M. Tech.
COMPUTER SCIENCE AND ENGINEERING
SYLLABUS

Department of Computer Science and Engineering
(M. Tech. CSE Programme Accredited by NBA)

VELAGAPUDI RAMAKRISHNA
SIDDHARTHA ENGINEERING COLLEGE
(An Autonomous, ISO 9001:2015 Certified Institution)
(Approved by AICTE, Accredited by NAAC with ‘A’ Grade, Affiliated to JNTUK, Kakinada)
(Sponsored by Siddhartha Academy of General & Technical Education)
Kanuru, Vijayawada
Andhra Pradesh - 520007, INDIA.
www.vrsiddhartha.ac.in
INSTITUTE VISION

To nurture excellence in various fields of engineering by imparting timeless core values to the learners and to mould the institution into a centre of academic excellence and advanced research.

INSTITUTE MISSION

To impart high quality technical education in order to mould the learners into globally competitive technocrats who are professionally deft, intellectually adept and socially responsible. The institution strives to make the learners inculcate and imbibe pragmatic perception and pro-active nature so as to enable them to acquire a vision for exploration and an insight for advanced enquiry.

DEPARTMENT VISION

The department vision is clearly defined and is in line with the college’s vision. The vision of the department is:

"To evolve as a centre of academic excellence and advanced research in Computer Science and Engineering discipline."

DEPARTMENT MISSION

This mission of the Department is concise and supports the College’s mission. The mission of the Computer Science and Engineering Department is:

"To inculcate students with profound understanding of fundamentals related to discipline, attitudes, skills, and their application in solving real world problems, with an inclination towards societal issues and research."
Program Educational Objectives (PG)

We have program educational objectives for our Computer Science and Engineering Program. Program educational objectives are broad statements that describe the career and professional accomplishments that the program is preparing graduates to achieve.

Our Computer Science and Engineering program objectives

I. Will solve wide range of computing related problems to fulfil the needs of industry and society.

II. Will have successful careers in academia, research and industry.

III. Will communicate effectively, work in collaboration and practice the profession in accordance with professional standards and ethical practices.
PROGRAM OUTCOMES

**PO1:** An Ability to independently carryout research/ investigation and development work to solve Practical Problems. [Problem solving and Research skills]

**PO2:** An ability to write and present a substantial technical report/document. [Communication]

**PO3:** Able to demonstrate a degree of mastery over the area as per the specialization of the program. [Lifelong Learning]

Program Specific Outcomes

**PSO1:** An ability to learn the state of art emerging technologies related to computer science and apply the learned concepts in related fields.

**PSO2:** Have a clear understanding of professional and ethical responsibility
<table>
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<tr>
<th>S.No</th>
<th>Course Category</th>
<th>Course Code</th>
<th>Title of the Course</th>
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<td>1.</td>
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<td>Data Structures and Algorithms</td>
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<td>C. Advances in Operating System Design</td>
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## Elective

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L – Lecture, T – Tutorial, P – Practical, C – Credits
CE - Continuous Evaluation, SE - Semester-end Evaluation, T – Total Marks
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| 4.   | Programme Elective – III | 19CSCS2014 | A. Internet of Things  
B. Digital Forensics  
C. Geographic Information System  
D. Algorithms for Bioinformatics  
E. Industry need based Elective. | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 5.   | Programme Elective – IV | 19CSCS2015 | A. Blockchain Technologies 
B. Software Defined Networks 
C. Open source programming 
D. Modern Software Engineering 
E. Industry need based Elective | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
<p>| 6.   | Audit Course        | 19MTAC2036      | Technical Report Writing                   | 2 | 0 | 0 | - | 0 | 0 | 0 |
| 7.   | Term Paper          | 19CSCS2063      | Term Paper#                                 | 0 | 0 | 2 | 1 | 40 | 60 | 100 |
| 8.   | Laboratory - I      | 19CSCS2051      | High Performance Computing Laboratory       | 0 | 0 | 3 | 1.5 | 40 | 60 | 100 |
| 9.   | Laboratory - II     | 19CSCS2052      | Cloud Computing Laboratory                  | 0 | 0 | 3 | 1.5 | 40 | 60 | 100 |</p>
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L – Lecture, T – Tutorial, P – Practical, C – Credits  
CE - Continuous Evaluation, SE - Semester-end Evaluation, T – Total Marks

