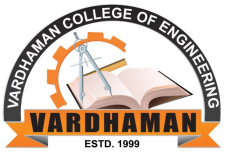

VARDHAMAN COLLEGE OF ENGINEERING

(AUTONOMOUS)

Affiliated to **JNTUH,** Approved by **AICTE,** Accredited by **NAAC** with **A++** Grade, **ISO 9001:2015** Certified

Kacharam, Shamshabad, Hyderabad - 501218, Telangana, India

www.vardhaman.org

CURRICULUM

For

Master of Technology

Computer Science and Engineering

Under

Choice Based Credit System (CBCS)

M. Tech. - Regular Two Year PG Degree Program

(For batches admitted from the Academic Year 2022-2023)

October 2022

M. Tech – Computer Science and Engineering

Regulations: VCE-R22

College Vision:

- **To be a pioneer institute and leader in engineering education to address societal needs through education and practice.**

College Mission:

- **To adopt innovative student centric learning methods.**
- **To enhance professional and entrepreneurial skills through industry institute interaction.**
- **To train the students to meet dynamic needs of the society.**
- **To promote research and continuing education.**

Department Vision:

- To be a leading source of competent computer engineers, meeting the needs of industry and society at large.

Department Mission:

- Facilitate learning in advanced technologies adopting innovative methods.
- Associate continuously with industry, to design and implementation of experiential curriculum.
- Promote Research and Development through Special Interest Groups (SIGs).
- Provide platform for harnessing entrepreneurial and leadership qualities.

Program Educational Objectives(PEOs):

- **PEO1: Graduates will establish himself/herself as effective professionals by solving real-world problems using investigative and analytical skills along with the knowledge acquired in the field of Computer Science and Engineering.**
- **PEO2: Graduates will demonstrate his/her ability to adapt to a rapidly changing environment in advanced areas of Computer Science and scale new heights in their profession through lifelong learning.**
- **PEO3: Graduates will prove his/her ability to work and communicate effectively as a team member and /or leader to complete the task with minimal resources, meeting deadlines.**
- **PE04: Graduates will embrace the professional code of ethics in the profession while deliberately being part of projects, which contributes to the society at large, without disturbing the ecological balance.**

Program Outcomes(POs):

- **PO1: An ability to independently carry out research/investigation and development work to solve practical problems.**
- **PO2: An ability to write and present a substantial technical report/document.**
- **PO3: An ability to demonstrate a degree of mastery in the domain of Computer science and engineering.**
- **PO4:An ability to translate theoretical understanding to experimental knowledge and solve complex problems using modern tools.**
- **PO5: An ability to transform societal issues into problems, investigate, understand and propose integrated solutions using emerging technologies.**

Programme Curriculum Structure
M. Tech – Computer Science and Engineering

Regulations: VCE-R22

I Year I Semester								
#	Course Code	Title of the Course	Hours per Week and Credit			Assessment Marks		
			L	P	C	CIE	SEE	Total
1	B6501	Cloud Computing and Virtualization	3	0	3	40	60	100
2	B6502	Advanced Data structures	3	0	3	40	60	100
3		Professional Elective – I	3	0	3	40	60	100
4		Professional Elective – II	3	0	3	40	60	100
5	B6503	Cloud Computing and Virtualization Laboratory	0	4	2	40	60	100
6	B6504	Advanced Data structures Laboratory	0	4	2	40	60	100
7	B6001	Research Methodology and IPR	2	0	2	40	60	100
8		Audit Course - I	2	0	0	-	100*	100*
Total			16	08	18	280	420	700

I Year II Semester								
#	Course Code	Title of the Course	Hours per Week and Credit			Assessment Marks		
			L	P	C	CIE	SEE	Total
1	B6505	Machine Learning	3	0	3	40	60	100
2	B6506	Big Data Analytics	3	0	3	40	60	100
3		Professional Elective - III	3	0	3	40	60	100
4		Professional Elective - IV	3	0	3	40	60	100
5	B6507	Machine Learning Laboratory	0	4	2	40	60	100
6	B6508	Big Data Analytics Laboratory	0	4	2	40	60	100
7	B6541	Mini-Project with Seminar	0	4	2	100	-	100
8		Dissertation Work Review -I	-	-	-	-	-	-
9		Audit Course-II	2	0	0	-	100*	100*
Total			14	12	18	340	360	700

Programme Curriculum Structure
M. Tech – Computer Science and Engineering

Regulations: VCE-R22

II Year I Semester								
#	Course Code	Title of the Course	Hours per Week and Credit			Assessment Marks		
			L	P	C	CIE	SEE	Total
1		Professional Elective -V	3	0	3	40	60	100
2		Open Elective	3	0	3	40	60	100
3	B6542	Dissertation Work Review - II	0	12	6	100	-	100
Total			06	12	12	180	120	300

II Year II Semester								
#	Course Code	Title of the Course	Hours per Week and Credit			Assessment Marks		
			L	P	C	CIE	SEE	Total
1	B6543	Dissertation Work Review - III	0	12	6	100	-	100
2	B6544	Dissertation Work Viva-Voce	0	28	14	-	100	100
Total			0	40	20	100	100	200

Programme Curriculum Structure
M. Tech – Computer Science and Engineering

Regulations: VCE-R22

List of Professional Electives

Professional Elective - I	
Course Code	**Title of the Course**
B6551	Digital Image Processing
B6552	Number Theory and Cryptography
B6553	Block Chain Technology

Professional Elective - II	
Course Code	**Title of the Course**
B6554	Data Warehousing and Data Mining
B6555	IoT and Edge Computing
B6556	Agile Project Management

Professional Elective - III	
Course Code	**Title of the Course**
B6557	Design Patterns
B6558	Web and Database Security
B6559	Wireless and Mobile Computing

Professional Elective - IV	
Course Code	**Title of the Course**
B6560	Robotic Process Automation Design and Development
B6561	Digital Forensics
B6562	Service Oriented Architecture

Professional Elective - V	
Course Code	**Title of the Course**
B6563	Artificial Intelligence and Neural Networks
B6564	Natural Language Processing
B6565	Social Network Analysis

Programme Curriculum Structure
M. Tech – Computer Science and Engineering

Regulations: VCE-R22

Audit Courses		
#	Course Code	Title of the Course
1	B6091	Disaster Management
2	B6092	Value Education
3	B6093	Constitution of India
4	B6094	Stress Management by Yoga
5	B6095	Personality Development through Life Enlightenment skills
6	B6096	Pedagogy Studies

Open Electives		
#	Course Code	Title of the Course
1	B6081	Business Analytics
2	B6082	Waste to Energy
3	B6083	Operations Research
4	B6084	IOT and Applications
5	B6085	Cyber Security
6	B6086	Mobile Cloud Computing

I YEAR I SEMESTER

Course Structure

B6501 - Cloud Computing and Virtualization

Hours Per Week		Hours Per Semester		Credits	Assessment Marks		
L	P	L	P	C	CIE	SEE	Total
3	0	42	0	3	40	60	100

1. Course Description

Course Overview

This course provides a hands-on comprehensive study of Cloud concepts and capabilities across the various Cloud service models including Infrastructure as a Service (IaaS), Platform as a Service (PaaS) and Software as a Service (SaaS). In IaaS main stream Cloud infrastructure services and related vendor solutions are covered in detail. The course also covers the Cloud migration and security model. Students will gain hands-on experience on virtual box and advanced open source tools like Azure, Open stack and Eucalyptus. The major motto of this course is to not just stick with the academic portion but also to encourage students to for cloud certifications to brighten their future endeavours in IT sectors.

Course Pre/co-requisites

The course has no specific prerequisite and co requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

B6501.1 Identify services, design issues and layers in cloud computing .
B6501.2 Choose the cloud migration model and challenges of integration in cloud sectors.
B6501.3 Make use of virtualization concepts in cloud.
B6501.4 Select cloud storage, privacy approaches for efficient implementation of cloud.
B6501.5 Implement IaaS / PaaS service on a public cloud using any open source tool.

3. Course Syllabus

Introduction to Cloud Computing: Cloud Computing in a Nutshell- Roots of Cloud Computing – Layers and Types of Clouds– Desired Features of a Cloud– Cloud Infrastructure Management, Infrastructure as a Service Providers, Platform as a Service Providers, Challenges and Risks, Hybrid.

Broad Approaches to Migrating into Cloud: Broad Approaches to Migrating into the Cloud: The Seven-Step Model of Migration into a Cloud - The Challenges of SaaS Paradigm

Approaching the SaaS Integration Enigma, the Integration Methodologies, SaaS Integration Products and Platforms SaaS Integration Services, Businesses-to-Business Integration (B2Bi) Services SaaS Integration Appliances, Managing Cloud Resources, Maintaining Connections.

Data Centre Technology and Virtualization: Virtualization Technology Overview-Public Cloud and Infrastructure Services-Private Cloud and Infrastructure Services-Distributed Management of Virtualization, Virtual Machines Provisioning And Manageability: VM Provisioning Process, Virtual Machine Migration Services-Migrations Techniques, VM Provisioning And Migration In Action, VM Life Cycle and VM Monitoring, VM Dynamic Management Using Open Nebula.

Secure Distributed Data Storage in Cloud Computing: Cloud Storage: From LANs To WANs, Existing Commercial Cloud Services Technologies For Data Security In Cloud Computing: Database Outsourcing And Query Integrity Assurance Data Integrity in Untrustworthy Storage, Multimedia Data Security Storage, Data Privacy and Security Issues, Content Level Security—Pros and Cons .

Workflow Engine for Clouds: Introduction, Workflow Management Systems and Clouds, Architecture of Workflow Management Systems, Utilizing Clouds for Workflow Execution, Salesforce Workflow Model, Aneka Workflow Model, A Classification Of Scientific Applications And Services In The Cloud: Saga-Based Scientific Applications That Utilize Clouds.

4. Books and Materials

Text Books:

1. Rajkumar Buyya, James Broberg, Andrzej Goscinski. Cloud Computing: Principles and Paradigms, Wiley, 2013.

Reference Books:

1. Barrie Sosinsky. Cloud Computing Bible, 1st Edition, Wiley India, 2011.
2. Tim Malhar, S.Kumaraswammy, S.Latif., Cloud Security and Privacy, 1st Edition, O'Reilly Media, Inc.,2009.

Course Structure

B6502 - Advanced Data Structures

Hours Per Week		Hours Per Semester		Credits	Assessment Marks		
L	P	L	P	C	CIE	SEE	Total
3	0	42	0	3	40	60	100

1. Course Description

Course Overview

Advanced Data Structures is a course for Post Graduate-level Engineering to improve the programming skills using C Language. This course enables to implement various applications in software. The course covers implementing different forms of Linked Lists, linear data structures such as stacks and queues. This course also enables to implement non-linear data structures like Trees and Graphs which are especially used to handle large amount of data. This course covers Binary Trees, Binary Search Tress, AVL Trees, Splay Trees, Red Black Trees and B- Trees. The course will also enable the use of appropriate Pattern Matching Algorithms and Tries.

Course Pre/co-requisites

The course has no specific prerequisite and co requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

B6502.1 Implement Linear Data Structures stacks , queues and linked lists to solve a real time application.
B6502.2 Make use of dictionaries and hash functions for effective storage.
B6502.3 Implement operations of non-linear data structures for handling large data.
B6502.4 Compare AVL Trees, Splay Trees and Red Black Trees for efficient search.
B6502.5 Identify appropriate algorithm for text processing.

3. Course Syllabus

Overview of Data Structures: Singly linked lists, doubly linked lists, circular list, representing stacks and queues using arrays and linked lists, infix to post fix conversion, postfix expression evaluation. Priority Queues– Realizing a Priority Queue using Heaps, Definition, insertion, Deletion.

Dictionaries Hash Tables: Dictionaries, linear list representation, operations insertion, deletion and searching, hash table representation, hash functions, collision resolution-separate chaining, open addressing-linear probing, quadratic probing ,double hashing, rehashing, extendible hashing.

Trees and Graphs: Introduction, definition and basic terminologies of trees and binary trees, representation of trees and binary trees, binary tree traversals, binary search trees: definition, operations and applications. Threaded binary trees; Graphs basic concepts, representation and traversals.

Search Trees: AVL Trees, Definition, Height of an AVL Tree, Operations – Insertion, Deletion and Searching, Red Black and Splay Trees, B- trees: definition, operations and applications. R-trees: Nearest neighbor Query, join and range queries.

Text Processing: Sting Operations, Brute-Force Pattern Matching, The Boyer- Moore Algorithm, The Knuth-Morris-Pratt Algorithm, Standard Tries, Compressed Tries, Suffix Tries, The Huffman Coding Algorithm.

4. Books and Materials

Text Books:

1. Ellis Horowitz, Sartaj Sahni, SanguthevarRajasekaran., Fundamentals of Computer Algorithms, 2nd Edition,UniversityPress(India) PrivateLimited, India. 2008.
2. G.A.V.Pai., Data Structures and Algorithms,Tata Mcgrawhill, NewDelhi, 2009.

Reference Books:

1. D.Samanta., Classic Data Structures, Prentice Hall of India Private Limited, 2003.
2. Aho, Hopcraft, Ullman., Design and Analysis of Computer Algorithms, Pearson Education India, 1998.

Course Structure

B6503 - Cloud Computing and Virtualization Laboratory

Hours Per Week		Hours Per Semester		Credits	Assessment Marks		
L	P	L	P	C	CIE	SEE	Total
0	4	0	56	2	40	60	100

1. Course Description

Course Overview

This course provides a hands-on experience on Cloud Virtualization techniques. The course includes AWS, Google App Engine, Microsoft Azure, Eucalyptus and Open Stack to work in cloud environment. Students will gain hands-on experience on virtual box and advanced open source tools like Cloud Foundry, Open stack and Eucalyptus. The major motto of this course is to not just stick with the academic portion but also to encourage students to for cloud certifications to brighten their future endeavours in IT sectors. This course enables to learn security issues in cloud.

Course Pre/co-requisites

The course has no specific prerequisite and co requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

B6503.1 Implement the concepts of virtualization in cloud environment.
B6503.2 Examine the Security and Networking issues in Azure.
B6503.3 Perform scheduling operations using CloudSim.
B6503.4 Implement IaaS using Open Stack.

