
- Apply Network Management Standards in NMS
- Learn SNMP concepts in network management
- Know about Network Management in Network Management Tools

Unit I : Introduction to Data Communication and Network Management
Analogy of Telephone Network management, Data (Computer) and Telecommunication Network - Distributed Computing Environment - TCP Based Network - Communication Protocols and Standard : Communication Architecture, Protocol Layer Services - Network Management: Goals, Organization and function : Goal of Network Management, Network Provisioning, Network Operation and NOC, Network Installation and Maintenance - Network Management Architecture and Organization - Network Management Perspective.

Unit II : Network and Technology
Network Technology - Local Area Network : Ethernet, Fast Ethernet, Gigabit Ethernet, Full-Duplex Ethernet, Virtual LAN, Token ring, FDDI, Wireless LAN - Network Interconnecting Device : Hubs, Bridges, Remote Bridges, Transparent Bridges, Source-Routing Bridges, Routers, Gateways and Protocols Converter, Multiprotocol and Tunneling, Half Bridge Configuration of Router, Edge Router, Switches.

Unit III : Transmission Technology & Basic foundations of Network Management : Standards, Models and Languages
Wide Area Network, Transmission Technology: Wired Transmission - Transmission Technology : Wireless Transmission - Transmission Model - Network Management Standards - Network Management Models, Organization Model - Information Model - Communication Model - Abstract Syntax Notation One ANS.1 – Macros - Functional Model.

Unit IV : SNMPv1 Network Management
Managed Network - History of SNMP Management, Internet Organization and Standards - SNMP Model - SNMP Model : Organization Model - Information Model : Structure of Management Information, Information Model, Management of Information Base.

Unit V : SNMP Communication and Functional Models & Network Management Tools, System, and Engineering
SNMP Communication Model: SNMP Architecture , Administrative Model, SNMP Protocol Specification , SNMP Operation,SNMP MIB Group. Functional Model - **Network Management Tools, System, and Engineering** System Utilities for Management : Basic Tools , SNMP Tools, Protocol Analyzer, Network Statistics -Measurement System: Traffic Load Monitoring - Network Statistics Measurement System : Protocol Statistics , Data and Error Statistics, Using MRTG to collect Traffic Statistics - MIB Engineering : General Principles and Limitations of SMI, Object-Oriented Approach t MIB Engineering, SMI Tables, SMI Actions, SMI Transactions - NMS Design - Network Management System.

Text Book(s):

1. Mani Subramanian; Timothy A. Gonsalves; N. Usha Rani, *"Network Management: Principles and Practice"*, Pearson Education India, 2010

References Book(s):

1. James F Kurose and Keith W. Ross, *"Computer Networking"* – A Top-Down Approach, Sixth Edition, 2013, Pearson Publication.

Elective 2b) Web Services

Objectives:

To impart knowledge on the emergence of web services as a service and the technology behind it.

Unit I

Introduction – What are web services? SOAP WSDL UDDI-Why Web Services are important? – The evolution of web applications -Not just another distributed computing platform – Web services and enterprises.

Unit II

XML Fundamentals XML: The Lingua Franca of web services - XML Documents-XML namespaces: Explicit and Default namespaces, Inheriting namespaces, And not inheriting namespaces, Attributes and namespaces –XML Schema. XML schema and namespaces, A first schema, Implementing XML schema types, The any Element, Inheritance, Substitution groups, Global and local type declarations, Managing Schemas, Schemas and instance documents, XML schema best practices- Processing XML SAX: Simple API for XML, DOM: Document object Model, XSLT, XPATH.

Unit III

SOAP and WSDL5: The SOAP Model- SOAP- SOAP Messages, SOAP Envelope, SOAP Header, SOAP Body, SOAP Faults- SOAP encoding – SOAP RPC- Using alternative SOAP Encodings, Document, RPC, Literal, Encoded SOAP RPC and SOAP Document-Literal, SOAP web services and the REST Architecture- Looking back to SOAP 1.1: Syntactic differences between SOAP 1.2 and SOAP 1.1- Changes to SOAP-RPC- SOAP Encoding- WSDL structure - The stock quote WSDL interface, definitions, The type element, bindings, services, managing WSDL descriptions, Extending WSDL – Using SOAP and WSDL.

Unit IV

UDDI: UDDI at a glance- The UDDI Business registry- UDDI under the covers – Accessing UDDI-How UDDI is playing out Conversations Overview – Web Services – Web services Conversation Language – WSCL Interface components – The Bar scenario conversations – Relationship between WSCL and WSDL Workflow Business Process Management – Workflow and Workflow management systems – Business process execution language for web services.

Unit V

Transactions: ACID Transactions – Distributed Transactions and two phase commit – Dealing with Heuristic outcomes – Scaling transactions to web services – OASIS business transaction protocol – Other web services transaction Protocol Security Everyday security basis – Security is an end to end product – Web service security issues – Types of Security attacks and threats - Web services security road map – WS security .

Text Book:

1. *"Developing Enterprise Web Services - An Architect's Guide"* – Sandeep Chatterjee, James Webber, Pearson Education– Second Indian Reprint 2005.

Reference Book:

1. *"Understanding SOA with Web Services",* Eric Newcomer, Greg Lomow, Pearson Education, and First Indian Reprint 2005.

Elective 2c) Client Server Computing

Objectives:
　　　　To impart knowledge on client server, NOS, transaction processing, groupware and compound documents.

Unit 1:

Client/Server – Fat servers / clients – 2 tier versus 3-tier – intergalactic client / server – client/server building blocks – a one size fits all model – server-to-server middleware – clients, servers and operating systems.

Unit 2:

Creating the single system Image – NOS middleware: The transparent issues – RPC, messaging and peer-to-peer – peer-to-peer communications – remote procedures call. Messaging and Queuing: The MOM middleware – MOM versus RPC- SQL database servers – fundamentals of SQL and Relational Databases – SQL database server architecture – stored procedures, triggers and rules – SQL middleware and federated databases – SQL middleware options – real SQL API – open SQL gateways.

Unit 3:

Client / Server Transaction processing – ACID properties – Transaction models – TP monitors – transaction management standards – TP lite – TP – Heavy – TP – Lite versus TP – Heavy.