*Students to be encouraged to go industrial training for at least Six weeks during semester break  
#Students should conduct the Literature Survey for the proposed research topic and they need to develop a prototype or simulation based (must be outcome oriented) – the same to be presented in any conference (national or international)
<table>
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<th>S.No</th>
<th>Course Category</th>
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| Total | 0 | 0 | 24| 15| 40| 260| 300|

L – Lecture, T – Tutorial, P – Practical, C – Credits
CE - Continuous Evaluation, SE - Semester-end Evaluation, T – Total Marks

# Evaluation done by MOOC’s providers will be considered

*To be continued in the IV Semester

Program Elective V may be completed in semester I or II by satisfying the pre-requisites those who are going for industrial project.
Semester IV  

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L – Lecture, T – Tutorial, P – Practical, C – Credits  
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Total Credits: 68

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# 19CSCS1001
## DATASTRUCTURES AND ALGORITHMS

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<th>Continuous Evaluation:</th>
<th>Lecture -Tutorial-Practice:</th>
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<td>Total Marks:</td>
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### COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

- **CO1**: Implement various tree operations
- **CO2**: Compare greedy and dynamic algorithms
- **CO3**: Understand graph algorithms and their applications
- **CO4**: Implement number theoretic algorithms
- **CO5**: Analyze string matching and Approximate algorithms.

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

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COURSE CONTENT

UNIT I
Binary Search Trees: BST, Querying BST, Insertion and Deletion, Randomly built binary search trees.
B-Trees: Definition of B-trees, Basic operations on B-Trees, Deleting a key from a B-tree.

UNIT II
Dynamic Programming: Matrix Chain Multiplication, Elements of dynamic programming, longest common subsequences, optimal binary search trees.

UNIT III
All-Pairs Shortest Paths: Floyd-Warshall algorithm.

UNIT IV
NP-Completeness: Polynomial time, Polynomial time verification, NP-completeness and reducibility, NP-complete problems

TEXT BOOKS

REFERENCE BOOKS
2nd edition, Universities Press.


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<tr>
<th>E-RESOURCES AND OTHER DIGITAL MATERIAL</th>
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<tr>
<td>[4] <a href="https://nptel.ac.in/courses/106101060/">https://nptel.ac.in/courses/106101060/</a></td>
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19CSCS1002
MACHINE LEARNING

Course Category: Programme Core Credits: 3
Course Type: Theory Lecture -Tutorial-Practice: 3 - 0 - 0
Prerequisites: Data Mining Continuous Evaluation: 40

Course Type:
Credits:
Course Category:
Prerequisites:
Lecture -Tutorial-Practice:
Continuous Evaluation:
Total Marks:

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

CO1 Identify instance based learning algorithms
CO2 Design neural network to solve classification and function approximation problems
CO3 Build optimal classifiers using genetic algorithms
CO4 Analyze probabilistic methods for learning

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

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COURSE CONTENT

UNIT I

Introduction - Well-posed learning problems, Designing a learning system, Perspectives and issues in machine learning

Concept learning and the general to specific ordering – Concept learning as
search, General-to-specific ordering of hypotheses, Find-S: finding a maximally specific hypothesis, List then eliminate algorithm, Candidate elimination learning algorithm

UNIT II

**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

**Artificial Neural Networks** – Neural network representation, Appropriate problems for neural network learning, Perceptrons- Gradient descent and the Delta rule, Multilayer networks and the back propagation algorithm

**Evaluation Hypotheses** – Estimation hypothesis accuracy, Basics of sampling theory, A general approach for deriving confidence intervals

UNIT III

**Bayesian learning** – Bayes theorem, Bayes theorem and concept learning, Bayes optimal classifier, Naïve Bayes classifier, Bayesian belief networks- Conditional independence, Learning Bayesian belief networks, The EM algorithm- general statement of EM algorithm,

**Computational learning theory** – Sample complexity for Finite Hypothesis Space, Sample Complexity for infinite Hypothesis Spaces- Shattering a Set of Instances

**Instance-Based Learning** - k -Nearest Neighbour Learning- Locally Weighted Regression, Case-Based Reasoning

UNIT IV

Genetic Algorithms – An illustrative Example, Genetic Programming-

**Representing Programs, Illustrative Example**, Models of Evolution and Learning


TEXT BOOKS

REFERENCE BOOKS


E-RESOURCES AND OTHER DIGITAL MATERIAL

19CSCS1003
WIRELESS AND MOBILE NETWORKS

Course Category: Programme Core
Course Type: Theory
Prerequisites: Computer Networks