3. Course Syllabus

1. Installation and Introduction to Virtual Box, Install Virtual box/VMware Workstation with different flavours of Linux.
2. Install a C compiler in the virtual machine created using virtual box and execute Simple Programs.
3. Configure a Nested Virtual Machine (VM under another VM) in cloud and local machine. Install OS images and work with few OS commands.
4. Create a ssh tunnel between your server in local machine and remote clients in EC2 instances and test the connections with programs using X11 traffic.
5. Implementing Security and Networking in Azure. a) Create security groups in Azure. b) Manage container security and network traffic rules.
6. Find a procedure to transfer the files from one virtual machine to another virtual machine.

7. Install Eucalyptus cloud, understand the concepts of cluster controller and cloud controller.
8. Find a procedure to launch virtual machine using trystack (Online Openstack Demo Version).
9. Deployment and configuration in Microsoft Azure.
10. Installation and Understanding the features of Goggle app engine.
11. SaaS – Deployment of any SaaS application for an online Collaborative tool.
12. Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim.
13. Find a procedure to launch virtual machine using trystack (Online Openstack Demo Version).
14. Use GAE launcher to launch the web applications.
15. Write a Program to Create, Manage and groups User accounts in own Cloud by Installing Administrative Features.
16. Study and implementation of infrastructure as Service using Open Stack.

4. Laboratory Equipment/Software/Tools Required

1. A computer System with Ubuntu Operating System.
2. Virtualbox, Open Stack, Azure and Eucalyptus Cloud.
3. AWS Amazon and google app engine.

5. Books and Materials

Text Books:

1. Rajkumar Buyya, Christian Vecchiola and S. Thamarai Selvi., Mastering Cloud Computing, Foundations and Applications Programming, ELSEVIER,2016.

Reference Books:

1. Barrie Sosinsky. Cloud Computing Bible, 1st Edition, Wiley India, 2011.
2. Tim Malhar, S.Kumaraswammy, S.Latif.,Cloud Security and Privacy, 1st Edition, O'Reilly Media, Inc.,2009.

Course Structure

B6504 - Advanced Data Structures Laboratory

Hours Per Week		Hours Per Semester		Credits	Assessment Marks		
L	P	L	P	C	CIE	SEE	Total
0	4	0	56	2	40	60	100

1. Course Description

Course Overview

Advanced Data Structures Laboratory is a course for Post Graduate-level Engineering to improve the programming skills using C Language. This course covers implementing various forms of linked lists, linear and nonlinear data structures for efficient data storage and access. The course also enables to implement advanced search tress and text processing. After the completion of this course student will be able to implement efficient algorithm for a software.

Course Pre/co-requisites

The course has no specific prerequisite and co requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

B6504.1 Implement programs using linear data structures to process data.
B6504.2 Implement operations on non-linear data structures for handling large data.
B6504.3 Build traversal algorithms for efficient search on nonlinear data structures.
B6504.4 Develop algorithms for text processing applications.

3. Course Syllabus

1. (a) Write a C program that implements stack operations using arrays.
   (b) Write a C program that uses Stack operations to convert infix expression into postfix expression.
2. Write a C program that implement stack operations using Linked List.
3. (a) Write C program that implement Queue operations using arrays.
   (b) Write C program that implement Queue operations using Linked lists.
4. (a) Write a C program that uses functions to create a Singly Linked List.
   (b) Write a C program that uses functions to perform insertion and deletion operation on a Singly Linked List.
5. (a) Write a C program that uses functions to create Doubly Linked List.
   (b) Write a C program that uses functions to perform insertion and deletion operation on a Doubly Linked List.

6. (a) Write a C program that uses functions to create a Circular Linked List.
   (b) Write a C program that uses functions to perform insertion and deletion operation on a Circular Linked List.
7. Write a C program to perform the following operations:
   (a) Insert an element into a Binary Search Tree.
   (b) Delete an element from a Binary Search Tree.
   (c) Search for a key element in a Binary Search Tree.
8. Write a C program to perform the following operations on B-Trees:
   (a) Insertion b) Deletion
9. Write a C program to perform the following operations on AVL-trees:
   (a) Insertion b) Deletion
10. Write C program for the implementation of BFS and DFS for a given graph.
11. Write C program that uses non-recursive functions to traverse a Binary Tree in:
    (a) Preorder (b) Inorder (c) Postorder
12. Write a C program that implement Brute-Force Pattern Matching Algorithm.
13. Write a C program that implement Boyer- Moore Pattern Matching Algorithm.
14. Write a C program that implement Knuth-Morris-Pratt Pattern Matching Algorithm.

4. Laboratory Equipment/Software/Tools Required

1. A computer System with Ubuntu Operating System.
2. C/C++ Compiler.
3. A text editor gedit (Ubuntu) or IDE for C/C++.

5. Books and Materials

Text Books:

1. Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran., Fundamentals of Computer Algorithms, 2nd Edition, University Press(India) Private Limited, India. 2008.
2. G.A.V.Pai., Data Structures and Algorithms,Tata Mcgrawhill, New Delhi, 2009.

Reference Books:

1. D.Samanta., Classic Data Structures, Prentice Hall of India Private Limited, 2003.
2. Aho, Hopcraft, Ullman., Design and Analysis of Computer Algorithms, Pearson Education India, 1998.

Course Structure

B6001 - Research Methodology and IPR

Hours Per Week		Hours Per Semester		Credits	Assessment Marks		
L	P	L	P	C	CIE	SEE	Total
2	0	28	0	2	40	60	100

1. Course Description

Course Overview

Research is an art of scientific investigation. Research is an original contribution to the existing stock of knowledge making for its advancement. It is the pursuit of truth with the help of study, observation, comparison and experiment. This course will help students to understand about the research process, tools, importance of ethics. Students can learn about the law of patent and copyrights and knowledge on IPR (Intellectual Property rights)

Course Pre/co-requisites

This course has no specific prerequisite and co-requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

B6001.1. Identify an appropriate research problem in their suitable domain.
B6001.2. Construct a well-structured research paper and scientific presentations.
B6001.3. Express the importance of research ethics in scientific community.
B6001.4. Explore on various component of IPR and process of filing.
B6001.5. Gain knowledge on patents and copyrights.

3. Course Syllabus

Research Problem: Scope and objectives, Selection criteria, Research Problems, Research Approaches, Data collection, Data analysis, Ethics, Instrumentation, Interpretation.

Literature Studies: Effective literature studies, Types of literature review, Process and Purpose, Survey, Critical analysis, classification and comparison, case study, identifying the knowledge gap and propose a action plan.

Technical Writing: Effective Report/Article/Thesis writing, tools required, documentation using suitable application (Word, LaTeX, Pages), data representation using graphs, bar diagrams, pi-charts, preparation of manuscript, plagiarism, presentation of research work, Abstract and Conclusion.

Research proposal: Problem defining, national and international Scenario of proposed research, key factors, cost and contingencies, preparing timeline for research plan, funding agencies, collaboration, product and patent development.

Patent Rights and IPR: Process of Patenting and Development, Copyright, Trademark, Licensing and transfer of technology, Patent information and databases, New Developments in IPR, Administration of Patent System, Trade Secret, Copyright Infringement.

4. Books and Materials

Text Books:

1. C.R. Kothari, Gaurav Garg, Research Methodology : Methods And Techniques, New Age International Publishers; 4th edition, 2019
2. P Suganda Devi, Research Methodology: A Handbook for Beginners, Notion Press; 1st edition, 2017
3. Brad Sherman and Lionel Bently, Intellectual Property Law, Oxford University Press, 4th edition, 2014

I YEAR II SEMESTER

Course Structure

B6505 - Machine Learning

Hours Per Week		Hours Per Semester		Credits	Assessment Marks		
L	P	L	P	C	CIE	SEE	Total
3	0	42	0	3	40	60	100

1. Course Description

Course Overview

This course will provide build machine learning models as well as demonstrate how these models can solve complex problems in a variety of industries, from medical diagnostics to image recognition to text prediction. Machine learning brings together computer science and statistics to harness that predictive power. This post graduate-level course will give insights on how to apply machine learning to solve a new problem. Students will learn the algorithms which underpin many popular Machine Learning techniques, as well as developing an understanding of the theoretical relationships between these algorithms.

Course Pre/co-requisites

B6554 - Data Warehousing and Data Mining

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

B6505.1 Identify the fundamental issues, challenges and evaluating machine learning models.
B6505.2 Examine various hypothesis using machine Learning approaches.
B6505.3 Build machine learning solutions to solve forecasting and predictive problems.
B6505.4 Design various machine learning algorithms in a range of real-world applications.
B6505.5 Identify the context of neural networks in real time applications.

3. Course Syllabus

Introduction to Machine Learning: Types of Machine Learning, Problems not to be solved using Machine Learning, Applications of Machine Learning, and Tools in Machine Learning, Issues in Machine Learning, Machine learning Activities, Basic Types of Data in Machine Learning, Exploring Structure of data, Data Quality & Remediation, Data Pre-Processing. Modelling and Evaluation: Introduction. Selecting a Model, Training a Model, Model Representation and Interpretability, Evaluating Performance of a Model, Improving performance of a Model, Feature subset selection, Dimensionality Reduction - PCA, SVD, FA, LDA.

Concept Learning: Well- posed learning problems, issues in machine learning Concept learning and the general to specific ordering – Introduction, A concept learning task, Concept learning as search, Find-S: finding a maximally specific hypothesis, Version spaces and the candidate elimination algorithm, Remarks on version spaces and candidate elimination, Inductive bias.

Decision Tree Learning: Introduction, Decision tree representation, Appropriate problems for decision tree learning, The basic decision tree learning algorithm, Hypothesis space search in decision tree learning, Inductive bias in decision tree learning, Issues in decision tree learning.SVM. Introduction of Regression: Example of Regression, linear Regression, Multiple linear Regression, polynomial Regression.

Bayesian Learning and Instance Based Learning: Introduction, Bayes theorem, Maximum likelihood and least squared error hypotheses, Maximum likelihood hypotheses for predicting probabilities, Bayes optimal classifier, Gibs algorithm, Naïve Bayes classifier, an example learning to classify text, Bayesian belief networks, EM algorithm. Instance Based Learning-Introduction, k -Nearest Neighbour Learning, Locally Weighted Regression, Case-Based Reasoning, Remarks on Lazy and Eager Learning.

Artificial Neural Networks: Introduction, Neural network representation, Appropriate problems for neural network learning, Perceptions, Multilayer networks and the back propagation algorithm, Remarks on the back propagation algorithm, An illustrative example face recognition Advanced topics in artificial neural networks.

4. Books and Materials

Text Books:

1. Amit Kumar, Das Saikat Dutt, Subramanian Chandramouli., Machine Learning, Pearson India Education Services, 2019.
2. Tom M. Mitchell., Machine Learning, McGraw Hill Education, 2013.

Reference Books:

1. Pang-Ning Tan, Michael Steinbach, Anuj Karpatne, Vipin Kumar., Introduction to Data Mining, 2nd Edition, Pearson Publication, 2016.
2. Chris Bishop. Pattern Recognition and Machine Learning, Springer, 2006.

Course Structure

B6506 - Big Data Analytics

Hours Per Week		Hours Per Semester		Credits	Assessment Marks		
L	P	L	P	C	CIE	SEE	Total
3	0	42	0	3	40	60	100

1. Course Description

Course Overview

The key objective of this course is to familiarize the students with most important information technologies used in manipulating, storing, and analyzing big data with low latency. Big data analytics is the use of advanced analytic techniques against very large, diverse data sets that include structured, semi-structured and unstructured data, from different sources, and sizes. Through this course the students comprehend and appreciate how Hadoop open-source software frame work stores and processes big data in a distributed fashion on large clusters of commodity hardware. The course gives insights of the modern big data tools like Cassandra, MongoDB, Pig and Hive that allows users to make better and faster decisions.

Course Pre/co-requisites

B6501 – Cloud Computing and Virtualization

B6503 - Cloud Computing and Virtualization Laboratory

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

B6506.1 Identify the fundamental concepts of big data analytics.

B6506.2 Illustrate Hadoop environment and apply HDFS commands on file management tasks.

B6506.3 Utilize optimization techniques of MapReduce Programming to process massive amounts of data in parallel.

B6506.4 Make use of NoSQL databases like MangoDB and Cassandra to stock log data to be pulled for analysis.

B6506.5 Identify appropriate modern tools like Pig and Hive for complex data flow and analysis.

3. Course Syllabus

Introduction to Big Data: Classification of Digital Data, Characteristics of Data, Definition of Big Data, Challenges with Big Data, Definitional Traits of Big Data, Traditional Business Intelligence (BI) versus Big Data, Coexistence of Big Data and Data Warehouse, Realms of Big Data, Big Data Analytics, Classification of Analytics, Challenges of Big Data, Terminologies Used in Big Data Environments, Few Top Analytics Tools.

The Big Data Technology Landscape: NoSQL (Not Only SQL), Types of NoSQL Databases, SQL versus NoSQL, Introduction to Hadoop, RDBMS versus Hadoop, Distributed Computing Challenges, Hadoop Overview, Hadoop Distributors, HDFS (Hadoop Distributed File System), Working with HDFS commands, Interacting with Hadoop Ecosystem.

Mapreduce Programming: Processing Data with Hadoop, Mapper, Reducer, Combiner, Partitioner, Searching, Sorting, Compression, Managing Resources and Applications with Hadoop YARN.

Cassandra: Features of Cassandra, CQL Data Types, Keyspaces, CRUD Operations, Collection Types, Table Operations. MONGODB: Features of MongoDB, RDBMS vs MongoDB, Data Types in MongoDB, MongoDB Query Language, CRUD operations, Count, Limit, Sort, and Skip.

PIG: The Anatomy of Pig, Pig Philosophy, Pig Latin Overview, Data Types in Pig, Running Pig, Execution Modes of Pig, Relational Operators, Eval Functions, Word Count using Pig. HIVE: Introduction to Hive, Hive Architecture, Hive Data Types, Hive File Format, Hive Query Language (HQL): DDL, DML, Partitions, Pig versus Hive.