Unit 4:

Client / Server groupware – what is groupware? – importance of groupware – components of groupware – client / server with distributed objects – distributed objects and components – from distributed objects to components – 3-tier client/server object style. CORBA: From ORBs to business objects – distributed objects, CORBA style – CORBA components – OMG's object management architecture – CORBA 2.0: The Intergalactic ORB – CORBA object services – CORBA common facilities – CORBA Business objects.

Unit 5:

The Client Framework : compound documents – the compound document framework – the open Doc component – model – components, open Doc – style – Open Doc's Constituent Technologies – open Doc become OLD and vice versa – what open Doc does for client/server systems – OLE/D COM : What is OLE? OLE's constituent Technologies.

Text Book:

1. *"The Essential Client / Server Survival Guide"* – Robert orfali, Dan Harkey and Jeri Edwards –Galgotia Publications.

Reference Book:
1. *"Client Server Computing"* by Patrick Smith, Steve Gueugerich, 2nd Edition

Machine Learning Lab

Course Objectives

This lab course teaches students how to practice Machine Learning (ML) algorithms and solve ML real world problems using Scikit-Learn library.

Learning Outcomes

Upon completion of this course, students should be able to:
- Generate synthetic datasets
- Preprocess synthetic data and real use case data sets
- Create ML models for the target data sets
- Evaluate the performance of ML model
- Compare the performance of ML models

1. [Data preprocessing]: Create dataset in CSV file with 10 rows and 5 columns (name, age, height, eight, BP). Load the CSV file and do the following preprocessing to the data. Apply data range normalization, predict the missing value (if any) and select the useful features automatically. Finally print the preprocessed data.
2. [Linear Regression]: Generate random numbers for input features and target. Divide the data into training and testing set. Print the training and testing data. Create a linear regression model for the dataset and run the model for 100 iterations. Print the evaluation results and learned model weights.
3. [Multiple Linear Regression]: Load the boston house price prediction dataset. Divide the data into training and testing set. Print the training and testing data. Create a multiple linear regression model for the dataset and run the model for 500 iterations. Print the evaluation results and learned model weights.
4. [Logistic Regression]: Load the Iris classification dataset. Divide the data into training and testing set. Print the training and testing data. Create a logistic regression model for the dataset and run the model for 500 iterations. Print the evaluation results and learned model weights.
5. [Support Vector Machine]: Load the Digits classification dataset. Divide the data into training and testing set. Print the training and testing data. Create a Linear SVM model for the dataset and run the model for 500 iterations. Apply logistic regression to the dataset and print the results. Print the evaluation results and learned model weights. Compare the results with results of logistics regression in terms of speed and accuracy.
6. [Decision Tree Classifier]: Load the Wine classification dataset. Divide the data into training and testing set. Print the training and testing data. Create a Decision Tree model for the dataset and run the model for 500 iterations. Print the evaluation results and learned model weights. Apply SVM to the dataset and print the results. Compare the results with results of Support Vector machines in terms of speed and accuracy.
7. [Decision Tree Regressor]: Load the Diabetes prediction dataset. Divide the data into training and testing set. Print the training and testing data. Create a Decision Tree Regression model for the dataset and run the model for 500 iterations. Apply Linear Regression to the dataset and print the results. Print the evaluation results and learned model weights. Compare the results with results of Linear regression in terms of speed and accuracy.
8. [K-Means Clustering]: Populate clustering dataset with 2 features using sklearn built-in functions. Divide the data into training and testing set. Print the training and testing data. Apply K-Means for the dataset and run the model for 500 iterations. Visualize the clustering results using 2D plots.

9. [Spectral Clustering]: Populate clustering dataset with 2 features using sklearn built-in functions. Divide the data into training and testing set. Print the training and testing data. Apply spectral clustering for the dataset and run the model for 500 iterations. Visualize the clustering results using 2D plots. Visually compare the results with plots of the K-means in terms of speed and clustering validity.
10. [Simple Neural Networks]: Load the Digits classification dataset. Divide the data into training and testing set. Print the training and testing data. Create a Neural Network with 2 layers and 100 nodes each for the dataset and run the model for 500 iterations. Apply logistic regression, SVM, decision tree to the dataset and print the results. Print the evaluation results and learned model weights. Compare the results in terms of speed and accuracy.

Real Time Web App Development Lab

Course Objectives

This course provides exercises to develop web applications using Node.js, Express.js, AngularJS and performs CRUD operations using MongoDB and Mongoose.

Learning Outcomes

Upon completion of this course, students should be able to:
- Understand and implement the various real time web application tools such as Node.js, Express.js, AngularJS.
- Perform database operation using MongoDB and Mongoose

1. Create students web application for welcoming the user using Node.js
2. Create students profile using Node.Js
3. Implement the MVC pattern
4. Develop Hello world Express.js application
5. Build a registration form using Express.js
6. Develop a web application for Library that can perform the CRUD operations.
7. Build single page Coffee shop application using Angular JS.
8. Make a Shopping list using Angular JS which can add and delete items
9. Create a Angular JS application to implement the ngModel and ngController features.
10. Develop a web application for restaurant that can perform the CRUD operations using MEAN.

NMEC - Internet Technology

Objectives:

To impart knowledge on internet, e-mail, world wide web and web page construction.

UNIT -I

Introduction to Internet - protocols and other jargon - host machines and host names - internet architecture and packet switching - client server software model - band width and asynchronous communication.

UNIT - II

Working with e-mail- anatomy of an e-mail message - viewing inbox - viewing mail messages - sending a new mail message - replying to and forwarding e-mail messages - e-mail netiquette - inbox and mail folders.

UNIT - III

Mailing list and e-mail archives - mailing list - subscribing to mailing list managing mailing list - searching e-mail archives.

UNIT- IV

The world wide web - hypertext and multimedia - web browser tips and tricks - search engines - subject tree - calculated serendipity - cleaning houses - assessing web page credibility - constructing own home page.

UNIT -V

Web page construction - remember the big picture - working with text - working with graphic - URL and path names - using tables and frames - HTML tag.

Text Book:

1. ***"A beginners guide to Internet and World Wide Web"**,* Wendly G. Lehnert, Internet 101 –Pearson Education, 2003.