Credits: 3
Lecture -Tutorial-Practice: 3 - 0 - 0
Continuous Evaluation: 40
Semester end Evaluation: 60
Total Marks: 100

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

CO1 Understand the concepts of wireless communication.
CO2 Analyze WPAN, WMAN and WWAN technologies
CO3 Compare 3G and 4G technologies of communications.
CO4 Familiarize with concepts of Wireless Adhoc Networks

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

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COURSE CONTENT

UNIT I
Introduction to Mobile Communications: Growth of Mobile Communications, A Little History, Mobile Communication fundamentals, Mobile Data, WiFi, Bluetooth, Cable Systems, Wireless Migration Options

UNIT II

Wireless Personal Area Networks (WPAN): WPAN, Network Architecture, WPAN Components, WPAN Technologies and Protocols, WPAN Applications

Wireless Metropolitan Area Networks (WMAN): WMAN, WMAN Architecture, Network Protocols, Broadband Wireless Networks, WMAN Applications

Wireless Wide Area Networks (WWAN): Cellular Networks, Satellite Networks, WLAN Versus WWAN, Interworking of WLAN and WWAN, WWAN Applications

UNIT III


Long-Term Evolution: LTE Ecosystem, Standards, Radio Spectrum, LTE Architecture, UE, eNodeB, Core Network, Radio Channel Components, TD-LTE, MIMO, LTE Scheduler, Carrier aggregation, Cell Search, Cell Reselection, Attach and Default Bearer Activation, Handover, SONs, Relay Cells, HetNET, RRH, VoLTE, LTE Advanced

UNIT IV


TEXT BOOKS

Protocols”, Wiley India, 2014

REFERENCE BOOKS


E-RESOURCES AND OTHER DIGITAL MATERIAL

19CSCS1014A
IMAGE PROCESSING AND PATTERN RECOGNITION

<table>
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<th>Programme Elective</th>
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COURSE OUTCOMES
Upon successful completion of the course, the student will be able to:

CO1 Understand the fundamental concepts and basic relations among the pixels.

CO2 Analyze the Spatial and Frequency domain concepts for image enhancement.

CO3 Identify the Image restoration and Image segmentation technique for image.

CO4 Understand the basic of Pattern recognition and Feature Extraction

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

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COURSE CONTENT

UNIT I
Digital Image Fundamentals: Elements of Visual Perception, Image Sensing and Acquisition, Image Sampling and Quantization, Some basic Relationships between Pixels

UNIT II
Intensity transformations: Some Basic intensity Transformation functions, Histogram Processing, Smoothing and Sharpening.
Spatial and Frequency Filtering for Image Enhancement: Fundamentals of Spatial Filtering, Smoothing spatial Filters, Sharpening spatial Filters, Fundamentals of Frequency Filtering, Smoothing frequency-domain Filters, Sharpening Frequency-domain Filters

UNIT III
Image restoration: A model of the image degradation/restoration process, noise models, restoration in the presence of noise—only spatial filtering, Weiner filtering, constrained least squares filtering
Image Segmentation: Fundamentals, Point, Line and Edge Detection, Thresholding, Region-Based Segmentation, Color Image Processing: Color fundamentals, color models, pseudo color image processing, basics of full – color image processing.

UNIT IV
Feature Extraction And Dimension Reduction: Color, Texture, Shape, Local Features, Spatial and frequency domain, HOG, Corner Detection, SIFT and SURF, Hough Transform, Principal Component Analysis.

TEXT BOOKS
[2] Richard O. Duda, Peter E. Hart and David G. Stroke Pattern Classifications. 2
Research Publications on feature extraction and pattern recognition.