4. Books and Materials

Text Books:

1. Seema Acharya, Subhashini Chellappan., Big Data and Analytics, 2nd Edition, Wiley India Private Limited, New Delhi, 2019.

Reference Books:

1. Tom White., Hadoop - The Definitive Guide, 4th Edition, O'Reilly Publications, India, 2015.
2. Judith Hurwitz, Alan Nugent, Dr. Fern Halper, Marcia Kaufman., Big Data for Dummies, John Wiley & Sons, Inc., 2013.

Course Structure

B6507 - Machine Learning Laboratory

Hours Per Week		Hours Per Semester		Credits	Assessment Marks		
L	P	L	P	C	CIE	SEE	Total
0	4	0	56	2	40	60	100

1. Course Description

Course Overview

This course will provide you a foundational understanding of machine learning models as well as demonstrate how these models can solve complex problems in a variety of industries, from medical diagnostics to image recognition to text prediction. Machine learning brings together computer science and statistics to harness that predictive power. This post graduate-level course will give insights on how to apply machine learning to solve a new problem. Students will implement the machine algorithms using Python.

Course Pre/co-requisites

B6554 - Data Warehousing and Data Mining

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

B6507.1 Identify the packages and the procedures for the machine learning algorithms.
B6507.2 Implement Python programs for various machine learning algorithms
B6507.3 Use appropriate data sets to the Machine Learning algorithms.
B6507.4 Examine performance of Machine Learning algorithms to solve real world problems.

3. Course Syllabus

1. Demonstrate the Data Pre-Processing techniques by taking real datasets.
2. Demonstrate Feature subset selection and implement dimensionality reduction (PCA) technique.
3. Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis.
4. Implement and demonstrate the Candidate Elimination algorithm for finding the most specific hypotheses.
5. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.

6. Write a program to implement the SVM classifier for a sample training data set stored as a .CSV file.
7. Implement multiple linear Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.
8. Write a program to implement the naïve Bayesian classifier for a sample training data set.
9. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set.
10. Write a program to implement EM algorithm.
11. Write a program to implement the K-NN classifier for a sample training data set
12. Write a program to implement Locally Weighted Regression.
13. Build an Artificial Neural Network by implementing feed-forward neural network algorithm.
14. Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.

4. Laboratory Equipment/Software/Tools Required

1. A computer System with Ubuntu Operating System.
2. Pycharm or Jupyter Note Book.
3. Python version 3.x.x or above

5. Books and Materials

Text Books:

1. Introduction to Machine Learning with Python, Andreas C Muller & sarah Guido, O'Reilly Media, Inc. , October 2016.
2. Machine Learning Algorithms from Scratch with Python, Jason Brownlee.

Reference Books:

1. Chris Bishop, Neural Networks for Pattern Recognition, Oxford University Press, 1999.

Course Structure

B6508 - Big Data Analytics Laboratory

Hours Per Week		Hours Per Semester		Credits	Assessment Marks		
L	P	L	P	C	CIE	SEE	Total
0	4	0	56	2	40	60	100

1. Course Description

Course Overview

The objective of this course is to use NoSQL database and Hadoop framework for manipulating, storing, and analyzing structured, semi-structured and unstructured data with low latency from different sources and sizesThe course gives insights of the modern big data tools like Cassandra, MongoDB, Pig and Hive that allows users to make better and faster decisions.

Course Pre/co-requisites

B6504 - Advanced Data Structures

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

B6508.1 Implement HDFS commands in Hadoop environment.
B6508.2 Build applications to search and sort data using MapReduce programming.
B6508.3 Perform CRUD operations on NoSQL databases using Cassandra and MongoDB.
B6508.4 Use PIG and HIVE commands for data flow and analysis.

3. Course Syllabus

1. Hadoop Environment setup
   - Write the steps to download, install and configure the Hadoop framework on Ubuntu/ Linux and Windows operating systems.
2. Hadoop HDFS Commands
   - Implement the following file management tasks in Hadoop framework using Cloudera:
   - Adding files and directories
   - Retrieving files
   - Deleting files
3. MapReduce Programming
   - Develop a WordCount Java program and implement in Hadoop MapReduce framework using Cloudera.
4. MapReduce Programming
   - Develop a MapReduce program to search for a specific keyword in a file.
   - Develop a MapReduce program to sort data by student name (value).

5. Cassandra
   - Implement keyspace operations to group column families together for the given application data.
   - Implement CRUD operations on the given dataset using Cassandra.
6. Cassandra
   - Design a table/column family and perform various collection types Set, List and Map using Cassandra.
   - Design a table/column family and perform Alter table commands using Cassandra.
7. MongoDB
   - Implement a program with basic commands on databases and collections using MongoDB.
   - Implement CRUD operations on the given dataset using MongoDB.
8. MongoDB
   - Perform Count, Limit, Sort, and Skip operations on the given collections using MongoDB
9. Pig Latin commands
   - Implement Relational operators –Loading and Storing, and Diagnostic operators - Dump, Describe, Illustrate & Explain on the given database in Hadoop Pig framework using Cloudera.
   - Develop a Pig Latin program to implement Filtering, Sorting operations on the given database.
10. Pig Latin commands
    - Implement Grouping, Joining, Combining and Splitting operations on the given database using Pig Latin statements.
    - Perform Eval Functions on the given dataset.
    - Develop a WordCount program using Pig Latin statements.
11. Hive commands
    - Implement Data Definition Language (DDL) Commands for databases in Hadoop Hive framework using Cloudera.
    - Implement Data Definition Language (DDL) Commands for tables in Hive.
12. Hive commands
    - Implement Data Manipulation Language (DML) Commands for tables in Hive.
    - Perform data partitioning to split the given larger dataset into more meaningful chunks.

4. Laboratory Equipment/Software/Tools Required

1. A Computer System with Ubuntu Operating System.
2. Open-source Analytical Tools: Hadoop, Cassandra, MongoDB, Pig, Hive.
3. Open-source IDE: Cloudera.

4. Web browser: Internet Explorer/ Google Chrome/ Mozilla Firefox.

5. Books and Materials

Text Books:

1. Seema Acharya, Subhashini Chellappan. Big Data and Analytics, 2nd Edition, Wiley IndiaPrivate Limited, New Delhi, 2019.

Reference Books:

1. Tom White. Hadoop - The Definitive Guide, 4th Edition, O'Reilly Publications, India, 2015.
2. Judith Hurwitz, Alan Nugent, Dr. Fern Halper, Marcia Kaufman. Big Data for Dummies, John Wiley & Sons, Inc., 2013.

Professional Electives

Course Structure

B6551 - Digital Image Processing

Hours Per Week		Hours Per Semester		Credits	Assessment Marks		
L	P	L	P	C	CIE	SEE	Total
3	0	42	0	3	40	60	100

1. Course Description

Course Overview

This course provides the awareness of image processing techniques to represent and understand the image. It covers all the fundamental steps involved to process the image. Students will learn about the image processing techniques consists of image representation, sampling, quantization, filtering, sharpening, restoration, and degradation models to analyze the image for various applications to solve the complex problems.

Course Pre/co-requisites

The course has no specific prerequisite and co requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

B6551.1 Identify the fundamentals of image processing and real – time applications of DIP.
B6551.2 Implement the image processing techniques with spatial and frequency domain.
B6551.3 Exploit image restoration mechanisms with various filters.
B6551.4 Make use various pre-processing techniques to obtain the features in image.
B6551.5 Examine the best features using edge detection and segmentation.

3. Course Syllabus

Fundamentals of Digital Image: Origins of Digital Image Processing, Applications of digital image processing, Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Elements of Visual Perception, Image Sensing and Acquisition, Image Sampling and Quantization, Some Basic Relationships between Pixels, Linear and Nonlinear Operations.

Spatial and Frequency Domain: Basic Intensity Transformation Functions, Histogram Processing, Histogram Equalization, Fundamentals of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters Frequency Domain: Preliminary Concepts, The Discrete Fourier Transform (DFT) of Two Variables, Properties of the 2-D DFT, Filtering, Image Smoothing and Image Sharpening Using Frequency Domain Filters, High boost filtering, and

Selective Filtering.

Restoration: Noise models, Restoration using Spatial Filtering and Frequency Domain Filtering, Linear, Position-Invariant Degradations, Estimating the Degradation Function, Inverse Filtering, Minimum Mean Square Error (Wiener) Filtering, and Constrained Least Squares Filtering.

Color Image Processing Morphological Image Processing: Color Fundamentals, Color Models, and Pseudo - color Image Processing, wavelets- Gabor, DWT. Morphological Image Processing: Neighbourhood concepts, adjacency and distance measures, dilation & erosion, opening & closing operations, basic morphological operations - region filling, thinning, thickening, skeletons, pruning for binary images.

Segmentation: Introduction, classification of image segmentation algorithms, Detection of Discontinuities, Edge Detection, Hough Transforms and Shape Detection, Corner Detection, and Principles of Thresholding. Image representation: chain codes, boundary descriptors & regional descriptors.

4. Books and Materials

Text Books:

1. Rafael C. Gonzalez and Richard E. Woods, Digital Image Processing, 3rd Edition, Prentice Hall, 2008.
2. Pratt W.K., Digital Image Processing, John Wiley, 2001.

Reference Books:

1. Jain A.K., Fundamentals of Digital Image Processing, PHI, 1997.
2. S. Sridhar, Digital Image Processing, 2nd Edition, Oxford University Press, 2016.

Course Structure

B6552 - Number Theory and Cryptography

Hours Per Week		Hours Per Semester		Credits	Assessment Marks		
L	P	L	P	C	CIE	SEE	Total
3	0	42	0	3	40	60	100

1. Course Description

Course Overview

Cryptography is an essential tool for protecting information across computer systems. The course introduces the technical and policy foundations of information/ network security and also the mathematical background in implementing algorithms. This course explains the inner workings of cryptographic systems and how to correctly use them in real-world applications. The course enables to learn various message digest algorithms for integrity and also learn the protocols required for secure transmission. The authentication protocols are also covered as part of security. This course enables the student to choose "Network Security" domain for learning recent advancements.

Course Pre/co-requisites

The course has no specific prerequisite and co requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

B6552.1 Identify the mathematical theorems for implementing security algorithms.
B6552.2 Choose symmetric encryption algorithms on a plain text for information security.
B6552.3 Utilize various mathematical models for generating asymmetric keys to get rid of various attacks.
B6552.4 Perform the integrity check of the message using message digest algorithms.
B6552.5 Make use of transport layer protocols for secure transmission.

3. Course Syllabus

Number Theory: Prime and Relatively prime numbers, testing for primarily. Modular Arithmetic: Fermat's and Euler's theorems, Euclid's Algorithm, Extended Euclid's Algorithm, the Chinese remainder theorem, Discrete Logarithmic Problem. Random Number Generation Algorithms.

Conventional Encryption: Simplified DES, Block Cipher Principles, Data Encryption standard, Strength of DES, Differential and Linear Cryptanalysis, Block Cipher Design Principles and Modes of operations. Algorithms: Triple DES, International Data Encryption

algorithm, Blowfish, RC5, CAST-128, RC2, Characteristics of Advanced Symmetric block ciphers. Placement of Encryption function, Key distribution.

Public Key Cryptography: CPrinciples, RSA Algorithm, Key Management, Diffie-Hellman Key exchange, Elliptic Curve Cryptography. Message Authentication and Hash functions: Authentication requirements and functions, Message Authentication, Hash functions, Security of Hash functions and MACs.

Hash Functions and MAC Algorithms: MD5, Message Digest Algorithm, Secure Hash Algorithm, RIPEMD-160, HMAC. Digital Signatures and Authentication Protocols: Digital signatures, Authentication Protocols, Digital signature standards.

Transport-Level and Email Security: Web Security Considerations, Secure Sockets Layer, Transport Layer Security, Pretty Good Privacy (PGP), Kerberos, X.509 directory Authentication service.

4. Books and Materials

Text Books:

1. William Stallings. Cryptography and Network Security: principles and practice, 6th Edition, Pearson Publication, 2014.

Reference Books:

1. Forouzan, Behrouz A and Debdeep Mukhopadhyay. Cryptography and Network Security, McGraw-Hill Education, 2011.
2. Atul Kahate, Cryptography and Network Security, 2nd Edition,Tata Mc Grawhill, India, 2008.

Course Structure

B6553 - Blockchain Technology

Hours Per Week		Hours Per Semester		Credits	Assessment Marks		
L	P	L	P	C	CIE	SEE	Total
3	0	42	0	3	40	60	100

1. Course Description

Course Overview

This course presents an overview of the working principles of the Blockchain and the Cryptocurrencies. The objective of this class is to emphasize the fundamentals and importance of Blockchain Technology. Students will learn different techniques and procedures that enable them to perform a Blockchain Technology their needs. This course focuses mainly on the Decentralization Computing and how this decentralization will be achieved on Blockchain Technology. It covers the major phases of Blockchain Technology such as Mining, Proof of Work(POW), Proof of Stake(POS) , Distributed Ledger, Smart Contract and Types of Consensus . The objective of this class is to emphasize the importance of Blockchain Technology and to prepare students to create Blockchain for their projects with distributed ledger.

Course Pre/co-requisites

The course has no specific prerequisite and co requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

B6553.1 Identify the need and challanges of block chain technology for data security.
B6553.2 Choose a hash function to build a message digest on given privacy data.
B6553.3 Select a decentralization approach for blockchain computing.
B6553.4 Make use of mining algorithms to find the consensus.
B6553.5 Utilize Bitcoin Concepts for creating cryptocurrency.

3. Course Syllabus

Blockchain Fundamentals: Introduction to Blockchain technology and its applications, Generic elements of Blockchain, How Blockchain works, How Blockchain accumulates, Pro's and Con's of the Blockchain , Tiers of Blockchain, Features of Blockchain, Types of Blockchain.

Hash Functions: Hash functions and its purpose, Message Digest's : MD series, SHA series , Hash based Message Authentication Codes(MAC), Merkle trees, Patrica trees, Distributed Hash tables, Digital signatures, RSA digital signature Algorithm , Signcryption, Zero-Knowledge Poorfs, Types of Consensus theorems, Consenus in Blockchain ,CAP theorem on Blockchain.