Reference Books:

1. "***Internet for Everyone"**,* Alexis Leon & Mathews Leon, Leon Tech world, 1998.
2. ***"Internet Complete"**,* Maureen Adams, Sherry Bonelli, BPB Publications, 1998.

NMEC - Office and Visual Basic Programming

Objectives:
        To impart knowledge on Ms-Office and Visual Basic.

UNIT I
        Windows: A jump start – A short course in word for windows – The basics – Getting it right – Making it pretty – Formatting with styles – proofing your work – Tables – Automation x Customization.

UNIT II
        A short course in excel for windows – The basics – Building blocks – Enhancements – All about printing – Creating Excel – Database – Charting your course, Greeting your point across with PowerPoint – Editing presentations – Enhancing presentations.

UNIT III
        First steps with Microsoft Visual Basic 6 – the integrated development environment – Running the IDE – Selecting the project type – your very first VB program.

UNIT IV
        Introduction to forms – Common properties – Common methods – Common events – The form object.

UNIT V
        Intrinsic controls – Text box controls – Label and frame controls – Command Button, Checkbox, Option Button Control – List Box and Combo box controls – Picture box and Image controls.

Text Books:

1. *"Microsoft Office in Concert"* – John Weingarten, Galgotia Publications, 2nd Edition, 2003.
2. *"Programming Microsoft Visual Basic 6.0"* – Francesco Balene, low cost Edition, 2003, by wp publishers and distributors (p) Ltd.

Computer Vision

Course Objectives
This course introduces students the methods that enable a machine to "understand" or analyze images and videos. Topics include edge detection, segmentation, motion estimation and object detection

Learning Outcomes
Upon completion of this course, students should be able to:
- Understand the fundamental concepts of images and image acquisition
- Apply image transformation, image filtering, image segmentation and edge detection methods
- Detect motions from videos and objects

Unit I : Basics of Image Processing
Introduction and motivation to computer vision – Digital image representation and file formats – Basic image processing operations – Basics of MATLAB – Scripts, functions, graphics & visualization – Basic Image operations using image processing toolbox – Image manipulation using image processing toolbox – Light, Color, and Electromagnetic Spectrum – Image Acquisition – Image Digitization.

Unit II : Image Operations, Transformations and Histograms
Arithmetic Operations: Fundamentals and Applications – Logic Operations: Fundamentals and Applications – Mapping and Affine Transformations – Geometric Operations Using MATLAB – Other Geometric Operations and Applications – Gray-level (Point) Transformations – Other Linear and Non-linear Point Transformations – Computing and interpreting Image Histograms Histogram Equalization – Histogram Modification Techniques.

Unit III : Image Filtering, Edge Detection and Image Segmentation
Convolution and Correlation – Image Smoothing (Low-pass Filters) – Image Sharpening (High-pass Filters) – Fourier Transform: the Mathematical Foundation – Low-pass Filtering – High-pass Filtering – First-order and Second-order Derivative Edge Detection – Canny Edge Detector, Edge Linking and Boundary Detection Intensity-based Segmentation – Region-based Segmentation and Watershed Segmentation.

Unit IV : Color Images, Compression and Feature Extraction, Representation
Color Models – Pseudocolor Image Processing – Full-color Image Processing – Basic Concepts of Image Compression – Lossless and Lossy Compression Techniques – Image Compression Standards and Quality Measures – Feature Vectors and Vector Spaces – Binary Object Features Boundary Descriptors – Histogram-based (Statistical) and Texture Features.

Unit V : Video Processing: sampling and motion estimation
Monochrome Analog Video and Color Video – Digital Video Basics – Digital Video Formats and Standards – Video Processing in MATLAB – Video Sampling and Basics - Standards Conversion – Fundamentals of Motion Estimation and Motion Compensation – General Methodologies in Motion Estimation – Motion Estimation Algorithms – Video Enhancement and Noise Reduction.

Text Book(s):
1. Oge Marques, *"Practical Image and Video Processing Using MATLAB"*, Wiley Publications, 2011. ISBN 978-0470048153

References Book(s):
1. Mark S. Nixon and Alberto S. Aguado, *"Feature Extraction & Image Processing for Computer Vision"*, 3ed, Academic Press, 2012.

Text and Web Mining

Course Objectives

This course introduces models and algorithms for retrieving relevant data from text and web and evaluating IR systems. Further, it focuses on social network analysis, opinion mining and recommender systems

Learning Outcomes

Upon completion of this course, students should be able to:
- Understand terminologies of IR and Web
- Develop simple IR systems based on various IR models
- Evaluate the effectiveness of IR systems
- Crawl data from web and analyze social networks
- Develop sentiment analysis systems and recommender systems for real world use cases

Unit I : Information Retrieval Part-I

Information Retrieval Terminologies: Definition, Unstructured document, General IR system architecture – Boolean retrieval model: Term-Document Incident Matrix for Document representation, Boolean queries, Relevance of a document, Precision and Recall – Inverted Index Construction – Processing Boolean queries using inverted index – Determining vocabulary terms: tokenization, Stop words removal, Normalization, Stemming, Lemmatization. – Term frequency and weighting: Bag of words, term frequency, document frequency and inverse document frequency, tf-idf weighting, Overlap score measure. – Vector space model: Dot product, Queries as vectors, Computing vector scores. – Other tf-idf functions – Evaluation of IR systems: Precision, Recall, F-measure, Precision-Recall graph – Evaluation of IR systems: Interpolated precision, Mean average precision, Precision @ k, R-precision.

Unit II : Information Retrieval Part-II

Evaluation of IR systems: ROC curve, Sensitivity, Specificity, Cumulative gain – Evaluation of IR systems: Normalized Discounted Cumulative Gain, Dice coefficient, Kappa statistic – Relevance Feedback (RF): Rocchio algorithm – Probabilistic RF, Pseudo RF, Indirect RF, Query expansion – Probabilistic retrieval: Binary independence model – Okapi BM25: Non binary model. Example – Language model: Query likelihood model – Naïve Bayes text classification: Multinomial model – Naïve Bayes text classification: Bernoulli model – Feature selection: Mutual information.

Unit III : Social Network Analysis

Centrality and Prestige – Co-citation and Bibliographic coupling – PageRank algorithm Part-I – PageRank algorithm Part-II – HITS algorithm – Strengths and weaknesses of PageRank and HITS – Community discovery: Bipartite core based algorithm – Community discovery: Maximum flow based algorithm – Betweenness measure to discover email communities – Heuristic approach to discover overlapping communities.