**REFERENCE BOOKS**


**E-RESOURCES AND OTHER DIGITAL MATERIAL**

[1] Lecture Series on Digital Image Processing by Prof. P.K.Biswas, IIT Khargapur Available at: http://nptel.ac.in/courses/117105079/1

[2] Lecture Series on Pattern Recognition and Application by Prof. P.K.Biswa, IIT Khargapur Available at: https://nptel.ac.in/courses/117105101/
19CSCS1014B
EMBEDDED SOFTWARE DESIGN AND VALIDATION

Course Category: Programme Elective
Course Type: Theory
Prerequisites: Computer Organization

Credits: 3
Lecture -Tutorial-Practice: 3 - 0 - 0
Continuous Evaluation: 40
Semester end Evaluation: 60
Total Marks: 100

COURSE OUTCOMES
Upon successful completion of the course, the student will be able to:

CO1 Understand the different components for an embedded system.
CO2 Illustrate different devices used in embedded systems.
CO3 Summarize different services used in real time operating systems.
CO4 Compare various embedded software development tools.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

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COURSE CONTENT

UNIT I
Introduction to Embedded Systems: Embedded systems; Processor embedded into a system; Embedded hardware units and devices in a system; Embedded software in a system; Examples of embedded systems; Embedded System-on-Chip (SoC) and use of VLSI circuit design technology; Complex systems
design and processors; Design process in embedded system. Formalization of system design; Design process and design examples; Classification of embedded systems; Skills required for an embedded system designer.

UNIT II

**Devices:** I/O types and examples; Serial communication devices; Parallel device ports; Sophisticated interfacing features in device ports. Wireless devices; Timer and counting devices; Watchdog timer; Real time clock.

**Device Drivers and Interrupts Service Mechanism:** Device access without interrupts; ISR concept; Interrupt sources; Interrupt servicing mechanism; Multiple interrupts; Context and the periods for context-switching, interrupt latency and deadline.

UNIT III

**8051 Architecture, Memory Organizations and Real World Interfacing:** 8051 Architecture; Real world interfacing, Processor and Memory Organization.

**Program Modeling Concepts, Processes, Threads, and Tasks:** Program models; DFG models; State machine programming models for event controlled program flow; Modeling of multiprocessor systems. Multiple processes in an application; Multiple threads in an application; Tasks and task states; Task and data; Distinctions between functions, ISRs and tasks.

UNIT IV

**Real-time Operating systems:** Operating System services; Process management; Timer functions; Event functions; Memory management; Device, file and I/O sub-systems management; Interrupt routines in RTOS environment and handling of interrupt source calls.

**Embedded Software Development, Tools:** Introduction; Host and target machines; Linking and locating software; Getting embedded software into the target system; Issues in hardware software design and co-design; Testing on host machine; Simulators; Laboratory tools.

**TEXT BOOKS**

REFERENCE BOOKS


E-RESOURCES AND OTHER DIGITAL MATERIAL

[1] https://nptel.ac.in/courses/108102045/
19CSCS1014C
ADVANCES IN OPERATING SYSTEM DESIGN

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COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

CO1 Demonstrate the mutual exclusion, deadlock detection and agreement protocols of distributed operating system.

CO2 Learn the various resource management techniques for distributed systems.

CO3 Identify the different features of real time and mobile operating system.

CO4 Modify existing open source kernels in terms of functionality or features used.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

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COURSE CONTENT

UNIT-I

UNIT II

UNIT III
Multiprocessor and Real-Time Scheduling: Multiprocessor Scheduling, Real-Time Scheduling, Linux Scheduling, UNIX PreclssSl) Scheduling, Windows Vista Hours Scheduling, Process Migration, Distributed Global States, Distributed Mutual Exclusion, Distributed Deadlock.

UNIT IV
### TEXT BOOKS


### REFERENCE BOOKS


### E-RESOURCES AND OTHER DIGITAL MATERIAL

[1] Prof. P.K. Biswas sir, Ph.D.(IIT Kharagpur), Video Lectures on "Operating Systems"


19CSCS1014D
BIOINFORMATICS

Course Category: Programme Elective
Course Type: Theory
Prerequisites: Biology for Engineers

Credits: 3
Lecture - Tutorial - Practice: 3 - 0 - 0
Continuous Evaluation: 40
Semester end Evaluation: 60
Total Marks: 100

COURSE OUTCOMES
Upon successful completion of the course, the student will be able to:

CO1 Understand the biological sequence and structural databases.
CO2 Analyze the genome information and DNA sequence.
CO3 Compare pair-wise and multiple sequence alignment methods.
CO4 Apply secondary structures on DNA data.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

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COURSE CONTENT

UNIT-I

Introduction: Definitions, Sequencing, Biological sequence/structure, Genome
Projects, Pattern recognition and prediction, Folding problem, Sequence Analysis, Homology and Analogy.

