Course Learning Outcome:
After successful completion of the course, student will be able to

- understand technical foundations and challenges of virtualization, cloud computing and service oriented computing
- identify various service delivery models of cloud computing architecture
- understand security aspects in cloud
- design and develop simple cloud based web services

Syllabus:

Introduction: Cloud computing introduction, Roots of cloud computing, Layers of clouds, desired features of cloud, Cloud infrastructure management, Cloud Services, Challenges and risks.

Virtualization: Characteristics of virtual environments, taxonomy, virtualization and cloud computing technology examples.


Software as a Service: Evolution of SaaS, Challenges of SaaS paradigm, SaaS integration services, SaaS integration of products and platforms.

Infrastructure as a Service: Virtual machines provisioning and manageability- introduction, Virtual machine migration services.

Platform as a Service: Integration of private and public cloud, Technologies and tools for cloud computing, Aneka cloud platform, Resource provisioning Services.

Migrating into a Cloud: Cloud services for individuals, Cloud services aimed at the mid-market, Enterprise class cloud offering.

Data Security in the cloud: cloud computing and identity, the cloud, digital identity and data security.


Self Study:
The self-study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self-study contents.
Laboratory Work:
Laboratory work will be based on above syllabus with minimum 8 experiments to be incorporated.

References:
5. Mark D. Hansen, SOA using Java Web Services, Prentice Hall.

3CA1527 Elective-IV Image Processing [3 0 2 4]

Course Learning Outcome:
After successful completion of the course, student will be able to
• understand the fundamental concepts of a digital image processing system
• critically analyze different image enhancement methodology
• identify appropriate algorithm for segmentation and dividing into region
• analyze, design, implement digital image processing operations to build an image processing system

Syllabus:

Digital Image Fundamentals: Elements of Visual Perception, Image Sensing and Acquisition, Image sampling and Quantization and other low level operations.


Image Segmentation: Detection of Discontinuities, Edge Linking And Boundary Detection, Region Oriented Segmentation.

Morphological Image processing: Various morphological operators like erosion, dilatation open and close, Some Basic Morphological Algorithms.

Representation: Representation Schemes, Boundary Descriptors, Regional Descriptors.
Recognition: Elements of Image Analysis, Patterns and Pattern Classes, Decision Theoretic Methods, Structural Methods.

Self Study:
The self-study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self-study contents.

Laboratory Work:
Laboratory work will be based on above syllabus with minimum 10 experiments to be incorporated.

References:
5. Richard O. Duda and Peter E. Hart, Pattern Classification and Scene Analysis, John Wiley and Sons.

3CA1537  Elective-IV Soft Computing  [3 0 2 4]

Course Learning Outcome:
After successful completion of the course, student will be able to

- understand soft computing techniques and their role in problem solving
- conceptualize and parameterize various problems to be solved through basic soft computing techniques
- analyze and integrate various soft computing techniques in order to solve problems effectively and efficiently

Syllabus:


Associative Memory: Introduction, Auto-associative Memory, Iterative Auto-associative Net, Bi-directional Hetero-associative Memory.

Fuzzy Set Theory: Fuzzy versus crisp, crisp sets, Fuzzy sets, crisp relations, Fuzzy Relations.


Self Study:
The self-study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self-study contents.

Laboratory work:
Laboratory work will be based on above syllabus with minimum 10 experiments to be incorporated.

References:
3. Timothy J Ross, Fuzzy logic with engineering Application, McGraw-Hill.
4. S. N. Sivanandam, M. Paulraj, Introduction to Artificial Neural Networks, Vikas Publication.
5. J S R Jang, C T Sun and E Mizutan, Neuro-Fuzzy and Soft Computing, PHI.
7. J. Yen and R. Langari, Fuzzy Logic, Intelligence, Control and Information, Pearson Education.

3CA1547 Elective-IV Bio-Informatics [3 0 2 4]

Course Learning Outcome:
After successful completion of this course, student will be able to

- understand fundamentals of biological data processing
- identify mathematical structure of various biological entities to be processed through bioinformatics
- understand and apply various biological database software tools for implementing bioinformatics solutions
- predict and visualize the outcomes of bioinformatics processing

Syllabus:
Introduction of Bioinformatics: Biology in the Computer Age, Computational Approaches to Biological Questions: Molecular Biology's Central Dogma, Introduction to Biologists Model, A Computational Biology Experiment.

Software, Judging the Quality of Information, Sequence Analysis, Pairwise Alignment and Database Searching, Multiple Sequence Alignments, Trees and Profiles.


**Databases and Visualization:** Building Biological Databases, Data Mining and Visualization on the biological database: Preparing Your Data, Viewing Graphics, Sequence Data Visualization, Networks and Pathway Visualization, Working with Numerical Data, Visualization: Summary, Data Mining and Biological Information.

**Self Study:**
The self study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self study contents.

**Laboratory Work:**
Laboratory work will be based on above syllabus with minimum 10 experiments to be incorporated.

**References:**
1. Cynthia Gibas and Perl Jambeck, Developing Bioinformatics Computer Skills, O'Reilly.
4. Zhumar Ghosh and Bibekanand Mallick, Bioinformatics Principles and Applications, Oxford Publications

**3CA1557 Elective-IV Data Compression [3 0 2 4]**

**Course Learning Outcome:**
After successful completion of the course, student will be able to

- understand the importance of data compression and its feasibility
- describe various lossless and lossy compression techniques
- identify and apply appropriate compression technique to compress various types of data

**Syllabus:**

**Introduction:** Compression Techniques, Modeling and Coding.

**Mathematical Preliminaries for Lossless Compression Overview:** Introduction to Information Theory, Models, Coding.

**Huffman Coding:** Overview, Huffman Coding Algorithm, Minimum Variance Optimality and Length of Huffman Codes, Adaptive Huffman Coding, Application of Huffman Coding.
Arithmetic Coding: Introduction, Coding a Sequence, Generating a Binary Code, Comparison of Huffman and Arithmetic Coding, Applications.