Unit IV : Web Crawling

Basic sequential crawler – Basic sequential crawler: Implementation issues – Universal Crawler – Focused Crawler – Context Focused Crawler – Topical crawlers: Topical locality and cues – Topical crawlers: Best N First crawler – Topical crawlers: InfoSpider crawler – Crawler evaluation – Crawler ethics and conflicts.

Unit V : Opinion Mining and Recommender Systems

Opinion mining: Problem definition – Aspect based opinion summary – Document Sentiment Classification: supervised and unsupervised – Sentence level sentiment classification – Aspect based opinion mining – Opinion spam detection – Content based recommendation – Collaborative filtering based recommendation: kNN – Collaborative filtering based recommendation: Association rules – Collaborative filtering based recommendation: Matrix factorization.

Text Book(s):

1. Christopher D. Manning, Prabhakar Raghavan and Hinrich Schutze. "*Introduction to Information Retrieval",* Cambridge University Press, 2009. (http://nlp.stanford.edu/IR-book/)

2. Bing Liu. "*Web Data Mining: Exploring Hyperlinks, Contents, and Usage Data*", 2nd Edition, Springer July 2011. (http://www.cs.uic.edu/~liub/WebMiningBook.html)

References Book(s):

1. Soumen Chakrabarti. "*Mining the Web: Discovering knowledge from unstructured data*", Morgon Kaufmann Publishers, 2003.

Human Computer Interaction Design

Course Objectives

This course introduces students to design user interfaces based on the capabilities of computer technology and the needs of human factors. Students design a user interface for a system and implement a prototype from a list of informal requirements.

Learning Outcomes

Upon completion of this course, students should be able to:
- Explain the capabilities of both humans and computers from the viewpoint of human information processing.
- Describe typical human–computer interaction (HCI) models, styles, and various historic HCI paradigms.
- Apply an interactive design process and universal design principles to designing HCI systems.
- Describe and use HCI design principles, standards and guidelines.
- Analyse and identify user models, user support, socio-organizational issues, and stakeholder requirements of HCI systems.
- Discuss tasks and dialogs of relevant HCI systems based on task analysis and dialog design.
- Analyse and discuss HCI issues in groupware, ubiquitous computing, virtual reality, multimedia, and Word Wide Web-related environments.

Unit I : Understanding and conceptualizing interaction

Interaction design, Good and Bad design – Process and goals of Interaction Design: Usability goals, User experience goals – Design and usability principles: Heuristics and usability principles – Understanding the problem space – Conceptual Models: Based on activities – Conceptual Models: Based on objects – Case of mix and match – Interface metaphors – Interaction Paradigms – Transition from conceptual model to physical design.

Unit II : Designing for collaboration and communication

Understanding cognition – Applying knowledge from physical world to the digital world – Conceptual frameworks for cognition: Mental models – Conceptual frameworks for cognition: Information processing , External cognition – Informing design : from theory to practice – Social mechanisms used in communication and collaboration: conversational mechanisms, designing collaborative technologies to support conversation – Social mechanisms used in communication and collaboration: co-ordination mechanisms, designing collaborative technologies to support co-ordination – Awareness mechanisms, Designing collaborative technologies to support awareness – Ethnographic studies of collaboration and communication – Conceptual framework: Language /action framework, distributed cognition.

Unit III : Human centered software evaluation

Affective aspects, Expressive interfaces – Virtual characters: Agents, Kinds of agents, General design concerns – Introduction, Four basic activities of Interaction design – Key characteristics of Interaction design process – Lifecycle models: Simple lifecycle model for interaction design – Lifecycle models: Lifecycle model in s/w engineering, lifecycle model in HCI – Evaluation introduction, What, Why and When to evaluate – Evaluation Paradigms and techniques – DECIDE: Framework to guide evaluation – Determine, Explore, Choose, Identify, Decide, Evaluate.

Unit IV : Design prototyping and construction

Introduction, Kinds of requirements – Data gathering: Techniques, Choosing between techniques, Data gathering guidelines – Data interpretation and analysis – Task description – Hierarchical task analysis – Prototyping: Introduction, Low fidelity and High fidelity and compromises in prototyping – Conceptual design: Perspectives for developing conceptual

model, Expanding conceptual model – Scenarios and prototypes in conceptual design – Physical design : Guidelines, Kinds of widget – Tool support.

Unit V : Human centered software design
Degrees of involvement, User centered approach – Applying ethnography in design-Coherence , contextual design – Participatory design: PICTIVE, CARD – Goals, questions and paradigms for observation – To observe : In controlled environments, In field, Participant observation and Ethnography – Data collection – Indirect observation : Diaries, Interaction logging – Analyzing, Interpreting and presenting data: Qualitative Analysis – Analyzing, Interpreting and presenting data: Quantitative data analysis – Feeding the findings back to design.

Text Book(s):
1.   Preece, J., Rogers, Y., & Sharp, H. (2015). "***Interaction design: Beyond human-computer interaction***" (4th ed.) John Wiley & Sons Ltd.

References Book(s):
1.   Dix, A., Finlay, J., Abowd, G.D., & Beale, R. (2004). "***Human computer interaction***" (3rd ed.). Prentice Hall.

Elective 3a) Design and Implementation of Data Warehouse

Course Objectives

This course introduces students data warehouse fundamentals, OLAP operations, data warehouse design concepts, querying data warehouse, physical design of data warehouses and ETL operations

Learning Outcomes

Upon completion of this course, students should be able to:

- Explain fundamental concepts of data warehouse
- Illustrate data warehouse architecture
- Describe online analytical processing operation
- Explain data warehouse design concepts
- Get desired results from data warehouse by using query language
- Get information from the internal and external sources using Extraction, Transformation and Loading techniques
- Describe the importance of physical design concepts of data warehouses

Unit I : Data warehouse fundamental concepts

Hierarchies – Measures – OLAP operations – Data warehouses – Data warehouse architecture: Back-End tier, Data Warehouse tier – OLAP tier, Front-end tier – Variations of the architectures – Data warehouse Design – Microsoft SQL Server Tools – Pentaho Business Analytics.