Decetralization and Dapps: Decentralization using Blockchain, methods of decentralizations, routes of decentralization, How to decentralize, Decentralize framework Example, Blockchain and full ecosystem decentralize: Storage, communications and Computing power and decentralization. Introduction to Decentralized Application's(DApp's), Requirements of DApp's, Operations of a DApp's, How DApp's work's, DApp Examples: KYC-chain, Open-Bazar, Lazooz Platforms or Decentralization .

Blockchain Structure and Mining: Structure of Blockchain, Blockchain header , Mining , tasks of Miners, Mining rewards, Proof of work(POW) ,Proof of Stake (POS) Mining Algorithm, The Hash rate, Mining Systems ,Mining pool's .

Introduction to Bitcoin and Transactions : A birds –eye view, private keys in bitcoin, public keys in bitcoin , Address in bitcoin , Base 58 check Encoding, Vanity address, Multisignature address ,Transaction and lifecycle, Transaction fee, Transaction pool's, Transaction Datastructure, Types of transactions, Coinbase Transaction, Contracts transaction verification, BItcoin network, Types of wallets.

4. Books and Materials

Text Books:

1. Imran Bashir ., Mastering Blockchain, 2nd Edition, , Packt Publishing Ltd,Mumbai,2017.
2. Narayanan A, Bonneau J, Felten E, Miller A, Goldfeder S., Bitcoin and cryptocurrency technologies: a comprehensive introduction, Princeton University Press, 2016.

Reference Books:

1. Arshdeep Bahga, Vijay Madisetti., Blockchain Applications: A Hands On Approach, VPT, 2017.
2. Andreas Antonopoulos, Satoshi Nakamoto., Mastering Bitcoin, 2nd Edition, O"Reilly , 2017.
3. A. Narayanan, J. Bonneau, E. Felten, A. Miller, S. Goldfeder., Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Princeton University Press, 2016.

Course Structure

B6554 - Data warehousing and Data Mining

Hours Per Week		Hours Per Semester		Credits	Assessment Marks		
L	P	L	P	C	CIE	SEE	Total
3	0	42	0	3	40	60	100

1. Course Description

Course Overview

This course provides the concepts and techniques in processing gathered data or information, which will be used in various applications. Students will become acquainted with both the strengths and limitations of various data mining techniques like Association, Classification, Cluster and Outlier analysis. Data mining tools predict future trends and behaviours, allowing businesses to make proactive, knowledge-driven decisions.

Course Pre/co-requisites

The course has no specific prerequisite and co requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

B6554.1 Make use of pre-processing techniques on any given raw data.
B6554.2 Build data warehouse schemas for enterprise applications.
B6554.3 Perform market basket analysis using association rule mining.
B6554.4 Utilize classification techniques for analysis and interpretation of data.
B6554.5 Identify appropriate clustering and outlier detection techniques to handle complex data.

3. Course Syllabus

Introduction to Data Mining: Data mining, Knowledge Discovery process, Data Mining Functionalities-Kinds of Patterns, Major Issues in Data Mining. Data Objects and Attribute Types, Basic Statistical Descriptions of Data, Data Visualization, Dissimilarity of Numeric Data-Distance measures, Data Pre-processing: Major Tasks in Data Pre-processing, Data Cleaning, Data Integration, Data Reduction, Data Transformation and Data Discretization.

Data Warehouse and OLAP: Data Warehouse basic concepts, Differences between Operational Database Systems and Data Warehouses, Multi-tiered Architecture, Data Warehouse Models, Schemas for Multidimensional Data Models, Typical OLAP Operations, Data Warehouse Design Process, OLAP Servers.

Association Analysis: Basic Concepts, Market Basket Analysis, Apriori Algorithm, FP-growth, From Association Analysis to Correlation Analysis, Pattern Mining in Multilevel Associations and Multidimensional Associations.

Classification: Basic Concepts, Decision Tree Induction, Bayes Classification Methods, Rule-Based Classification, Metrics for Evaluating Classifier Performance, Ensemble Methods, Multilayer Feed-Forward Neural Network, Support Vector Machines, k-Nearest-Neighbor Classifiers.

Cluster Analysis: Requirements for Cluster Analysis, Overview of Basic Clustering Methods, Partitioning Methods-k-Means, k-Medoids, Hierarchical Methods-AGENES, DIANA, BIRCH, Density-Based Method-DBSCAN, Outlier Analysis: Types of Outliers, Challenges of Outlier Detection, and Overview of Outlier Detection Methods.

4. Books and Materials

Text Books:

1. Jiawei Han, Micheline Kamber, Jian Pei., Data Mining: Concepts and Techniques, 3rd Edition, Morgan Kaufmann/Elsevier, 2012.

Reference Books:

1. Pang-Ning Tan, Michael Steinbach, Anuj Karpatne and Vipin Kumar., Introduction to Data Mining, 2nd Edition, Pearson Education India, 2021.
2. Margaret H Dunham., Data Mining Introductory and Advanced Topics, 2nd Edition, Pearson Education India, 2006.
3. Amitesh Sinha., Data Warehousing, Thomson Learning, India, 2007.

Course Structure

B6555 - IoT and Edge Computing

Hours Per Week		Hours Per Semester		Credits	Assessment Marks		
L	P	L	P	C	CIE	SEE	Total
3	0	42	0	3	40	60	100

1. Course Description

Course Overview

Internet of Things (IoT) is presently a trending technology. Government, academia, and industry are involved in different aspects of research, implementation, and business with IoT. It is used in agriculture, space, healthcare, manufacturing, construction, water, and mining, which are presently transitioning their legacy infrastructure to support IoT. Edge computing was developed due to the exponential growth of IoT devices, which connect to the internet for either receiving information from the cloud or delivering data back to the cloud. And many IoT devices generate enormous amounts of data during their operations. Edge-computing hardware and services help solve this problem by being a local source of processing and storage for many of these systems.

Course Pre/co-requisites

The course has no specific prerequisite and co requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

B6555.1 Idenity the IoT value chain structure, applications and technologies in real time.
B6555.2 Compare the various implementation features in cloud, fog and edge computing.
B6555.3 Design an IoT system and writes the necessary control software for a specific application.
B6555.4 Use Intelligent algorithms for IOT based Applications.
B6555.5 Examine the different security threats of fog and edge nodes.

3. Course Syllabus

Introduction to IOT: Introduction to IoT, Sensing, Actuation, Communication Protocols, Arduino Programming and Integration of Sensors Arduino Board – Industrial IoT – Challenges of IoT – Distributed IoT Data Storage.

IoT and Fog Computing: Cloud Computing – Introduction to Fog Computing – Characteristics – IoT Application Scenarios – Need for Fog Computing - Issues in Fog Computing -

Data Management in Fog Computing - Optimization Problems in Fog Computing – Middleware design – Scalability of Fog nodes.

IoT and Edge Computing: Introduction to Edge Computing Scenario's and Use cases - Edge computing purpose and definition, Edge computing use cases, Edge computing hardware architectures, IoT and edge architecture - Edge platforms, Edge vs Fog Computing, Types of Edge node (Thick vs Thin vs Micro Edge node) - Communication Models - Edge, Fog and M2M.

Raspberry Pi Applications: Raspberry Pi: Introduction to Raspberry Pi, About the Raspberry Pi Board: Hardware Layout and Pinouts, Operating Systems on Raspberry Pi, Configuring Raspberry Pi, Programming Raspberry Pi - Connecting Raspberry Pi via SSH - Remote access tools - Interfacing DHT Sensor with Pi - Pi as Webserver, Pi Camera, Image & Video Processing using Pi – Data Analytics using Raspberry Pi – Applications.

Security Issues in IoT and Fog/Edge nodes: Trust and privacy issues in IoT Network - Web Semantics and trust Management for Fog Computing - Machine Learning based security in Fog Computing - Cyber Physical Energy Systems over Fog Computing.

4. Books and Materials

Text Books:

1. Arshdeep Bahga and Vijay Madisetti., Internet of Things - A Hands-on Approach, Universities Press, 2015.
2. Simon Monk., Raspberry Pi Cookbook, Software and Hardware Problems and solutions, O'Reilly (SPD), 2016.

Reference Books:

1. Rajkumar Buyya, Satish Narayana Srirama., Fog and Edge Computing: Principles and Paradigms, Wiley Publishers, by 2019.
2. David Boswarthick, The Internet of Things: Key Applications and Protocols Wiley Publishers, 2012.
3. Daniel Kellmereit and Daniel Obodovski., The Silent Intelligence, The Internet of Things, DND Ventures LLC , 2013.
4. Alasdair Gilchrist., Industry 4.0: The Industrial Internet of Things, Apress publishers, 2015.

Course Structure

B6556 - Agile Project Management

Hours Per Week		Hours Per Semester		Credits	Assessment Marks		
L	P	L	P	C	CIE	SEE	Total
3	0	42	0	3	40	60	100

1. Course Description

Course Overview

This Agile project management has become an increasingly dominant and popular manner to develop new or improved products, services, or results in a variety fields such as software development, engineering, product development, and process improvement. In environments with uncertainty (for example, changing customer needs or unknown root cause), agile project management has been found to product higher customer satisfaction in less time compared to more traditional, plan-driven project management methodologies.

Course Pre/co-requisites

The course has no specific prerequisite and co requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

B6556.1 Use Agile project management approach including values and principles for a project.
B6556.2 Identify the essential roles in a Scrum team for effective development of project working models.
B6556.3 Make use of Self Organizing Teams to solve issues during the project.
B6556.4 Build a Product Backlog and perform Backlog Refinement in a given scenario.
B6556.5 Examine large projects by using scrum methods.

3. Course Syllabus

Agile Software Development: Basics and Fundamentals of Agile Process Methods, Values of Agile, Principles of Agile, stakeholders, Challenges. Lean Approach: Waste Management, Kaizen and Kanban, add process and products add value. Roles related to the lifecycle, differences between Agile and traditional plans, differences between Agile plans at different lifecycle phases.

Agile and Scrum Principles: Agile Manifesto, Twelve Practices of XP, Scrum Practices, Applying Scrum. Need of scrum, working of scrum, advanced Scrum Applications, Scrum and the Organization, scrum values.

Agile Product Management: Communication, Planning, Estimation Managing the Agile approach Monitoring progress, Targeting and motivating the team, managing business involvement, Escalating issue.

Agile Requirements: User Stories, Backlog Management. Agile Architecture: Feature Driven Development. Agile Risk Management: Risk and Quality Assurance, Agile Tools. Agile Testing: Agile Testing Techniques, Test-Driven Development, User Acceptance Test.

Scaling Agile for large projects: Scrum of Scrums, Team collaborations, Scrum; Estimate a Scrum Project, Track Scrum Projects, Communication in Scrum Projects, and Best Practices to Manage Scrum.

4. Books and Materials

Text Books:

1. Robert C. Martin., Agile Software Development, Principles, Patterns, and Practices, Alan Apt Series, 2011.
2. Mike Cohn., Succeeding with Agile: Software Development Using Scrum, Pearson Publications, 2010.

Reference Books:

1. David J. Anderson and Eli Schragenheim., Agile Management for Software Engineering: Applying the Theory of Constraints for Business Results, 4th Edition, Prentice Hall, 2003.
2. Hazza and Dubinsky., Agile Software Engineering Series: Undergraduate Topics in Computer Science, Springer, 2009.

Course Structure

B6557 - Design Patterns

Hours Per Week		Hours Per Semester		Credits	Assessment Marks		
L	P	L	P	C	CIE	SEE	Total
3	0	42	0	3	40	60	100

1. Course Description

Course Overview

This course introduces object-oriented analysis and design by incorporating design patterns to create interactive applications. You'll develop a foundation for more complicated software applications by surveying recognised design patterns. Finally, you'll use a list of code smells to identify bad software designs. The course provides various design patterns for solving real time problems.

Course Pre/co-requisites

The course has no specific prerequisite and co requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

B6557.1 Identify the need of design patterns for the given problem statement.
B6557.2 Implement the case studies through design patterns.
B6557.3 Select an appropriate design pattern for a real time problem.
B6557.4 Choose a behavioral pattern to increase flexibility in carrying out communication.

3. Course Syllabus

Introduction: What Is a Design Pattern? Design Patterns in Smalltalk MVC, Describing Design Patterns, The Catalog of Design Patterns, Organizing the Catalog, How Design Patterns Solve Design Problems, how to Select a Design Pattern, how to Use a Design Pattern.

Case Study: Designing a Document Editor: Design Problems, Document Structure, Formatting, Embellishing the User Interface, Supporting Multiple Look-and-Feel Standards, Supporting Multiple Window Systems, User Operations Spelling Checking and Hyphenation, Summary.

Creational Patterns: Abstract Factory, Builder, Factory Method, Prototype, Singleton, Discussion of Creational Patterns. Structural Patterns: Adapter, Bridge, Composite. Decorator, açade, Flyweight, Proxy.

Behavioral patterns – I: Chain of Responsibility, Command, Interpreter, Iterator, ediator, Memento, Observer.

Behavioral patterns –II: State, Strategy, Template Method, Visitor, Discussion of Behavioral Patterns. What to Expect from Design Patterns?

4. Books and Materials

Text Books:

1. Erich Gamma, Richard Helm, Rolph Johnson, John Vlissides., Design Patterns: Elements of Reusable Object-Oriented Software, 1st Edition, Pearson Education, Addison Wesley.

Reference Books:

1. Alan Shalloway, James R. Trott., Design Patterns Explained: A New Perspective on Object-Oriented Design (Software Patterns Series), Pearson Education,2001.
2. Frank Buschmann, Regine Meunier and Hans Rohnert., Pattern-Oriented Software Architecture, A System of Patterns: 1, Wiley,1996.