**Protein Information Resources:** Biological databases, Primary sequence databases, Protein Sequence databases, Secondary databases, Protein pattern databases, and Structure classification databases.

**UNIT II**

**Genome Information Resources:** DNA sequence databases, specialized genomic resources

**DNA Sequence analysis:** Importance of DNA analysis, Gene structure and DNA sequences, Features of DNA sequence analysis, EST (Expressed Sequence Tag) searches, Gene hunting, Profile of a cell, EST analysis, Effects of EST data on DNA databases

**UNIT III**

**Pair wise alignment techniques:** Database searching, Alphabets and complexity, Algorithm and programs, Comparing two sequences, sub-sequences, Identity and similarity, The Dot plot, Local and global similarity, different alignment techniques, Dynamic Programming, Pair wise database searching.

**Multiple sequence alignment:** Definition and Goal, The consensus, computational complexity, Manual methods, Simultaneous methods, Progressive methods, Databases of Multiple alignments and searching.

**UNIT IV**

**Secondary database searching:** Importance and need of secondary database searches, secondary database structure and building a sequence search protocol

**Analysis packages:** Analysis package structure, commercial databases, commercial software, comprehensive packages, packages specializing in DNA analysis, Intranet Packages, Internet Packages.

**TEXT BOOKS**

REFERENCE BOOKS

[2] Sequence Analysis in A Nutshell, Scott Markel &Darryl Leon, O’REILLY

E-RESOURCES AND OTHER DIGITAL MATERIAL

[1] www.rcsb.org
   https://www.bioinformatics.org/
[4] Protein Secondary Structure Databases:
   http://cybionix.com/bioinformatics/databases/
[5] Dong Xu, University of Missouri, Columbia, Missouri, University of Missouri, Columbia, Missouri; Protein Databases on the Internet
# 19CSCS1015A
## DATA SCIENCE

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### COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

| CO1 | Understand the concepts of Data Science |
| CO2 | Apply Data Science algorithms for Big Data. |
| CO3 | Apply advanced Analytical Theory and Methods on Time series and Text databases |
| CO4 | Solve the Data Science problems using various technologies and tools |

### Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

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COURSE CONTENT

UNIT-I

**Introduction to Big Data Analytics:** Big Data Overview, State of the Practice in Analytics, Key Roles for the New Big Data Ecosystem, Examples of Big Data Analytics

**Data Analytics Lifecycle:** Data Analytics Lifecycle Overview, Discovery, Data Preparation, Model Planning, Model Building, Communicate Results, Operationalize.

**Basic Data Analytics Methods:** Introduction to R, Exploratory Data Analysis, Statistical Methods for Evaluation

UNIT II

**Advanced Analytical Theory and Methods-Clustering:** k-means, additional algorithms;

**Association Rules:** Apriori Algorithm, Evaluation of Candidate Rules, Applications of Association Rules, Transactions in a Grocery Store, Validation and Testing;

**Regression:** Linear Regression, Logistic Regression, Additional Regression Models

UNIT III

**Advanced Analytical Theory and Methods-Classification:** Decision Trees, Naïve Bayes;

**Advanced Analytical Theory and Methods-Time Series Analysis:** Overview of Time Series Analysis, ARIMA Model;

**Advanced Analytical Theory and Methods-Text Analysis:** Text Analysis Steps, Text Analysis Example, Collecting Raw Text, Representing Text, Term Frequency—Inverse Document Frequency (TFIDF), Categorizing Documents by Topics, Determining Sentiments

UNIT IV

**Hadoop-** Analytics for Unstructured Data- Use Cases, MapReduce, Apache
Hadoop, YARN

**The Hadoop Ecosystem**-Pig, Hive, HBase,

**In-Database Analytics**-SQL Essentials, Joins, Set Operations, Grouping Extensions

**Putting It All Together:** Communicating and operationalizing an Analytics Project, Creating the final deliverables, and Data Visualization basics.