Unit II : Conceptual Data warehouse design

Conceptual modeling of data warehouses – Balanced Hierarchies and Unbalanced hierarchies – Generalized Hierarchies – Parallel hierarchies – Alternative – hierarchies – Parallel hierarchies – Non strict hierarchies – Facts with Multiple – granularities – Many to many dimensions – Querying the Northwind Cube Using the OLAP Operations.

Unit III : Logical Data warehouse Design

Logical Modeling of data warehouses – Relational data warehouse design – Relational implementation of the conceptual model – Time Dimensions – Logical representation of hierarchies – Advanced modeling aspects – Slowly changing dimensions – SQL/OLAP operations : Data Cube – Rollup, Cube and Grouping sets – Window Functions.

Unit IV : Querying Data warehouses

Tuples and Data sets, Basic Queries – Slicing, Navigation – Cross join, Sub-queries – Calculated Members and Named sets – Relative Navigation – Time Series Functions – Filtering – Sorting – Top and Bottom analysis – Aggregation functions.

Unit V : Physical Data warehouse design and Extraction, Transformation and Loading

Physical modeling of data warehouses – Materialized views – Data Cube Maintenance – PipeSort Algorithms – Cube Size Estimation – Evaluation of Star queries – Data warehouse partitioning – Business Process Modeling Notation – Conceptual ETL Design using BPMN – Conceptual design of the Northwind ETL Process.

Text Book(s):

1. Alejandro Vaisman, Esteban Zimanyi, "***Data Warehouse Systems"***, Springer – 2014, ISBN 978-3-642-54654-9

References Book(s):

1. William H. Inmon , "***Building the Data Warehouse"***, Wiley Publishing Inc, 2005, 4th Edition, ISBN-13: 978-0-7645-9944-6

Elective 3b) Mobile Computing

Objectives:

To impart knowledge on Middleware and Gateways, Blue Tooth, and GPRS

Unit – 1

Mobile Computing- Middleware and Gateways-Developing Mobile Computing Applications-Security in Mobile Computing – Architecture of Mobile Computing-Three-Tier Architecture-Design Consideration for Mobile Computing-Mobile Computing through Internet-Mobile Computing through Telephone-Developing an IVR Applications.

Unit-2

Bluetooth-RFID-Wireless Broadband (WiMax)- Mobile IP – IPV6-Java Card –Global System for Mobile Communications – GSM Architecture – Call Routing in GSM – GSM Addresses and Identifiers – Network Aspects in GSM – GSM Frequency Allocation – Authentication and Security- Mobile Computing Over SMS – SMS-Value Added Services through SMS.

Unit-3

GPRS and Packet Data Network – GPRS Network Architecture – GPRS Network Operations –Data Services in GPRS- Applications for GPRS – Limitations of GPRS- Spread Spectrum Technology-CDMA Versus GSM – Wireless Data – Third Generation Networks – Applications on 3G – Wireless LAN Advantages – Wireless LAN Architecture- Mobility in Wireless LAN – Deploying Wireless LAN – Wireless LAN Security.

Unit-4

Mobile Phones – PDA- Design Constraints in Applications for Handheld Devices – Palm OS Architecture – Communications in Palm OS – Introduction to Symbian – Symbian OS Architecture – Applications for Symbian – Security on the Symbian OS- JAVA in the Handset – Java 2 Micro Edition Technology – Different Flavours of Windows CE- Windows CE Architecture.

Unit-5

Voice over IP- H.323 Framework for Voice Over IP- Session Initiation Protocol (SIP)-Comparison between H.323 and SIP – Real Time Protocols – Voice Over IP Applications – Security Techniques and Algorithms – Security Protocols – Public Key Infrastructure – Security Models-Security Framework for Mobile Environment.

Text Book:

1. *"Mobile Computing",* Asoke K Talukder and Roopa R Yuvagal, Tata McGraw Hill Publishing Company Limited, 2005.

Reference Book:
1. *"Mobile Communications"* by Jochen Schiller, Second Edition, 2007

Elective 3c) Distributed Object Technology

Objectives:

       To impart knowledge on Software process assessment, Configuration management, Testing and Defect preventions.

Unit I

Introduction – Software Process Assessment Overview – Assessment phase – Assessment principles – Assessment conduct – Implementation consideration – Quality Management – Quality Assurance Plan – Consideration – Verification and Validation.

Unit II

Configuration Management – The need for Configuration Management – Software product nomenclature – Basic configuration management functions – Baselines – Responsibilities – Need for Automated tools – Configuration Management Plan – SCM support functions – The requirement phase design control – The implementation phase – Test phase – SCM for Tools – Configuration Accounting and Audit.

Unit III

Software Standards and Inspection – Definitions – The reasons for software standards – Benefits of standards – Establishing standards – Guidelines – Types of reviews – Inspection of objectives – Basic Inspection Principles – The conduct of Inspection – Inspection Training.

Unit IV

Testing and Managing Software Quality – Testing principles – Types of tests – Test planning – Test Development – Test execution and reporting – Test tools and methods – Real time testing – Quality Management paradigm – Quality motivation – Measurement criteria – Establishing a software quality program – Estimating software quality.

Unit V

Defect Prevention – Principles of software defect prevention – Process change for defect prevention – Defect prevention considerations – Management role – Framework for software process change – Managing resistance to software process change – Case studies.

Text Book:
1. "***Introduction to the Team Software Process",*** Watts S. Humphrey, Addison Wesley – 2000.

Reference Books:
1. ***"Introduction to the Personal Software Process",*** Watts S. Humphrey, Addison Wesley – 2000.
2. ***"Managing the Software Process",*** Watts S. Humphrey, Addison Wesley – 1999.

Computer Vision Lab

Course Objectives

This lab course teaches students the theories and models of images and videos that enable machines to see. Students will be introduced techniques to process images and videos

Learning Outcomes

Upon completion of this course, students should be able to:
- Practice fundamental concepts of images and image acquisition
- Apply transformation, filtering, segmentation and edge detection methods to images
- Detect motions and objects from videos

1. Develop an application for Image Enhancement
2. Develop an application for Image Compression
3. Develop an application for Color Image Processing
4. Develop an application for Image Segmentation
5. Develop an application for Image Transformations
6. Develop an application for Image Histogram
7. Develop an application for Edge Detection
8. Develop an application for Blurring 8 bit color versus monochrome
9. Develop an application for Video enhancement
10. Develop an application for Motion detection in videos

Text and Web Mining Lab

Course Objectives

This lab course trains Students models and algorithms for retrieving relevant data from text and web and evaluating IR systems using Python and NLTK. Further, it focuses on social network analysis, opinion mining and recommender systems.