Course Structure

B6558 - Web and Database Security

Hours Per Week		Hours Per Semester		Credits	Assessment Marks		
L	P	L	P	C	CIE	SEE	Total
3	0	42	0	3	40	60	100

1. Course Description

Course Overview

Internet web sites are increasingly using web applications to access database systems for information retrieval, transactions and publication. These Internet web applications are commonly being used for e-commerce, e-banking, and e-government to purchase goods, make reservations, pay taxes, enroll in classes, retrieve academic transcripts, acquire account balances and pay bills, to name a few. In order to provide these Internet services many are connecting their security sensitive information stored in databases directly to the Internet. And, in many cases, the securities of these applications have been designed with the same securities as for trusted internal applications. By doing this organization are creating security risks of possibly exposing sensitive information, critical business applications being disabled or compromised. This course looks at the problems associated with using web applications that access databases for Internet services. It also discusses some options of securing web services that utilize databases, as well as the overall security layers needed.

Course Pre/co-requisites

The course has no specific prerequisite and co requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

B6558.1 Identify the applications and design challenges of web security.
B6558.2 Make use of various techniques in providing security to servers.
B6558.3 Utilize data access mechanisms for database security.
B6558.4 Identify common application vulnerabilities, prevention of misuse in database.
B6558.5 Select algorithmic techniques for privacy preserving data.

3. Course Syllabus

Web Security: The Web Security Problem, Risk Analysis and Best Practices, Cryptography and the Web: Cryptography and Web Security, Working Cryptographic Systems and Protocols, Legal Restrictions on Cryptography, Digital Identification.

Web Privacy: The Web's War on Your Privacy, Privacy-Protecting Techniques, Backups

and Antitheft, Web Server Security, Physical Security for Servers, Host Security for Servers, Securing Web Applications.

Database Security: Recent Advances in Access Control, Access Control Models for XML, Access Control Policy Languages in XML, Database Issues in Trust Management and Trust Negotiation, Authenticated Index Structures for Outsourced Databases, Towards Secure Data Outsourcing, Managing and Querying Encrypted Data, Security in Data Warehouses and OLAP Systems.

Security Re-Engineering for Databases: Concepts and Techniques, Database Watermarking for Copyright Protection, Database Watermarking: A Systematic View, Trustworthy Records Retention, Damage Quarantine and Recovery in Data Processing Systems, Hippocratic Databases: Current Capabilities.

Privacy Preserving Data Mining: A survey, Privacy in Database Publishing: Bayesian Perspective, Privacy-enhanced Location-based Access Control, Privacy Preserving Publication: Anonymization Frameworks and Principles, Privacy Protection through Anonymity in Location-based Services, Efficiently Enforcing the Security and Privacy Policies in a Mobile Environment.

4. Books and Materials

Text Books:

1. Simson G. Arfinkel, Gene Spafford., Web Security, Privacy and Commerce, 2rd Edition, O' Reilly Publications,2014.
2. Michael Gertz, SushilJajodia., Handbook on Database security applications and trends, Springer, 2010.

Reference Books:

1. Jonathan LeBlanc, Tim Messerschmidt., Identity and Data Security for Web Development: Best Practices,1st Edition, O' Reilly, 2016.
2. Bryan Sullivan and Vincent Liu., Web Application Security, A Beginner's Guide, McGrawHill, 2012.
3. Mark O'Neill., Web Services Security (Application Development), McGrawHill, 2003.

Course Structure

B6559 - Wireless and Mobile Computing

Hours Per Week		Hours Per Semester		Credits	Assessment Marks		
L	P	L	P	C	CIE	SEE	Total
3	0	42	0	3	40	60	100

1. Course Description

Course Overview

This course provides an overview about the wireless IEEE 802 standards for wireless communication and summarizes the state of the art for Wireless LANs, Wireless PANs, and Cellular LTE, sensor networks including new topics such as Wi-Fi mesh networks, cognitive radio, Internet-of-Things, audio communications and visible light communication. These include mobility and service management, data management, routing in mobile ad hoc and sensor networks, and security issues for mobile systems. While mobile computing covers many topics, in this course our main focus will be on mobility, data and service management, and security issues in mobile computing environments.

Course Pre/co-requisites

The course has no specific prerequisite and co requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

B6559.1 Identify the concepts of Telecommunication networks for mobile computing.
B6559.2 Interpret various functionalities of mobile IP and transport layer suitable in mobile environment.
B6559.3 Identify Wireless application Protocols to develop mobile content application for the social and ethical issues including privacy.
B6559.4 Examine various protocols for mobile and adhoc wireless communication networks.
B6559.5 Choose dissemination technique for transmitting or distributing data to end users.

3. Course Syllabus

Mobile Computing: GEO, LEO, MEO, Applications, Routing, Localization, Handover. Wireless Lan: Infrared vs. radio transmission, infrastructure and ad hoc networks, IEEE 802.11, HIPER LAN: Protocol architecture. Introduction, history, architecture, devices and applications, limitations, Medium Access Control: Motivation for a specialized MAC (Hidden and exposed terminals, near and far terminals). Global System for Mobile Communications (GSM): Mobile services, system architecture, radio interface, protocols, localization and calling, handover, security, and new data services.

Mobile Network Layer: Mobile IP (goals, assumptions, entities and terminology, IP packet delivery, agent advertisement and discovery, Registration, tunneling and encapsulation, optimizations), dynamic host configuration protocol (DHCP). Mobile Adhoc Networks (MANETS): Overview, properties of a MANET, applications, routing algorithms, security in MANETs.

Mobile Transport Layer: Traditional TCP, indirect TCP, snooping TCP, mobile TCP, fast retransmit/ fast recovery, transmission /time-out freezing, selective retransmission, and transaction oriented TCP.

Wireless Application Protocol: WAP. (Introduction, protocol architecture, and treatment of protocols of all layers), Bluetooth (user scenarios, physical layer, MAC layer, networking, security, link management) ,COGNITIVE RADIO and J2ME.

Data Dissemination: Push based mechanisms, pull based mechanisms, hybrid mechanisms, selective tuning (indexing) techniques. Database Issues: Hoarding techniques, caching invalidation mechanisms, quality of service issues.

4. Books and Materials

Text Books:

1. Jochen Schiller ., Mobile Communications, 2nd Edition, Low price edition, Pearson Education, New Delhi, 2004.
2. Rajkamal., Mobile Computing, 2nd Edition, Oxford University Press, USA, 2007.

Reference Books:

1. Stojmenovic, Cacute., Handbook of Wireless Networks and Mobile Computing, John Wiley, New York, 2002.
2. Hansmann, Merk, Nicklous, Stober., Principles of Mobile Computing,2nd Edition,Springer, 2003.

Course Structure

B6560 - Robotic Process Automation Design and Development

Hours Per Week		Hours Per Semester		Credits	Assessment Marks		
L	P	L	P	C	CIE	SEE	Total
3	0	42	0	3	40	60	100

1. Course Description

Course Overview

RPA is an advanced form of business process automation that can provide a path for businesses to automate human actions. RPA is ultimately about automating some of the most mundane and repetitive computer-based tasks and processes in the workplace like text, image automation with sequence of actions, keyboard based automation, and E-mail automation etc. Process automation is able to record tasks performed by a human on their computer, then perform those same tasks without human intervention.

Course Pre/co-requisites

The course has no specific prerequisite and co requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

B6560.1 Identify the programming languages and platforms for RPA.
B6560.2 Explore the concept of RPA, its design issues, risk & challenges in real time.
B6560.3 Make use of RPA tool to apply in various business applications.
B6560.4 Utilize advanced automation concepts to enhance the UI interaction in different application softwares.
B6560.5 Use automation in real time applications like email and exception handling.

3. Course Syllabus

Programming Basics & Recap: Programming Basic Concepts, Understanding the application, Basic Web Concepts, Protocols, Email Clients, Data Structures, Data Tables, Algorithms, Software Processes, Software Design, Scripting, .Net Framework, .Net Fundamentals, XML, Control structures and functions, XML, HTML, CSS, Variables & Arguments.

RPA Concepts: RPA Basics, History of Automation, What is RPA, RPA vs Automation, Processes & Flowcharts, Programming Constructs in RPA, What Processes can be Automated, Types of Bots, Workloads which can be automated, RPA Advanced Concepts, Standardization of processes, RPA Development methodologies, Difference from SDLC, Robotic control flow architecture, RPA business case, RPA Team, Process Design Document/Solution Design Document, Industries best suited for RPA, Risks & Challenges with RPA, RPA and

emerging ecosystem.

RPA Tool Introduction & Basics: Introduction to RPA Tool, The User Interface, Variables, Managing Variables, Naming Best Practices, The Variables Panel, Generic Value Variables, Text Variables, True or False Variables, Number Variables, Array Variables, Date and Time Variables, Data Table Variables, Managing Arguments, Naming Best Practices, The Arguments Panel, Using Arguments, About Imported Namespaces, Importing New Namespaces, Control Flow, Control Flow Introduction, If Else Statements, Loops, Advanced Control Flow, Sequences, Flowcharts, About Control Flow, Control Flow Activities, The Assign Activity, The Delay Activity, The Do While Activity, The If Activity, The Switch Activity, The While Activity, The For Each Activity, The Break Activity, Data Manipulation, Data Manipulation Introduction, Scalar variables, collections and Tables, Text Manipulation, Data Manipulation, Gathering and Assembling Data.

Advanced Automation Concepts and Techniques: Recording and Advanced UI Interaction, Recording Introduction, Basic and Desktop Recording, Web Recording, Input/output Methods, Screen Scraping, Data Scraping, Scraping advanced techniques, Selectors, Selectors, Defining and Assessing Selectors, Customization, Debugging, Dynamic Selectors, Partial Selectors, RPA Challenge, Image, Text & Advanced Citrix Automation, Introduction to Image & Text Automation, Image based automation, Keyboard based automation, Information Retrieval, Advanced Citrix Automation challenges, Best Practices, Using tab for Images, Starting Apps, Excel Data Tables & PDF, Data Tables in RPA, Excel and Data Table basics, Data Manipulation in excel, Extracting Data from PDF, Extracting a single piece of data, Anchors, Using anchors in PDF.

Email Automation & Exceptional Handling: Email Automation, Email Automation, Incoming Email automation, Sending Email automation, Debugging and Exception Handling, Debugging Tools, Strategies for solving issues, Catching errors.

4. Books and Materials

Text Books:

1. Alok Mani Tripathi., Learning Robotic Process Automation, Publisher: Packt Publishing Release, ISBN: 9781788470940, 2008.
2. Richard Murdoch., Robotic Process Automation: Guide to Building Software Robots, Automate Repetitive Tasks & Become an RPA Consultant, Asia-Pacific Holdings PVT LTD.

Reference Books:

1. Frank Casale, Rebecca Dilla, Heidi Jaynes, Lauren Livingston., Introduction to Robotic

Process Automation: A Primer, Institute of Robotic Process Automation.

2. Srikanth Merianda, Robotic Process Automation Tools, Process Automation and their benefits: Understanding RPA and Intelligent Automation.
3. https://www.uipath.com/rpa/robotic-process-automation.

Course Structure

B6561 - Digital Forensics

Hours Per Week		Hours Per Semester		Credits	Assessment Marks		
L	P	L	P	C	CIE	SEE	Total
3	0	42	0	3	40	60	100

1. Course Description

Course Overview

This course presents an overview of the principles and Practices of digital investigation. The objective of this class is to emphasize importance of digital forensics. Students will learn different techniques and procedures that enable them to perform a digital investigation. This course focuses mainly on the analysis of physical storage media and volume analysis. It covers the major phases of digital investigation such as preservation, analysis and acquisition of artifacts that reside in hard disks and random-access memory. The course enables to prepare students to conduct a digital investigation in an organized and systematic way. This course will provide theoretical knowledge, as well as current research on Digital Forensics. Upon completion of the course, students can apply open-source forensics tools to perform digital investigation and understand the underlying theory behind these tools.

Course Pre/co-requisites

The course has no specific prerequisite and co requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

B6561.1 Identify the services, steps, laws and technologies in computer forensics.
B6561.2 Select the data recovery and evidence collection process from storage.
B6561.3 Choose a method to prevent modification of data using duplication and preservation, Image verification.
B6561.4 Build a method to recover data when it is corrupted by discovering evidence and reconstructing past.
B6561.5 Make use of network forensics concepts for Monitoring and analysis of network traffic.

3. Course Syllabus

Computer Forensics Fundamentals: Introduction to Computer Forensics, Use of Computer Forensics in Law Enforcement, Computer Forensics Assistance to Human Resources/Employment Proceedings, Computer Forensics Services, Benefits of Professional Forensics Methodology, Steps taken by Computer Forensics Specialists, Who Can Use Computer Forensic Evidence? Types of Computer Forensics Technology: Types of Military Computer Forensic Technology, Types of Law Enforcement Computer Forensic Technology, Types

of Business Computer Forensics Technology.

Computer Forensics Evidence and Capture: Data Recovery: Data Recovery Defined, Data Backup and Recovery, the Role of Backup in Data Recovery, The Data-Recovery Solution, and Case Histories. Evidence Collection and Data Seizure: Why Collect Evidence? Collection Options, Obstacles, Types of Evidence, The Rules of Evidence, Volatile Evidence, General Procedure, Collecting and Archiving, Methods of Collection, Artifacts, Collection Steps, Controlling Contamination: The Chain of Custody.

Duplication and Preservation of Digital Evidence: Preserving the Digital Crime Scene, Computer Evidence Processing Steps, Legal Aspects of Collecting and Preserving Computer Forensic Evidence. Computer Image Verification and Authentication: Special Needs of Evidential Authentication, Practical Considerations, Practical Implementation.

Computer Forensics Analysis: Discovery of Electronic Evidence: Electronic Document Discovery: A Powerful New Litigation Tool. Identification of Data: Time Travel, Time Matters, Forensic Identification and Analysis of Technical Surveillance Devices. Reconstructing Past Events: How to Become a Digital Detective, Useable File Formats, Unusable File Formats, Converting Files.

Network Forensics: Scenario, A Technical Approach, Destruction of Email, Damaging Computer evidence, International Principles against Damaging of Computer Evidence, Tools Needed for Intrusion Response to the Destruction of Data, Incident Reporting and Contact Forms.

4. Books and Materials

Text Books:

1. John R. Vacca., Computer Forensics: Computer Crime Scene Investigation,2rd Edition, Charles River Media, INC, 2015.

Reference Books:

1. Nelson Phillips, Steuart Enfinger., Guide to Computer Forensics and Investigations, 4th Edition, Cengage Learning, 2009.
2. David Cowen., Computer Forensics, McGraw Hill, 2013.
3. Eoghan Casey., Digital Evidence and Computer Crime, 3rd Edition, Academic Press, 2011.