Scalar Quantization: Introduction, Quantization Problem, Uniform Quantizer, Adaptive Quantization, Non-uniform Quantization.

Vector Quantization: Introduction, Advantages of Vector Quantization over Scalar Quantization.

Transform Coding: Introduction, Transform, Transforms of Interest - Discrete Cosine Transform, Quantization and Coding of Transform Coefficients, Application to Image Compression – JPEG, Application to Audio Compression.


Self Study:
The self study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self study contents.

Laboratory Work:
Laboratory work will be based on above syllabus with minimum 10 experiments to be incorporated.

References:
5. Gareth A. Jones, Information and Coding Theory, Springer.

3CA1567 Elective-IV Computer Animation [3 0 2 4]

Course Learning Outcome:
After successful completion of the course, student will be able to

- understand the basic principle of computer generated animations
- conceptualize the complex, technical and aesthetic components of computer animation design
- apply computer animation techniques for various real life scenario

Syllabus:
Learning Animation: Working with files, workspace, setting the stage, using template, exploring drawing modes, working with drawing tools, adding filters.
Objects and text: Moving, copying, deleting and editing objects, transforming objects, working with text field, frames and key frames, layers and layer folders.

Advance Effects in Animation: Tween animation, motion tweens, editing the motion path of a motion tween, frame by frame animation, Bones, animating an armature and 3D animation.

Symbols, instances, library, Action Script: Types of symbols, creating and modifying symbols, instances and library panel, working with sound and video, actions panel overview, resizing the actions tool box or script pane, Publishing and exporting the files.

3DAnimation: Workflow of 3D content development, main features of 3D Animation tool, Exploring user Interface of 3D Animation tool, working with Projects and Scenes.

Objects, Polygonal Modeling in 3D Animation tool: Exploring types of Objects in 3D Animation tool, creating objects using interactive creation mode, Reflection, Transforming objects, describing the components of polygon mesh, creating and modifying polygon mesh.

NURBS Modeling: Components of NURBS, creating and editing NURBS curve and surface.

Animating Objects, Shading, Lighting and Texturing in 3D Animation tool: Types of animation, exploring animation controls, key frames, animation layers, sound in animation.

Rendering Scene in 3D Animation tool: Rendering methods, render able camera, nodes, layers.

Self Study:
The self study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self study contents.

Laboratory Work:
Laboratory work will be based on above syllabus with minimum 10 experiments to be incorporated.

References:
2. Lance Flavell, Beginning Blender, Apress.
Course Code | 3CA1577
Course Title | Big Data Analytics

Course Learning Outcome (CLO):

At the end of the course, student will be able to -
1. define the significance of Big Data,
2. discover the challenges of Big Data Analytics and how to deal with the same,
3. comprehend distributed file system with MapReduce programming,
4. discriminate Big Data Analytics problem with NoSQL databases.

Syllabus

UNIT I

Introduction to Big Data Analytics: Nature of Data, Types of Digital Data, Classification of Digital Data, Structured Data, Semi-Structured Data, Unstructured Data, Characteristics of Data, Introduction to Data Mining, Data Mining for Large Scale Dataset, Statistical Limits on Data Mining, Introduction to Big Data and its Importance, Big Data Dimensions, Drivers for Big Data, Big Data Analytics issues and challenges, Big Data analytics applications.

UNIT II

Hadoop: Introducing Hadoop, comparisons of RDBMS and Hadoop, Distributed Computing Challenges, A Brief History of Hadoop, Hadoop Overview, Business Value of Hadoop, Hadoop Distributors, Hadoop Distributed File System, Processing Data with Hadoop, Hadoop YARN, Hadoop Ecosystem, HDFS,

UNIT III

MapReduce and the New Software Stack: Distributed File Systems, MapReduce, Algorithms Using MapReduce, Extensions to MapReduce, the Communication Cost Model, Complexity Theory for MapReduce

UNIT IV

Mining Data Streams: The Stream Data Model, Sampling Data in a Stream, Filtering Streams, Counting Distinct Elements in a Stream with case studies.
UNIT V

**Open Source Solutions for Big Data Analytics:** Introduction to NoSQL Databases, Types of NoSQL databases, SQL Vs NoSQL, why NoSQL, Introduction to MongoDB, Data Types in MongoDB, CRUD, relevant case studies

UNIT VI

**Introduction to other frameworks:** Data Processing Operators in Pig, Hive Services, HiveQL, Querying Data in Hive, Applications on Big Data using Pig and Hive, Fundamentals of HBase and ZooKeeper, Streams, Visualizations, Visual Data Analysis Techniques, Interaction Techniques, Systems and Applications, Jasper Report using Jasper Soft, Spark Framework and Architecture, Spark essentials and Components

**Self-Study:**
The self-study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self-study contents.

**Laboratory Work:**
The Practical will be based on the topics covered in the syllabus. Project based laboratory should be carried out.

**Suggested Readings:**
1. Seema Acharya and Subhashini C, Big Data and Analytics, Wiley India
2. Anand Rajaraman and Jeffrey David Ullman, Mining of Massive Datasets, Cambridge University Press
3. Michael Berthold, David J. Hand, Intelligent Data Analysis, Springer
6. Bill Franks, Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics, John Wiley & sons
7. Glenn J. Myatt, Making Sense of Data, John Wiley & Sons
8. Da Ruan, Guoquing Chen, Etienne E.Kerre, GeertWets, Intelligent Data Mining, Springer