Learning Outcomes

Upon completion of this course, students should be able to:
- Apply NLP preprocessing methods to text and web data
- Implement IR models including Vector space model
- Evaluate the effectiveness of IR systems using Precision, recall
- Develop text classification system using ML methods
- Develop sentiment analysis systems and recommender systems for real world use cases

1. [NLP Preprocessing]: Read a text file from local directory. Tokenize the text, remove all the special character then apply Stemming, Lemmatization. Write result to an output file.
2. [Word Features]: Read a text file from local directory. Apply all text processing methods. Identify the features such as Unigrams, Bigrams, Trigrams and Ngram and further plot their frequency distribution.
3. [TFIDF]: Read a text file from local directory. Consider each line in the text file as a document. Apply all text processing methods. For each document (i.e. each line) compute the TFIDF vector and print to a file.
4. [Boolean Model]: Read a text file from local directory. Consider each line in the text file as a document. Apply all text processing methods. Build a Boolean model for the documents (i.e. each line). For a query text rank each document in the file using similarity measures such as dot product, cosine similarity etc. Print the top ranked documents as result.
5. [Vector Space Model]: Read a text file from local directory. Consider each line in the text file as a document. Apply all text processing methods. Build TFIDF matrix for the documents (i.e. each line). For a query text rank each document in the file using similarity measures such as dot product, cosine similarity etc. Print the top ranked documents as result.
6. [Evaluation]: For a given query text, compute relevant set of documents with ranking (either using W5 or manually given ranks and documents). Compute the following evaluation measures for the retrieval task. Accuracy, Precision, Recall, F-Measure, Confusion Matrix.
7. [Naïve Bayes Text Classification for Ham vs Spam detection]: Populate documents for Ham and Spam. Construct TFIDF vector for documents of documents of Ham vs Spam. Train a Naïve Bayes classification model for the Ham vs Spam detection.
8. [Sentiment analysis of Movie Reviews]: Populate documents for positive and negative reviews of a movie. Classify sentiment using dictionary based approach and also Naïve Bayes classification model for review classification.
9. [Content based recommender system for Library]: Create a user profile with user preferred keywords related to books. Create descriptions about books with different tags. Recommend new books to the user based on content based filtering.
10. [Collaborative Filtering using kNN for Music Recommendation]: Create an incident matrix with users and their ratings for music they listened to. Build a collaborative filtering using KNN for recommending music to new/existing users.

Neural Networks and Deep Learning

Course Objectives

This course introduces students the fundamentals of neural networks and deep learning neural networks. It also helps students to implement the various concepts using Tensorflow and Keras.

Learning Outcomes

Upon completion of this course, students should be able to:

- Explain how neural networks (deep and otherwise) compare to other machine learning models.
- Determine when a deep neural network would be a good choice for a particular problem.

Unit I : Neural Network Part-I

Background: Typical NN, NN Structure, XOR example for NN input and output, Training, Car – Database example – Neurons and Layers – Types of Neurons – Activation Functions – Rectified Linear Units Activation Functions – Logic Programming with NN – Self Organizing Maps – Neighbourhood Functions – Hopfield Network – Training a Hopfield Network.

Unit II : Neural Network Part-II

Boltzmann Machine and Boltzmann Machine Probability – Boltzmann Machine for Traveling – Salesman Problem – Single Output Feed Forward NN – RBF Networks – Data Normalization – Training and Evaluation: Binary Classification, Sensitivity, Specificity, ROC curves – Multi-class Classification: Log loss, Multi class log loss, Means square error – Training with Simulated Annealing – Backpropagation Training: Gradients ,Calculating output node delta and error functions.

Unit III : Neural Network Part-III

Backpropagation Training: Calculating interior node delta and derivatives of activation functions – Choices for Backpropagation: Batch, Online and Stochastic Gradient Descent Training – Resilient Propagation Training: Arguments and data structures – Resilient Propagation Training: Steps in the training process – Levenberg–Marquardt Training: Algorithm – Levenberg–Marquardt Training: Calculation of the Hessian – Levenberg–Marquardt Training: With multiple outputs and Overview of LMA process – NEAT Networks: Concepts – NEAT Networks: NEAT Mutation – NEAT Crossover.

Unit IV : Deep Learning Part-I

Deep Learning Features or Components – Deep Learning Tools – Comparison of NN and DBNN – Deep Belief Neural Networks architecture – Implementing DBNN with Restricted Boltzmann Machine – Training DBNN: Steps, Layer wise sampling, Computing positive and negative gradients, Updating weights and bias – Deep Belief Classification Example – Convolutional Neural Networks: LeNET-5, Convolutional layer – Convolutional Neural Networks: Max-Pool layer and Dense layer.

Unit V : Deep Learning Part-II

Pruning: connections, neurons, algorithm for pruning – Model Selection: Grid Search model selection – Model Selection: Random Search model selection, Other model selections – L1 Regularization – L2 Regularization – Dropout Regularization – Simple Recurrent Neural Networks: Context Neuron, Context Layer – Architecture of SRN: Elman SRN, Jordon SRN; – Training SRN: Backpropagation through time – Architecting Neural Network: Training parameters, Hyper Parameters.

Text Book(s):

1. Jeff Heaton, "*Artificial Intelligence for Humans"*, Volume 3: Neural Networks and Deep Learning, Heaton Research Inc,2015

References Book(s):

1. Kevin Gurney, "*An Introduction to Neural Networks"*, UCL Press, 1997
2. Ian Goodfellow and Yoshua Bengio and Aaron Courville, Deep Learning, MIT Press, 2016, (http://www.deeplearningbook.org)

Computer and Network Security

Course Objectives

This course enables the students to learn fundamental concepts of computer security and cryptography and utilize these techniques in computer Systems.