Course Structure

B6562- Service Oriented Architecture

Hours Per Week		Hours Per Semester		Credits	Assessment Marks		
L	P	L	P	C	CIE	SEE	Total
3	0	42	0	3	40	60	100

1. Course Description

Course Overview

Service-oriented architecture (SOA) is a software development model that allows services to communicate across different platforms and languages to form applications. This course presents a strong perspective on services as an essential and important part of enterprise systems. In this course we will explore Service Oriented Architecture characteristic, advantages and evolution. As the course proceeds, we will explore the basics of web services, protocols like SOAP and REST; it also focuses on web service language and framework (WSDL UDDI). In middle of the course mainly it focuses on how business can be developed by inculcating Principles of SOA, Services oriented Computing, SOA and WS- Extensions. At the end we will gain an insight into SOA platform.

Course Pre/co-requisites

The course has no specific prerequisite and co requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

B6562.1 Identify the need of SOA for web services.
B6562.2 Make use of SOAP and REST protocols in providing web services.
B6562.3 Design medium scale software project using SOA principles.
B6562.4 Use various SOA and WS Extensions for message exchange.
B6562.5 Select the appropriate framework components in the creation of web service solutions.

3. Course Syllabus

Introduction to SOA, Evolution of SOA: Concepts of Distributed Computing, XML, Fundamental of SOA, Common Characteristics of contemporary SOA; Common tangible benefits of SOA, evolution of SOA.

Web Services Fundamental and Standard Web Services: Definition, Architectures and Standards. Directory services, SOAP, REST WSDL, UDDI.

Principles of Service-Oriented Architecture: Service- orientation and object- orientation, SOA Standards Stack, SOA with Web Services, Key Principles of SOA.

SOA and WS-* Extension: Message Exchange Pattern, Coordination, Atomic Transactions, Business Activities, Orchestration, Choreography, WS-Addressing, WS- Reliable Messaging, WS-Policy, WS-Metadata Exchange, WS-Security.

Principles of Service-Oriented Computing, SOA Platform: RPC versus Document Orientation, Service Life Cycle, Service Creation, Service Design and Build, Service Deployment, Publish Web service using UDDI, Service Discovery, Service Selection, Service Composition, Service Execution and Monitoring, Service Termination, Service Composition. SOA Platform: SOA support in J2EE – Java API for XML- based web services (JAX-WS) - Java architecture for XML binding (JAXB).

4. Books and Materials

Text Books:

1. Thomas Erl., Service Oriented Architecture: Concepts, Technology, and Design, 1st Edition, Pearson education, 2006.
2. Munindar P. Singh and Michael N. Huhns., Service-Oriented Computing: Semantics, Processes, Agents, 1st Edition, John Wiley & Sons, Ltd, 2005.

Reference Books:

1. Mark D. Hansen., SOA Using Java™ Web Services Illustrated Edition, Prentice Hall, 2007.
2. Thomas Erl., SOA Design Pattern, 1st Edition, Prentice Hall, PTR, 2009.
3. Thomas Erl., Web service contract Design & Versioning for SOA, 1st Edition, Pearson Education India, 2008.

Course Structure

B6563 - Artificial Intelligence and Neural Networks

Hours Per Week		Hours Per Semester		Credits	Assessment Marks		
L	P	L	P	C	CIE	SEE	Total
3	0	42	0	3	40	60	100

1. Course Description

Course Overview

The course is to provide the concepts of AI and neural networks.It is to acquire the ability to design intelligent solutions to problems in a variety of domains and business applications in fields such as natural language Processing, text mining, robotics and reasoning. Neural networks provide a model of computation drastically different from traditional computers. Typically, neural networks are not explicitly programmed to perform a given task; rather, they learn to do the task from examples of desired input/output behaviour. The networks automatically generalize their processing knowledge into previously unseen situations and they perform well even when the input is noisy, incomplete or inaccurate. These properties are well-suited for modelling tasks in ill-structured domains such as face recognition, speech recognition and motor control.

Course Pre/co-requisites

B6554- Data Warehousing and Data Mining

B6505- Machine Learning

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

B6563.1 Identify AI techniques, searching techniques and knowledge representation approaches for a real time problem.

B6563.2 Examine the constraint satisfaction technique to solve the real world problems and semantic nets.

B6563.3 Make use of NLP, Expert Systems and Pattern Recognition using PROLOG.

B6563.4 Identify the network architecture and learning algorithms of various neural networks.

B6563.5 Compare single layer perceptron and multi layerperceptorns performance for a given problem.

3. Course Syllabus

Introduction to Artificial Intelligence: Problem and search, what is AI technique, criteria for success; problems, problem space and search, defining the problem as a state space search, production systems, problem characteristics, production system characteristics. Heuristic Search Techniques: Knowledge representation, knowledge representation is-

sues, using predicate logic, resolution principle. Representing knowledge using rules, forward vs backward reasoning, symbolic reasoning under uncertainty, non-monotonic reasoning, statistical reasoning.

Knowledge Representation: Semantic nets, Marvin minsky's frames, conceptual dependency theory, scripts. Understanding, what is understanding , what makes understanding hard, understanding as constraint satisfaction, waltz's algorithm.

Natural Language Processing: Overview of linguistics, grammars and languages, basic parsing techniques, transitional networks, semantic analysis and representation structures. Natural language generation, natural language systems, general concepts in knowledge acquisition. Types of learning, general learning model, performance measures, early work in machine learning, perceptrons, genetic algorithms, intelligent editors. Expert System Architecture: Characteristic features of expert systems, history, applications. Rule based system architecture, expert system shells. Pattern recognition, the recognition and classification process, learning classification patterns, recognizing and understanding speech. Perception and action, features of AI programming language PROLOG.

Introduction to Neural Networks: What is a neural network? human brain, models of neuron, neural networks viewed as directed graphs, feedback, network architectures, knowledge representation, artificial intelligence and neural networks. Learning Processes: Introduction, error-correction learning, learning with a teacher, learning without a teacher, learning tasks, statistical nature of the learning process, statistical learning theory, probably approximately correct model of learning.

Single Layer and Multi Layer Perceptrons: Introduction, adaptive filtering problem, unconstrained optimization techniques, linear least-squares filters, least mean square algorithm, learning curves, learning rate annealing techniques, perceptron, perceptron convergence theorem, relation between the perceptron and bayes classifier for a gaussian environment. Multilayer Perceptrons: Introduction, some preliminaries, back-propagation algorithm, summary of backpropagation algorithm, XOR problem.

4. Books and Materials

Text Books:

1. Elaine Rich, Kevin Knight., Artificial Intelligence, 2nd Edition, Tata McGraw Hill, New Delhi, 2002.
2. Simon Haykin., Neural Networks: a Comprehensive Foundation, Advanced Engineering Mathematics, 2nd Edition, Pearson Education, India, 1999.

Reference Books:

1. Patrick Henry Winston., Artificial Intelligence, 3[2rd] Edition, Pearson Education Private Limited, India, 2001.
2. Dan W. Patterson., Introduction to Artificial Intelligence and Expert Systems, Prentice Hall of India, 1999.
3. Satish Kumar., Neural Networks: A classroom approach, Tata McGraw Hill, New Delhi,2004.
4. B. Yegnanarayana., Artificial Neural Networks, Prentice Hall of India, 2001.

Course Structure

B6564 -Natural Language Processing

Hours Per Week		Hours Per Semester		Credits	Assessment Marks		
L	P	L	P	C	CIE	SEE	Total
3	0	42	0	3	40	60	100

1. Course Description

Course Overview

A major portion of communication now is through text and any organization has most of its content in the unstructured form. Natural Language Processing (NLP), an important part in Artificial Intelligence, is one of the technology that would help in activities such as classification, retrieving and extraction of information, identifying important documents, etc. Students will gather Knowledge in the fundamentals of NLP, methods and techniques and gain skills to use them in practical situations. This course also deals with grammar, semantics and pragmatics. The course enables the student to know in detail the various applications of NLP in real time.

Course Pre/co-requisites

B6505 - Machine Learning.

B6554 - Data Warehousing and Data Mining.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

B6564.1 Identify the NLP pre-processing techniques and models for analysing text.
B6564.2 Inspect Speech recognition process for converting speech into text.
B6564.3 Utilize the grammar rules while parsing text.
B6564.4 Examine the various semantics and pragmatics in processing text.
B6564.5 Compare use of different statistical approaches for various NLP applications.

3. Course Syllabus

Introduction: Words - Regular Expressions and Automata - Words and Transducers - N-grams - Part-of- Speech – Tagging - Hidden Markov and Maximum Entropy Models.

Speech: Speech, Phonetics, Speech Synthesis, Automatic Speech Recognition, Speech Recognition Advanced Topics, Computational Phonology.

Syntax: Formal Grammars of English - Syntactic Parsing - Statistical Parsing - Features and Unification - Language and Complexity.

Semantics and Pragmatics: The Representation of Meaning - Computational Semantics - Lexical Semantics - Computational Lexical Semantics - Computational Discourse.

Applications: Information Extraction, Question Answering and Summarization, Dialogue and Conversational Agents, Machine Translation.

4. Books and Materials

Text Books:

1. Daniel Jurafsky, "Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech", Pearson Publication, 2014.
2. 2. Steven Bird, Ewan Klein and Edward Loper, Natural Language Processing with Python, 1st Edition, O'Reilly Media, 2009.

Reference Books:

1. BreckBaldwin., Language Processing with Java and LingPipe Cookbook, Atlantic Publisher, 2015.
2. Richard MReese, Natural Language Processing with Java, O'Reilly Media, 2015.
3. Nitin Indurkhya and Fred J. Damerau., Handbook of Natural Language Processing,2nd Edition,Chapman and Hall/CRC Press,2010.

Course Structure

B6565 -Social Network Analysis

Hours Per Week		Hours Per Semester		Credits	Assessment Marks		
L	P	L	P	C	CIE	SEE	Total
3	0	42	0	3	40	60	100

1. Course Description

Course Overview

Social Networks are web based applications, where all the like minded people share a common platform to exchange their view, thoughts and information. In this course we will explore aggregating and knowledge representation methods of social media as the course proceeds, we will explore the extraction and mining communities in web social networks; it also focuses on predicting human behaviour and privacy issues. At end of the course mainly it focuses on visualization and applications of social networks.

Course Pre/co-requisites

B6505 – Machine Learning.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

B6565.1 Identify the concepts of Social Networks to analyse data.
B6565.2 Make use of different Modelling, Aggregating and Knowledge Representation methods of social networks.
B6565.3 Identify the various communities in web social networks.
B6565.4 Estimate the user behaviour by applying trust and privacy mechanisms.
B6565.5 Select appropriate visualization techniques to unveil the social networks applications.

3. Course Syllabus

Introduction Social Networks: Introduction to Semantic Web: Limitations of current Web - Development of Semantic Web - Emergence of the Social Web - Social Network analysis: Development of Social Network Analysis - Key concepts and measures in network analysis - Electronic sources for network analysis: Electronic discussion networks, Blogs and online communities - Web-based networks - Applications of Social Network Analysis.

Modeling, Aggregating and Knowledge Representation: : Ontology and their role in the Semantic Web: Ontology-based knowledge Representation - Ontology languages for the Semantic Web: Resource Description Framework - Web Ontology Language - Modelling and aggregating social network data: State-of-the-art in network data representation - Ontological representation of social individuals - Ontological representation of social relationships

- Aggregating and reasoning with social network data - Advanced representations.

Extraction and Mining Communities in Web Social Networks: Extracting evolution of Web Community from a Series of Web Archive - Detecting communities in social networks - Definition of community - Evaluating communities - Methods for community detection and mining - Applications of community mining algorithms - Tools for detecting communities social network infrastructures and communities - Decentralized online social networks - Multi-Relational characterization of dynamic social network communities.

Predicting Human Behaviour and Privacy Issues: Understanding and predicting human behaviour for social communities - User data management - Inference and Distribution - Enabling new human experiences - Reality mining - Context - Awareness - Privacy in online social networks - Trust in online environment - Trust models based on subjective logic - Trust network analysis - Trust transitivity analysis - Combining trust and reputation - Trust derivation based on trust comparisons - Attack spectrum and countermeasures.

Visualization and Applications of Social Network: Graph theory - Centrality - Clustering - Node-Edge Diagrams - Matrix representation - Visualizing online social networks, Visualizing social networks with matrix-based representations - Matrix and Node-Link Diagrams - Hybrid representations - Applications - Cover networks - Community welfare - Collaboration networks - Co-Citation networks.

4. Books and Materials

Text Books:

1. Peter Mika., Social Networks and the Semantic Web, 1st Edition, Springer, 2007.
2. BorkoFurht., Handbook of Social Network Technologies and Applications, 1st Edition, Springer, 2010.

Reference Books:

1. GuandongXu, Yanchun Zhang and Lin Li. Web Mining and Social Networking – Techniques and applications, 1st Edition, , Springer, 2011.
2. Dion Goh and Schubert Foo., Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively, IGI Global Snippet, 2008.
3. Max Chevalier, Christine Julien and Chantal Soulé-Dupuy., Collaborative and Social Information Retrieval and Access: Techniques for Improved user Modelling, IGI Global Snippet, 2009.

Audit Courses

Course Structure

B6091 – Disaster Management

Hours Per Week		Hours Per Semester		Credits	Assessment Marks		
L	P	L	P	C	CIE	SEE	Total
3	0	42	0	3	40	60	100

1. Course Description

Course Overview

The course has been framed with an intention to provide a general concept in the dimensions of disasters caused by nature beyond human control as well as the disasters and environmental hazards induced by human activities with emphasis on Natural disaster, Man-made disaster, vulnerability and risks of disasters, Disaster Management Mechanism, Capacity Building and disaster coping Strategies and Disaster management planning.

Course Pre/co-requisites

The course has no specific prerequisite and co requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

B6091.1 Identify concepts, hazards and vulnerabilities of different types of disasters.
B6091.2 Examine the components of disaster management mechanism.
B6091.3 Select suitable capacity building framework for disaster management.
B6091.4 Interpret various disaster coping strategies.
B6091.5 Develop Strategies for disaster management planning.