**TEXT BOOKS**

[1] Data Science and Big Data Analytics, EMC2 Education Services, wiley, 2015

**REFERENCE BOOKS**


**E-RESOURCES AND OTHER DIGITAL MATERIAL**

19CSCS1015B
INFORMATION RETRIEVAL SYSTEMS

<table>
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COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

- **CO1**: Understand the overview of Information Retrieval Systems
- **CO2**: Compute the process of indexing and Information Extraction.
- **CO3**: Analyze the concepts of term clustering and Information Visualization.
- **CO4**: Implement various text search algorithms.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

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COURSE CONTENT

UNIT I

**Introduction**: Definition, Objectives, Functional Overview, Relationship to DBMS, Digital libraries and Data Warehouses.
Information Retrieval System Capabilities: Search, Browse

UNIT II

UNIT III
Automatic Indexing: Statistical indexing: Probabilistic Weighting, Vector Weighting, Natural language, Concept indexing
Document and Term Clustering:
Introduction, Thesaurus generation, Item clustering, Hierarchy of clusters.

UNIT – IV
User Search Techniques: Search statements and binding, Similarity measures and ranking, Relevance feedback, Selective dissemination of information search, weighted searches of Boolean systems, Searching the Internet and hypertext.
Text Search Algorithms: Introduction, Software text search algorithms, Hardware text search systems.
Information System Evaluation: Introduction, Measures used in system evaluation, Measurement example – TREC results.

TEXT BOOKS

REFERENCE BOOKS

E-RESOURCES AND OTHER DIGITAL MATERIAL
19CSCS1015C
NATURAL LANGUAGE PROCESSING

Course Category: Programme Elective

Credits: 3

Course Type: Theory

Lecture -Tutorial-Practice: 3 - 0 - 0

Prerequisites: Artificial Intelligence

Continuous Evaluation: 40

Semester end Evaluation: 60

Total Marks: 100

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

CO1 Understand the basic Notation in natural language processing.

CO2 Solve NLP sub problems using tokenizing and tagging

CO3 Apply various Parsing Techniques in NLP.

CO4 Analyze the semantic of sentences

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

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COURSE CONTENT

UNIT I

Introduction – Models and Algorithms, Regular Expressions and Automata - Regular Expression - Basic Regular Expression Patterns, Disjunction, grouping,
and precedence, Finite State Automata – using an FSA to recognize sheeptalk, formal languages, Non-Deterministic FSAs, Using an NFAs to accept strings, Recognition as search, Relating Deterministic and Non Deterministic Automata. Regular Languages and FSAs, 

**Morphology and Finite-State Transducers** survey of English Morphology - Inflectional Morphology, Derivational Morphology, Finite-State Morphological Parsing – The lexicon and Morphotactics, Morphological parsing with finite state transducers, orthographic rules and finite state transducers, Combining an FST Lexicon and Rules, the Porter Stemmer, Human Morphological Processing.

**UNIT II**

**N-grams**- Counting Words in Corpora, Unsmoothed N-grams, Smoothing – Add-One smoothing, witten-Bell Discounting, Good-Turing Discounting, Backoff, Deleted Interpolation, N-Grams for spelling and Pronunciation, context-sensitive spelling error correction, N-grams for pronunciation Modelling.

**Word Classes and Part-of-Speech Tagging**- English Word Classes, Tagsets for English, Part of Speech Tagging, Rule-Based Part of Speech Tagging, Stochastic Part of Speech Tagging

**UNIT III**

**Context Free Grammars for English**- Constituency, Context-Free Rules and Trees, Sentence-Level Constructions, the Noun Phrase, Coordination, Agreement, The Verb phrase and Sub Categorization, Auxiliaries, spoken language syntax, grammar equivalence and normal form, finite state and context free grammars, grammars and human processing.

**Parsing with Context Free Grammars** – Parsing as Search – top-down parsing, bottom-up parsing, comparing top-down and bottom-up parsing, A Basic Top-Down Parser, problems with the basic top down parser, left recursion, ambiguity, repeated parsing of subtrees, The Earley Algorithm, Finite State Parsing Methods.

**UNIT IV**

**Semantic Analysis** –Syntax, Driven Semantic Analysis – semantic augmentations to context free grammar rules, quantifier scoping and the translation for complex terms, attachments for a fragment of English, sentences, noun phrases, verb phrases, prepositional phrases, integrating semantic analysis into the early parser. 

**Lexical Semantics:** Relations among lexemes and their senses, homonymy,
polysemy, synonymy, hyponymy, wordnet, the internal structures of words.