Learning Outcomes
Upon completion of this course, students should be able to:
* Explain security concepts, ethics in network security
* Identify and classify various of attacks
* Understand the same, compare and contrast symmetric and asymmetric systems
* Describe the role of 3rd party agents in the provision of authentication services
* Describe web security, intruders, viruses and fire walls

Unit I : Symmetric Ciphers
Introduction: Overview of security concepts - Overview of Symmetric cryptography - General model for Symmetric encryption -Examine a variety of algorithm[Monoalphabetic, Polyalphabetic] - Look briefly a different approach known as Steganography - Principles of modern Symmetric Cipher(DES) - DES example and strength - Overview of general structure of AES, Transformation function - AES key expansion,AES Example, Implementation - Analyse the security of encryption Scheme(Dpuble DES,Triple DES) - Compare the content ECB,CBC, CFB, OFB and counter Model of operation.

Unit II : Asymmetric Ciphers and Public key Crpteograhy, Data Integrity
Key concept to Prime numbers, Fermat's Theorem - Euclers Theorem, Testing of primality Chinis Remainder Theorm - Overview of the basic principle of public key Cryptography - RSA algorithm - Diffie Hell Mon key exchange(PKCS) - Eligamal cryptograph y System - Application of nCryptographic HASH function(Message authentication, Digital Signature) - Two (b simple Hash function Bit by Bit XOR, SHA Hash function based Cipher block Chaning) - SHA

Unit III : Message Authentication and Digital Signature
Introduction to the requirement of Message authentication - Digital signature - HMAC,MAC based of Block cipher DAA, CMAC - Authentication Encryption CCM and GCM - Key wrapping and unwrapping algorithm - Pseudo Random number generation using Hash functions - PRNG on MAC function, PRNG based on Hash and MAC - Digital Signature requirements, Elgamal DS - Schnorr Digital Signature   NIST Signature(DSA approach) - Elliptic Curve DSA - RSA-PSS Digital Signature algorithm.

Unit IV : Key management and Distribution user authentication
Symmetric Key Distribution using Encryption – Symmetric Key distribution using asymmetric key encryption – Distribution of Public Keys – X.509 certificates – PKI-PKIX management function, Protocols – Remote user authentication principle, Remote user authentication using symmetric encryption – Kerberos- version 4 – Kerberos version 5 – Federated Identity Management - Remote user authentication using asymmetric encryption, Personal Identity Verification.

Unit V : Network and Internet Security
Network access model, Extensible authentication Protocol - IEEE802.1X port based network access control - Cloud computing - Cloud secutiry,Risks and counter measures - Cloud security as a service - Transport level security-web security, SSL - TLS, HTTP - SSH , wireless security Electronic mail security, Pretty good privacy - IP security overview, policy.

Text Book(s):
1. *"Cryptography and network security"*: William Stallings, Pearson Edition 6th Edition,2016.

Reference Book(s):
1. *"Cryptography-Made-Simple"*:Nigel.P. Smart.

Elective 4a) Supply Chain Management

Course Objectives

This course teaches students supply chain strategy and concepts. It provides solid understanding on building framework to analyze supply chain, designing supply chain network, managing demand and supply and inventories, besides designing transportation networks.

Learning Outcomes

Upon completion of this course, students should be able to:

- Understand the importance of good supply chain design, planning and operation
- Apply strategic drivers and metrics of supply chain performance
- Provide recommendations for the given business problems

Unit I : Building strategic framework

Supply chain: Definition, 3 streams of knowledge, objectives and importance - Decision phases and process views of a supply chain (SC) - Examples of supply chain - Competitive strategy and SC strategy - 3 steps of achieving strategic fit - Improving SC performance by expanding scope of strategic fit, challenges to achieving strategic fit - Financial measures and drivers of SC performance - Logistical drivers: Roles in SC and decision components - Cross functional drivers: Roles in SC and decision components - Role of infrastructure in SC performance.

Unit II : Designing SC network

Key factors influencing distribution network design - Design options for a distribution network - Impact of online sales on customer service and cost - Network design decisions: Influencing factors, framework - Capacitated plant location model for network optimization - Gravity location model for network design - Model for demand allocation and locating plants - Global supply chain: Dimensions to evaluate total cost, SC risks, tailored risk mitigation strategies - Discounted cash flow analysis to evaluate network design decision - Decision tree analysis: Basics, Evaluating flexibility at Trip Logistics.

Unit III : Planning and coordinating demand and supply

Demand forecasting: role, characteristics, components and methods - Static demand forecasting methods - Adaptive demand forecasting methods - Measures of demand forecasting error - Aggregate planning: role, identifying aggregate units, strategies - Aggregate planning using Linear programming - Managing supply and demand to improve synchronization in SC - Lack of SC coordination: Bullwhip effect, effect on performance - Obstacles to coordination in SC - Managerial levers to achieve coordination of demand and supply in SC.

Unit IV : Planning and managing inventories

Cycle inventory terminologies: Lot size, Average flow time, Inventory holding cost, Ordering cost - Computing optimal lot size for single product: Economic order quantity, for Production environment, with Capacity constraint - Lot size based discount schemes: All unit quantity discounts, Marginal unit quantity discount - Trade promotions: Goals, Forward buying, Impact on lot size and cycle inventory - Factors affecting the level of safety inventory - Evaluating required safety inventory: Given a replenishment policy, Desired cycle service level, Desired fill rate - Impact of desired product availability and uncertainty on safety inventory - Impact of supply uncertainty on safety inventory - Factors affecting optimal level of product availability - Managerial levers of inventory to improve SC profitability.

Unit V : Transportation and cross functional drivers

Modes of transportation in SC - Design options for a transportation network - Transportation and inventory cost trade off - Transportation cost and customer responsiveness trade off - Tailored transportation - Sourcing decisions: In house or Outsource - Sharing risk and reward in SC - Pricing and revenue management for multiple customer segments - Pricing and revenue management for perishable assets - Pricing and revenue management for seasonal demand.

Text Book(s):
1. Sunil Chopra, Peter Meindl and DV Karla. "***Supply Chain Management: Strategy, planning and operation***", 6th edition, Pearson, 2016. ISBN 978-9332548237 (Excluding Excel Examples)

References Book(s):
1. David Simchi-Levi and Philip Kaminsky*. "Designing and managing the supply chain: Concepts, strategies and case studies"*, 3rd edition, McGraw Hill, 2007.