3. Course Syllabus

Introduction: Definition, Factors and Significance; Difference Between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude. **Disaster Prone Areas in India:** Study of Seismic Zones; Areas Prone to Floods and Droughts, Landslides and Avalanches; Areas Prone to Cyclonic and Coastal Hazards with Special Reference to Tsunami; Post-Disaster Diseases and Epidemics.

Repercussions of Disasters and Hazards: Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts and Famines, Landslides and Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks and Spills, Outbreaks of Disease and Epidemics, War and Conflicts.

Disaster Preparedness and Management: Preparedness: Monitoring of Phenomena Triggering A Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological and Other Agencies, Media Reports: Governmental and Community Preparedness.

Risk Assessment Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk Assessment. Strategies for Survival.

Disaster Mitigation: Meaning, Concept and Strategies of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation and Non-Structural Mitigation, Programs of Disaster Mitigation in India.

4. Books and Materials

Text Books:

1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'New Royal book Company.
2. Sahni, Pardeep Et. Al. (Eds.)," Disaster Mitigation Experiences and Reflections", Prentice Hall of India, New Delhi.
3. Goel S. L., Disaster Administration and Management Text and Case Studies", Deep &Deep Publication Pvt. Ltd., New Delhi

Course Structure

B6092 – Value Education

Hours Per Week		Hours Per Semester		Credits	Assessment Marks		
L	P	L	P	C	CIE	SEE	Total
3	0	42	0	3	40	60	100

1. Course Description

Course Overview

The present education system does not prepare students well for dealing with life. Primarily, it prepares them for profession or jobs. It concentrates on providing "How to do" rather than "What to do" or "Why to do?". This course will be helpful for students to develop critical ability, commitment and courage in real life problems. Students will learn about happiness, character development, self control, honesty, time management.

Course Pre/co-requisites

The course has no specific prerequisite and co requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

B6092.1 Identify the importance of value based living for character development.
B6092.2 Emerge as responsible citizens with clear conviction to practice values and ethics in life.
B6092.3 Interpret their role in nation building for a better tomorrow .
B6092.4 Develop a sense of commitment and decision making capability.

3. Course Syllabus

Values and Self - Development: Social values and individual attitudes. Work ethics, Indian vision of humanism. Moral and non-moral valuation. Standards and principles. Value judgments.

Importance of Cultivation of Values: Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truth fullness, Cleanliness. Honesty, Humanity. Power of faith, National Unity. Patriotism. Love for nature Discipline.

Personality and Behavior Development: Soul and Scientific attitude. Positive Thinking. Integrity and discipline. Punctuality, Love and Kindness.

Achieving Happiness: Avoid fault Thinking. Free from anger, Dignity of labour. Universal brotherhood and religious tolerance. True friendship. Happiness Vs suffering, love for

truth. Aware of self-destructive habits. Association and Cooperation. Doing best for saving nature.

Character and Competence: Holy Books vs Blind faith. Self-Management and Good health. Science of reincarnation. Equality, Nonviolence, Humility, Role of Women. All religions and same message. Mind your Mind, Self-control. Honesty, and Studying effectively.

4. Books and Materials

Text Books:

1. Chakroborty, S.K. "Values and Ethics for organizations Theory and practice", Oxford University Press, New Delhi.
2. David N. Aspin, Judith D. Chapman, "Values Education and Lifelong Learning: Principles, Policies, Programmes" Springer, 2007

Course Structure

B6093 – Constitution of India

Hours Per Week		Hours Per Semester		Credits	Assessment Marks		
L	P	L	P	C	CIE	SEE	Total
3	0	42	0	3	40	60	100

1. Course Description

Course Overview

This course enables the students to understand the constitution of India as the Supreme law of India. The student will also gain knowledge about the parliament of India and how it functions. This course will survey the basic structure and operative dimensions of the Indian constitution. It will explore various aspects of the Indian political and legal system from a historical perspective highlighting the various events that led to the making of the Indian constitution.

Course Pre/co-requisites

The course has no specific prerequisite and co requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

B6093.1 Identify the important components of Indian Constitution.
B6093.2 Explore the basics of Constitutional right in various domains .
B6093.3 Illustrate the evolution of Indian Constitution.
B6093.4 Analyze the Administrative process in India from grass-root level.
B6093.5 Relate the basic concepts of democracy, liberty, equality, secular and justice.

3. Course Syllabus

History of Making of the Indian Constitution: History Drafting Committee, (Composition & Working), **Philosophy of the Indian Constitution:** Preamble, Salient Features.

Contours of Constitutional Rights & Duties: Fundamental Rights Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.

Organs of Governance: Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualification, Powers and Functions.

Local Administration: District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. Pachayati raj: Introduction, PRI: Zila Pachayat. Elected officials and their roles, CEO Zila Pachayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy.

Election Commission: Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.

4. Books and Materials

Text Books:

1. The Constitution of India, 1950 (Bare Act), Government Publication
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015

Reference Books:

1. M. P. Jain, Indian Constitution Law, 7th Edition., Lexis Nexis, 2014
2. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015

Course Structure

B6094 - Stress Management by Yoga

Hours Per Week		Hours Per Semester		Credits	Assessment Marks		
L	P	L	P	C	CIE	SEE	Total
3	0	42	0	3	40	60	100

1. Course Description

Course Overview

Stress has been determined to be a key factor of illness and disease. Prolonged stress in any person can lead to negative thinking, depression and worse. The course is based on managing stress by practice of yogic principles that are proven to be highly effective and easy to learn. In this course the students will learn about different types of yoga practices, Meditation, Yoga asanas, Pranayama for stress, anger and fear management.

Course Pre/co-requisites

The course has no specific prerequisite and co requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

B6094.1 Make use of yoga for stress management in educational environments.
B6094.2 Improve emotional intelligence to better deal with stress.
B6094.3 Develop flexibility through participation in yoga.
B6094.4 Learn methods of performing asanas, pranayama, mudras and bandhas.
B6094.5 Practice meditation for holistic living.

3. Course Syllabus

Meaning and Definition of Stress: Eutress, Distress, Anticipatory Anxiety, Intense Anxiety and Depression. Necessity of Stress Management, Concept of Stress according to Yoga.

Introduction to Yoga: Definition and Meaning of Yoga, Historical Perceptive on yoga – yoga before the time of Patanjali (Indus valley civilization, Vedas, Brahmnas, Upanishads, Epics, Puranas).

Schools of Yoga: Eight Limbs of Yoga: Yama, Niyama, Asana, Pranayama, Pratyahara, Dharana, Dhyana & Samathi. General principles of practicing Asana, Pranay- ama, Meditation, Kriyas Bandhas and Mudra.

Essentials of yoga practices: Prayer, Disciplines in Yogic Practices, Place & Timing, Diet & Schedule for Yoga Practitioner. Obstacles in the Path of Yoga Practice, Sequence for yogic

practices, Different between yogic & non yogic system of exercise. Do's and donts during Yoga

Personality development by yoga: Yoga and development of Social qualities of personality, Co-operation, Simplicity, Tolerance, Social adjustments, Yoga and personal efficiency. Improvement of personal efficiency through yoga.

4. Books and Materials

Text Books:

1. Wasmer Linda Andrews, Stress Control For Peace of Mind, Barnes & Noble Publisher, 2005
2. H.R. Nagendra, and R. Nagarathana, Yoga practices for anxiety & depression. Bangalore: Swami Sukhabodhanandha Yoga Prakashana 2004.

Reference Books:

1. BKS Iyengar, The Art of Yoga. New Delhi: Harper Collins Publishers, 2003.

Course Structure

B6095 - Personality Development through Life Enlightenment Skills

Hours Per Week		Hours Per Semester		Credits	Assessment Marks		
L	P	L	P	C	CIE	SEE	Total
3	0	42	0	3	40	60	100

1. Course Description

Course Overview

The course aims to provide a basic awareness about the significance of Life Enlightenment skills in all-round development of personality. Personality development boosts confidence level in students and help them achieve high esteem. In this course the holistic development of personality in students will be done by practicing some basic Veres of Srimad Bhagavath Geetha by explaiing the true meaning of Wisdom, Pride, Virtue, Happiness, Pain.

Course Pre/co-requisites

The course has no specific prerequisite and co requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

B6095.1 Create Holistic development of personality.
B6095.2 Exercise the role model in the Bhagavath Geetha by practicing it.
B6095.3 Develop a sense of spirituality and heart fullness in mind and body.
B6095.4 Demonstrate knowledge of beliefs and values to continuing personal reflection and reassessment.

3. Course Syllabus

Neetisatakam - Holistic Development of Personality:

Verses- 19, 20, 21,22 (Wisdom)

Verses- 29, 31, 32 (Pride & Heroism)

Verses- 26, 28, 63, 65 (Virtue)

Do's and Dont's

Verses- 52, 53, 59 (Dont's)

Verses- 71, 73, 75, 78 (Do's)

Approach to Day to Day Work and Duties:

Chapter 2: Verses 41, 47,48

Chapter 3: Verses 13, 21, 27, 35

Chapter 6: Verses 5,13,17, 23, 35

Chapter 18: Verses 45, 46, 48.

Statements of basic knowledge :

Chapter 2: Verses 56, 62, 68

Chapter 12: Verses 13, 14, 15, 16,17, 18

Personality of Role Model

Chapter 2: Verses 17

Chapter 3: Verses 36,37,42

Chapter 4: Verses 18, 38,39

Chapter 18: Verses 37,38,63

4. Books and Materials

Text Books:

1. "Srimad Bhagavad Gita" by Swami Swarupananda Advaita Ashram (Publication Department), Kolkata.

Reference Books:

1. Bhartrihari's Three Satakam (Niti-sringar-vairagya) by P.Gopinath, Rashtriya Samskrit Sansthanam, New Delhi.

Course Structure

B6096 - Pedagogy Studies

Hours Per Week		Hours Per Semester		Credits	Assessment Marks		
L	P	L	P	C	CIE	SEE	Total
3	0	42	0	3	40	60	100

1. Course Description

Course Overview

Pedagogy is the relationship between learning techniques and culture. It requires meaningful classroom interactions between educators and learners. The objective of this course is to help students build on prior learning and develop skills and attitudes. Furthermore it can improve the quality of your teaching and the way students learn, helping them gain a deeper grasp of fundamental material.

Course Pre/co-requisites

The course has no specific prerequisite and co requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

B6096.1 Develop a positive attitude towards life and teaching profession
B6096.2 Critically analyze the classroom teaching, learning and behavior.
B6096.3 Compare the teaching and learning practices in educational institutes in the past decade.
B6096.4 Summarize the aspects of effective teaching process.

3. Course Syllabus

Introduction and Methodology: Aims and rationale, Policy background, Conceptual framework and terminology. Theories of learning, Curriculum, Teacher education, Conceptual framework, Research questions, Overview of methodology and Searching.

Thematic Overview: Pedagogical practices in formal and informal classrooms in developing countries, Curriculum development, Teacher education.

Evidence on the Effectiveness of Pedagogical Practices : Quality assessment of included studies, How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?. Theory of change. Strength and nature of the body of evidence for effective pedagogical practices. Pedagogic theory and pedagogical approaches. Teachers' attitudes and beliefs and Pedagogic strategies.

Professional Development: Alignment with classroom practices and followup support. Peer support, Support from the head teacher and the community. Curriculum and assessment. Barriers to learning: limited resources and large class sizes.

Research Gaps and Future Directions: Research design, Contexts, Pedagogy, Teacher education, Curriculum and assessment. Dissemination and research impact.

4. Books and Materials

Text Books:

1. Ackers J, Hardman F (2001) Classroom Interaction in Kenyan Primary Schools, Compare, 31 (2): 245-261.
2. Agrawal M (2004) Curricular Reform in Schools: The Importance of Evaluation, Journal of Curriculum Studies, 36 (3): 361-379.
3. Akyeampong K (2003) Teacher Training in Ghana - does it count? Multi-site Teacher Education Research Project (MUSTER) Country Report 1. London: DFID.

Reference Books:

1. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving Teaching and Learning of Basic Maths and Reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.
2. Alexander RJ (2001) Culture and Pedagogy: International Comparisons in Primary Education. Oxford and Boston: Blackwell.
3. Chavan M (2003) Read India: A mass scale, rapid, 'Learning to Read' campaign.

Open Electives

Course Structure

B6081 - Business Analytics

Hours Per Week		Hours Per Semester		Credits	Assessment Marks		
L	P	L	P	C	CIE	SEE	Total
3	0	42	0	3	40	60	100

1. Course Description

Course Overview

This course addresses the scope of business analytics, process and tools used to get competitive advantages of business analytics. It covers the forecasting techniques to predict the given data for various decision making. Apart from prediction it also establishes the relationship between the given data to formulate the strategies for business decisions.

Course Pre/co-requisites

This course has no specific prerequisite and co-requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

B6081.1	Demonstrate knowledge of data analytics.
B6081.2	Demonstrate the ability of think critically in making decisions based on data and deep analytics.
B6081.3	Demonstrate the ability to use technical skills in predicative and prescriptive modeling to support business decision-making,
B6081.4	Demonstrate the ability to translate data into clear, actionable insights.

3. Course Syllabus

Theory

Business analytics and Statistical Tools: Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organisation, competitive advantages of Business Analytics. Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modelling, sampling and estimation methods overview.

Trendiness and Regression Analysis: Modelling Relationships and Trends in Data, simple Linear Regression. Important Resources, Business Analytics Personnel, Data and models for Business analytics, problem solving, Visualizing and Exploring Data, Business Analytics Technology.

Organization Structures of Business analytics, Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, Measuring contribution of Business analytics, Managing Changes. Descriptive Analytics, predictive analytics, predicative Modelling, Predictive analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modelling, nonlinear Optimization.

Forecasting Techniques and Monte Carlo Simulation and Risk Analysis: Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series with Seasonality, Regression Forecasting with Casual Variables, Selecting Appropriate Forecasting Models. Monte Carle Simulation Using Analytic Solver Platform, New-Product Development Model, Newsvendor Model,Overbooking Model, Cash Budget Model.