**TEXT BOOKS**


**REFERENCE BOOKS**


**E-RESOURCES AND OTHER DIGITAL MATERIAL**

[2] https://nptel.ac.in/courses/106105158/#
## 19CSCS1015D
### GRAPH THEORY

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### COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

| CO1 | Understand various types of graph Algorithms and graph theory properties. |
| CO2 | Analyze the NP – complete problems. |
| CO3 | Distinguish the features of the various tree matching algorithms |
| CO4 | Understand the linear programming principles and its conversion. |

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

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### COURSE CONTENT

**UNIT I**
Basic definitions, Degree of vertices, Complement of a graph. Self
complementary graph, some eccentricity properties of graphs. Tree, spanning tree. Directed graphs standard definitions; strongly, weakly, unilaterally connected digraphs, deadlock communication network. Matrix representation of graph and digraphs. Some properties

UNIT II
Eulerian graphs and standard results relating to characterization. Hamiltonian graph-standard theorems (Dirac theorem, Chavathal theorem, closure of graph). Non Hamiltonian graph with maximum number of edges. Self-centered graphs and related simple theorems. Chromatic number; Vertex and edge - application to coloring. Planar graphs, Euler’s formula, maximum number of edges in a planar graph. Five colour theorem.

UNIT III
DFS-BFS algorithm, shortest path algorithm, min-spanning tree and max-spanning tree algorithm, planarity algorithm. Matching theory, maximal matching and algorithms for maximal matching. Perfect matching (only properties and applications to regular graphs).
Flows in graphs, Ranking of participants in tournaments, simple properties and theorems on strongly connected tournaments. Application of Eulerian digraphs. PERT-CPM. Complexity of algorithms; P-NP- NPC-NP hard problems and examples.

UNIT IV
Linear- Integer Linear programming, Conversion of TSP, maxflow, Knapsack scheduling, shortest path problems for Linear programming types - branch bound method to solve Knapsack problems- critical path and linear programming conversion- Floor shop scheduling problem- Personal assignment problem. Dynamic programming- TSP- compartment problems- Best investment problems

TEXT BOOKS
REFERENCE BOOKS


E-RESOURCES AND OTHER DIGITAL MATERIAL

19MTMC1026
RESEARCH METHODOLOGY AND IPR

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COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

CO1  Acquire an overview of the research methodology and techniques to define research problem

CO2  Review the literature and identify the problem.

CO3  Analyze the optimum sampling techniques for collected data.

CO4  Apply various forms of the intellectual properties for research work.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

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COURSE CONTENT

UNIT I
Research Methodology: Introduction, Meaning of Research, Objectives of Research, Motivation in Research, Research Approaches, Significance of Research, Research and Scientific Methods, Research Process, Criteria of Good...
Research, and Problems Encountered by Researchers in India.

**Research Problem:** Defining the Research Problem, Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem, an Illustration.

**UNIT II**

**Reviewing the literature:** Place of the literature review in research, improving research methodology, broadening knowledge base in research area, enabling contextual findings.


**UNIT III**

**Design of Sampling:** Introduction, Sample Design, Sampling and Non-sampling Errors, Sample Survey versus Census Survey, Measurement and Scaling: Qualitative and Quantitative Data, Classifications of Measurement Scales, Goodness of Measurement Scales, sources of error in measurement tools.

**Data Collection:** Experimental and Surveys, Collection of Primary Data, Collection of Secondary Data, Selection of Appropriate Method for Data Collection, Case Study Method **Testing of Hypotheses:** Hypothesis, Basic Concepts, Testing of Hypothesis, Test Statistics and Critical Region, Critical Value and Decision Rule, Procedure for Hypothesis Testing

**UNIT – IV**

**Interpretation and Report Writing:** Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, and Significance of Report Writing


**TEXT BOOKS**

[1] Research methodology: Methods and Techniques, C.R. Kothari, GauravGarg,
REFERENCES BOOKS


E-RESOURCES AND OTHER DIGITAL MATERIAL

19CSCS1051
DATA STRUCTURES AND ALGORITHMS LABORATORY

Course Category: Programme Core | Credits: 1.5
Course Type: Laboratory | Lecture -Tutorial-Practice: 0 - 0 - 3
Prerequisites: | Continuous Evaluation: 40
| Semester end Evaluation: 60
| Total Marks: 100

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

CO1: Implement various tree operations
CO2: Compare greedy and dynamic algorithms
CO3: Understand graph algorithms and their applications
CO4: Implement number theoretic algorithms