Elective 4b) Linked Open Data and Semantic Web

Objective :

    To impart knowledge on Semantic Web that provides a common framework and allows data to be shared and reused across application, enterprise, and community boundaries

UNIT I:

    The Semantic web Vision: Today Web – From Today's Web the Semantic Web – Examples – Semantic web Technologies – A Layered Approach – Structured Web Documents in XML: Introduction the XML Language – Structuring - Name Spaces.

UNIT II:

    Addressing and Quieting XML Documents – Processing – Describing Web Resources in RDF: Introduction – RDF: Basic Ideas – RDF XML – Based Syntax – RDF Schema Basic Ideas – RDF Schema: The Language – RDF and RDF Schema in RDF Schema.

UNIT III:

    An Axiomatic Semantic for RDF and RDF Schema – A Direct Inference System for RDF and RDFS – Querying in RQL – Web Ontology Language: Introduction – The OWL Language – Examples – OWL in OWL.

UNIT IV:

    Future Extensions Logic and Inference: Example of Monotonic Rules: Family Relationship – Monotonic Rules: Syntax – Semantics – Non – Monotonic Rules: Motivation and Syntax – Example of Non – Monotonic Rules: Brokered Trade – Rule Markup in XML: Monotonic Rules – Non monotonic Rules.

UNIT V:

    Applications: Introduction – Horizontal Information Products at Elsevier – Data Integration at Audi – Skill Finding at Swiss Life – Think Tank Portal at Enersearch – e – Learning – Web Services-Ontology Engineering: Introduction – Constructing ontologies – Manually – Resuing Existing ontologies – Using semiautomatic methods - On – to – knowledge Semantic web Architecture.

Text Book:
   1. *"Semantic Web Primer",* Grigoris Antoniou and Frank Van Harmelen by The MIT Press Cambridge, Massa Chusetts London, England.

Reference Books:
   1. *"Agency and the Semantic Web",* Christopher Walton, Oxford University Press, 2007
   2. *"Semantic Web Technologies and e-Business",* AF Salam and Jason R Stevens, Idea Group Publications, 2007

Elective 4c) Advanced Microprocessors and Microcontrollers

Objectives:

To impart knowledge on 8086, 80286, Pentium, architectures and assembly language programs and microcontrollers. It also provides details about various interfacing devices like 8255, 8253, 8259, 8279, 8251, 8257. It is also useful to the students who want to take microprocessor - based projects.

UNIT I

Register organization of 8086- Architecture- Signal description of 8086 - Minimum mode 8086 system and timings - Maximum mode 8086 System and Timings - Machine Language Instruction format - Addressing modes of 8086 - Instruction set of 8086 - Assembler directives and operators.

UNIT II

A few machine level programs - Machine coding the programs - Programming with an assembler - Assembly language example programs. Introduction to stack - STACK structure of 8086 - Interrupts and Interrupt Service Routines.

UNIT III

Salient features of 80286 - Internal Architecture of 80286 - Signal descriptions of 80286 - Real addressing mode - Protected Virtual Addressing Mode (PVAM) - Privilege - Protection - 80286 Bus Interface - Basic bus operations - Interfacing Memory and I/O devices with 80286 - Instruction set features.
Salient features of 80586 (PENTIUM) - A few relevant concepts of computer architecture - System architecture - Enhanced Instruction set of Pentium.

UNIT IV

PIO 8255 - programmable Interval Timer 8253 - Programmable Interrupt Controller 8259 - Keyboard / Display Controller 8279 - Programmable Communication Interface 8251 USART - DMA Controller 8257. Intel MMX Architecture – MMX Instruction set.

UNIT V

Architecture of 8051 - Signal Description of 8051 - Register set of 8051 - Important operational features of 8051 - Memory and I/O Addressing by 8051 - Interrupts of 8051 -Instruction set of 8051 - Design of a MicroController 8051 Based Length Measurement System for continuously Rolling Cloth or Paper.

Text Book:

1. ***"Advanced Microprocessor And Peripherals"*** –A.K. Ray and Bhurchandi , Tata McGraw - Hill 2000

Reference Books:

1. ***"Programming and Customizing the 8051 Microcontroller",*** Myke Predko ,
"Microprocessors and Interfacing Programming and Hardware", Douglas V. Hall - Second Edition, Tata McGraw - Hill Publishing Company Limited, New Delhi.

Project

Course Objectives

The Project Proposal emphasizes on application of the theoretical concepts of software analysis and design concepts. The analysis component consists of preparing formal Software Requirements Specifications (SRS) document. The SRS will contain a problem statement, scope, justification, requirements, cost estimation, assumptions, limitations, methodology and tools to be used in the development of the project. The scope of the proposed problem should be clear and well defined in the problem statement. All the functional and non-functional requirements of the system should be identified and analyzed in the proposal. The students will be encouraged to develop logical model of the proposed system based on the identified requirements. The design component of the course includes prototype including input and output of the proposed system.

In this phase of the course, students are required to implement the proposed design of the project. The students will review the design specification and make any necessary enhancements to synchronize the implementation details. The students will identify and learn the use of tools required for the project implementation. The students will be expected to: prepare application architecture, code, debug, document, and test the application software within suggested timeframe. Efforts will be made to ensure the quality of software project through various evaluation aspects such as professional coding style, documentation of code, intuitive user interface design, input validation, verification and user guide. The students will be further required to evaluate the developed system by generating test cases of the critical components of the designed model.

Learning Outcomes
Upon completion of this course, students should be able to:
- Identify and define the problem statement
- Define and justify scope of the proposed problem
- Gather and analyze system requirements
- Propose an optimized solution among the existing solutions
- Practice software analysis and design techniques
- Develop a functional application based on the software design
- Apply coding, debugging and testing tools to enhance the quality of the software
- Construct new software system based on the theory and practice gained
- Prepare proper documentation of software project following the standard guidelines
- Develop technical reporting and oral presentation skills

Text Book(s):
1. Lynn E. Miner & Jeremy T. Miner, *"Proposal Planning and Writing"*, Third Edition, Greenwood Publishing Group, 2003.

References Book(s):
1. William Navidi, *"Statistics for Engineers and Scientists",* 2nd Edition, McGraw-Hill, 2007.