Decision Analysis and recent trends: Formulating Decision Problems, Decision Strategies with the without Outcome Probabilities, Decision Trees, The Value of Information, Utility and Decision Making. Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data journalism.

4. Books and Materials

Text Books:

1. Varshney & Maheswari , Business analytics Principles, Concepts, and Applications, Marc J. Schniederjans, Dara G.Schniederjans, Christopher M. Starkey, 1st Ed., Pearson FT Press, 2014
2. Jamesh R Evans, Business Analytics, Global Edtion, Pearson Higher Education & Professional Group, 2020

Course Structure

B6082 - Waste to Energy

Hours Per Week		Hours Per Semester		Credits	Assessment Marks		
L	P	L	P	C	CIE	SEE	Total
3	0	42	0	3	40	60	100

1. Course Description

Course Overview

The course deals with the production of energy from different types of wastes through thermal, biological and chemical routes. This course provides insights into waste management options by reducing the waste destined for disposal and encouraging the use of waste as a resource for alternate energy production. This course is explores Biomass Pyrolysis, Biomass gasification, Biomass combustions and Bio energy systems.

Course Pre/co-requisites

The course has no specific prerequisite and co requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

B6082.1 Classify different waste material produces from all sources.
B6082.2 Analyze Bio energy systems resources, process and application.
B6082.3 Apply emerging methods for Bio mass Pyrolysis, gasification and combustion to improve the efficiency.
B6082.4 Analyze different case studies for understanding success and failure of waste to energy technologies.

3. Course Syllabus

Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors.

Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods - Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

Biomass Gasification: Gasifiers – Fixed bed system – Downdraft and updraft gasifiers - Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.

Biomass Combustion: Biomass stoves – Improved chullahs, types, some exotic designs,

fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion - Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India.

4. Books and Materials

Text Books:

1. Non Conventional Energy, Desai, Ashok V., Wiley Eastern Ltd., 1990.
2. Biogas Technology - A Practical Hand Book - Khandelwal, K. C. and Mahdi, S. S., Vol. I & II, Tata McGraw Hill Publishing Co. Ltd., 1983.

Reference Books:

1. Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd., 1991.
2. Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons, 1996.

Course Structure

B6083 - Operations Research

Hours Per Week		Hours Per Semester		Credits	Assessment Marks		
L	P	L	P	C	CIE	SEE	Total
3	0	42	0	3	40	60	100

1. Course Description

Course Overview

The courses in Operational Research offer a unique blend of traditional coursework, practical skills, and real-world problem-solving experience designed to position students for success in today's competitive world. This course covers Linear Programming, Non-Linear Programming Problem, Mathematical Models and problems.

Course Pre/co-requisites

Industrial Management concepts

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

B6083.1 Gain knowledge in concepts and techniques of Operations Research.
B6083.2 Determine the optimal solution for Linear Programming problems.
B6083.3 Formulate and obtain the optimal solution for non- Linear Programming problems.
B6083.4 Solve to get optimal solution using queuing and inventory models .
B6083.5 Determine solution for non- Linear Programming problems using dynamic programming

3. Course Syllabus

Linear Programming Problem & Its Application I: Introduction, Formulation of LPP. Slack Variable, Surplus Variable and Artificial Variables. Standard Form and Matrix Form. Concept of Duality. Graphical Method. Simplex Method. Big - M method & Two - Phase Method. Problems of Degeneracy.

Linear Programming Problem & Its Application II: Parametric Programming introduction . Types of Linear Variations. Graphical and Analytical Sensitivity Analysis.

Non-Linear Programming Problem I: Introduction, Formulation and Graphical Method, Kuhn-Tucker Conditions, Quadratic Programming Problems by Wolfe's and Beale's Method.

Non-Linear Programming Problem II: Geometric programming introduction and analytical methods , Fractional programming introduction and analytical methods, Dynamic

programming introduction and analytical methods.

General Mathematical Models: Sequencing - n Jobs and m Machines, Inventory Control - introduction and its analytical methods. Single server queuing model.

4. Books and Materials

Text Books:

1. S.D. Sharma, Operations Research Theory, Methods and Applications, 18th Edition, Kedarnath Ramnath Publishers, Delhi 2017
2. H.A. Taha, Operations Research- An Introduction,8th Edition PHI, 2008.
3. H.M. Wagner, Principles of Operations Research, PHI, Delhi, 1982.

Reference Books:

1. J.C. Pant, Introduction to Optimization: Operations Research, 7th Edition,Jain Brothers, Delhi, 2008.
2. Hitler Libermann, Operations Research: McGraw Hill Pub. 2009.
3. Pannerselvam, Operations Research:2nd Edition, Prentice Hall of India 2010.
4. Harvey M Wagner, Principles of Operations Research:2nd Edition, Prentice Hall of India 2010.

Course Structure

B6084 - IoT and Applications

Hours Per Week		Hours Per Semester		Credits	Assessment Marks		
L	P	L	P	C	CIE	SEE	Total
3	0	42	0	3	40	60	100

1. Course Description

Course Overview

The course introduces you to advance concepts and design methodologies to design IoT systems and developing IoT applications programming languages and tools optimized for IoT domain. The course covers python languages in great detail with set of packages which makes it obvious choice as a leading IoT language. It also exposes participants to communication technologies and legacy protocols as well as newly developed IoT specific application and physical layer protocols. The course covers Cloud based service in great detail with set of packages which makes it obvious choice as a leading IoT Technology.

Course Pre/co-requisites

The course has no specific prerequisite and co-requisite

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

B6084.1 Identify the basic Architecture of IoT and its characteristics
B6084.2 Determine the most appropriate IoT Devices and communication system management
B6084.3 Utilize Python standard libraries for implementing various IoT Applications
B6084.4 Analyze the appropriate protocol for establishing communication between various IoT Devices
B6084.5 Analyze cloud infrastructure, services, APIs and architectures of commercial and industrial cloud platforms

3. Course Syllabus

Introduction to Internet Of Things : Introduction, Definition & Characteristics of IoT,Physical Design of IoT, Logical Design of IoT, IoT Enabling Technologies, IoT Levels & Deployment Templates DOMAIN SPECIFIC IOTS - Introduction, Home Automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health & Lifestyle.

IoT , M2M and IoT System Management with NETCONF-YANG : Introduction, M2M, Difference between IoT and M2M, SDN and NFV for IoT IoT System Management with NETCONF-YANG - Need for IoT Systems Management, Simple Network Management

Protocol (SNMP), Network Operator Requirements, NETCONF, YANG, IoT Systems Management with NETCONF-YANG.

IoT Platforms Design Methodology : IoT Platforms Design Methodology - Introduction, IoT Design Methodology, Case Study on IoT System for Weather Monitoring, Motivation for Using Python IoT SYSTEMS - LOGICAL DESIGN USING PYTHON - Introduction, Installing Python, Python Data Types & Data Structures, Control Flow, Functions, Modules, Packages, File Handling, Date/Time Operations, Classes,Python Packages of Interest for IoT.

IoT Physical Devices & Endpoints : What is an IoT Device, Exemplary Device: Raspberry Pi, About the Board, Linux on Raspberry Pi, Raspberry Pi Interface, Programming Raspberry Pi with Python, Other IoT Devices IoT PHYSICAL SERVERS & CLOUD OFFERINGS - Introduction to Cloud Storage Models & Communication APIs, WAMP - AutoBahn for IoT, Xively Cloud for IoT, Python Web Application Framework,Designing a RESTful Web API, Amazon Web Services for IoT, SkyNet IoT Messaging Platform.

Case Studies Illustrating IoT Design : What is an IoT Device, Exemplary Device: Raspberry Pi, About the Board, Linux on Raspberry Pi, Raspberry Pi Interface, Programming Raspberry Pi with Python, Other IoT Devices IoT PHYSICAL SERVERS & CLOUD OFFERINGS - Introduction to Cloud Storage Models & Communication APIs, WAMP - AutoBahn for IoT, Xively Cloud for IoT, Python Web Application Framework,Designing a RESTful Web API, Amazon Web Services for IoT, SkyNet IoT Messaging Platform.

4. Books and Materials

Text Books:

1. Arshdeep Bahga,Vijay Madisetti(2015), "Internet of Things A Hands-On Approach", University Press, India.
2. Jain, R.K. and Iyengar, S.R.K., Advanced Engineering Mathematics, 3rd Edition, Narosa Publishing House, 2011

Course Structure

B6085 - Cyber Security

Hours Per Week		Hours Per Semester		Credits	Assessment Marks		
L	P	L	P	C	CIE	SEE	Total
3	0	42	0	3	40	60	100

1. Course Description

Course Overview

This course drawing upon a wealth of experience from academia, industry, and government service, Cyber Security details and dissects, in current organizational cyber security policy issues on a global scale—taking great care to educate students on the history and current approaches to the security of cyberspace. It includes thorough descriptions of Cyber Offences, Cyber Crime, tools and methods used in Cyber Crime. It also delves into organizational implementation issues, and equips students with descriptions of the positive and negative impact of specific policy choices.

Course Pre/co-requisites

The course has no specific prerequisite and co requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

B6085.1 Demonstrate the basics of cybercrime in computer, networked device or a network.
B6085.2 Identify various cyber offences in real time.
B6085.3 Identify the different attacks in cybercrime.
B6085.4 Use various methods and tools to control cybercrimes and cyber offences.
B6085.5 Examine how to protect organizations from intruders, attackers and cyber criminals.

3. Course Syllabus

Introduction to Cybercrime: Introduction, Cybercrime, and Information Security, who are Cybercriminals, Classifications of Cybercrimes. The legal Perspectives and Indian Perspective, Cybercrime and the Indian ITA 2000, A Global Perspective on Cybercrimes.

Cyber Offenses: How Criminals Plan Them: Introduction, How Criminals plan the Attacks, Social Engineering, Cyber stalking, Cyber cafe and Cybercrimes. Botnets: The Fuel for Cybercrime, Attack Vector, and Cloud Computing.

Cybercrime: Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing

Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops.

Tools and Methods: Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horse and Backdoors, Steganography, DoS and DDoS attacks, SQL Injection, Buffer Overflow.

Cyber Security: Organizational Implications Introduction, Cost of Cybercrimes and IPR issues, Web threats for Organizations, Security and Privacy Implications. Social media marketing: Security Risks and Perils for Organizations, Social Computing and the associated challenges for Organizations.

4. Books and Materials

Text Books:

1. Nina Godbole and Sunil Belapure., Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, 1st Edition, Wiley INDIA. 2011.

Reference Books:

1. James Graham, Richard Howard and Ryan Otson., Cyber Security Essentials, 1st Edition, CRC Press, 2011.
2. Chwan-Hwa(John) Wu,J.David Irwin., Introduction to Cyber Security, , 1st Edition, CRC Press T&F Group, 2013.
3. Richard A. Clarke, Robert Knake., Cyberwar: The Next Threat to National Security & What to Do About It, Ecco, 2010.

Course Structure

B6086 - Mobile Cloud Computing

Hours Per Week		Hours Per Semester		Credits	Assessment Marks		
L	P	L	P	C	CIE	SEE	Total
3	0	42	0	3	40	60	100

1. Course Description

Course Overview

This Course provides a comprehensive overview of how to integrate cloud and mobile technology. It is an emerging field and this course explores how distributed resources can be shared by mobile users in different ways and issues arising there from. This course also provides understanding of Architecture, Applications of Mobile Cloud Computing along with Offloading concept and Resource allocation techniques. This also introduces concept called Green Mobile Computing and also discusses about the security issues in Mobile Cloud Computing. This course enables the student to choose as research area of interest.

Course Pre/co-requisites

The course has no specific prerequisite and co requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

B6086.1 Identify the architecture, issues and applications in mobile cloud computing.
B6086.2 Make use of remote cloud and offloading techniques for storage and computation.
B6086.3 Choose a resource allocation method in mobile cloud computing.
B6086.4 Use green mobile computing for an energy efficient mobile network.
B6086.5 Identify the trust and privacy requirements in a mobile cloud computing environment.

3. Course Syllabus

Mobile Cloud Computing: : Introduction to cloud computing, Basic cloud architecture, Motivation to MCC, Architecture, Platform and Technologies, Mobile Augmentation approaches, Issues of Mobile Cloud Computing, Advantages and Applications of Mobile Cloud Computing.

Offloading in Mobile Cloud Computing: Introduction, Offloading Decision, Types of Offloading, offloading in CC and MCC: Similarities and Differences, Adaptive Computation offloading from Mobile Devices, Cloud Path selection for Offloading, Mobile Data Offloading Using Opportunistic Communication, Three-Tier Architecture of Mobile Cloud Computing,

Requirements of Data Offloading, Performance Analysis of Offloading Techniques, Multi-Cloud Offloading in Mobile Cloud Computing Environment.

Resource Allocation in MCC: Introduction, Significance of Resource Allocation, Resource-Allocation Strategies- Semi-Markov Decision Process (SMDP), Task Scheduling Using Activity-Based Costing Algorithm, Resource Allocation Using Middleware, Energy-Aware Resource Allocation, Resource Allocation in MCC Using Entropy-Based FIFO Method, Auction Mechanism for Resource Allocation in MCC.

Green Mobile Computing: Introduction, Green Mobile Computing, Green Mobile Network, Green Cloud Computing, Green Mobile Cloud Computing, Green Mobile Devices Using Mobile Cloud Computing, Green Femtocell Using MCC.

Privacy and Security in MCC: Introduction, Security Levels, Security Issues. Trust in MCC: Introduction, Properties, Components, types of Trust, Trust Issues, and Trust Establishment.

4. Books and Materials

Text Books:

1. Debashis De., Mobile Cloud Computing-Architectures, Algorithms and Applications, CRC Press, Taylor and Fransis group, 2016.

Reference Books:

1. Frank H.P. Fitzek and Marcos D. Katz., Mobile Clouds: Exploiting Distributed Resources in Wireless, Mobile and Social Networks, 1st Edition, WILEY publications, 2014.
2. Valentino Lee, Heather Schneider, and Robbie Schell., Mobile Applications: Architecture, Design, and Development, Prentice Hall, 2004.