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

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COURSE CONTENT

Task 1: Implement Binary Search Tree operations
Task 2: Evaluate expressions by implementing expression trees
Task 3: Implement sorting algorithm using B-Trees
Task 4: Implement a data compression algorithm using Huffman coding
Task 5: Implementing matrix chain multiplication using dynamic programming  
Task 6: Implement Sequence alignment algorithm for biological sequences  
Task 7: Implement greedy algorithm for shortest job first (SJF) CPU scheduling algorithm  
Task 8: Implement Bellman-Ford algorithm using adjacency matrix  
Task 9: Implement distance vector routing algorithm  
Task 10: To check whether the graph is DAG or not  
Task 11: Implement Finite automata based string search algorithm  
Task 12: Implement Aho-Corasick string matching algorithm  
Task 13: Implement Hamiltonian Path using Java  
Task 14: Implement 0/1 Knapsack problem  
Task 15: Implement travelling salesman problem

**TEXT BOOKS**


**REFERENCE BOOKS**


**E-RESOURCES AND OTHER DIGITAL MATERIAL**

[6] IIT Guwahati B-Tree Construction, nptel.ac.in/courses/ 106103069/21
19CSCS1052
MACHINE LEARNING LABORATORY

Course Category: Programme Core
Course Type: Laboratory
Prerequisites: Data Mining

Credits: 1.5
Lecture - Tutorial - Practice: 0 - 0 - 3
Continuous Evaluation: 40
Semester end Evaluation: 60
Total Marks: 100

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

CO1 Identify instance based learning algorithms
CO2 Design neural network to solve classification and function approximation problems
CO3 Build optimal classifiers using genetic algorithms
CO4 Analyze probabilistic methods for learning

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

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COURSE CONTENT

Task 1: Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.

Task 2: For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the
set of all hypotheses consistent with the training examples

Task 3: 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.

Task 4: Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.

Task 5: Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.

Task 6: Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.

Task 7: 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. You can use Java/Python ML library classes/API.

Task 8: Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.

Task 9: Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.

Task 10: Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.

**TEXT BOOKS**


**REFERENCE BOOKS**

E-RESOURCES AND OTHER DIGITAL MATERIAL

[1] Evaluating a hypothesis, Stanford University,  

[2] Balaraman Ravindran, NPTEL Lecture 1 - Introduction to Machine Learning,  
https://www.youtube.com/watch?v=fC7V8QsPBec, Last accessed on 26-8-2019

[3] Benchmarking Neural Networks on Oracle Cloud Infrastructure with Mapr,  

SEMESTER II
# Course: 19CSCS2001
## HIGH PERFORMANCE COMPUTING

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## COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

| CO1 | Understand the parallel programming platforms and parallel algorithms on parallel computer systems. |
| CO2 | Analyze the working group communication operations of MPI. |
| CO3 | Understand the accelerator technologies of GPGPU’s with CUDA, OpenCL. |
| CO4 | Implement algorithms for Matrix, Sorting and Graphs using OpenMP, Pthreads, MPI and CUDA Language/Library. |

### Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

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COURSE CONTENT

UNIT I


Principles of Parallel Algorithm Design: Preliminaries, decomposition Techniques, Characteristics of tasks and interactions, mapping techniques for load balancing, parallel algorithm models.

UNIT II

Basic communication operations: One-to-All Broadcast and All-to-One Reduction, All-to-All Broadcast and Reduction, All-Reduce and Prefix-Sum Operations, Scatter and Gather.

Analytical modeling of parallel programs: sources of overhead in parallel programs, performance metrics for parallel systems.


UNIT III


UNIT IV


Graph Algorithms: Minimum Spanning Tree: Prim’s Algorithm, Single-Source shortest paths: Dijkstra’s Algorithm.
Introduction to General-Purpose GPU programming (CUDA): The age of parallel processing, The Rise of GPU computing, CUDA, Applications of CUDA, Development Environment, Introduction to CUDA C, Parallel Programming in CUDA C.

TEXT BOOKS


REFERENCE BOOKS


E-RESOURCES AND OTHER DIGITAL MATERIAL

[1] nptel.ac.in/courses/106108055/


## 19CSCS2002
### CLOUD COMPUTING

| Course Category: | Programme Core | Credits: | 3 |
|------------------|----------------|---------|
| Course Type:     | Theory         | Lecture -Tutorial-Practice: | 3 - 0 - 0 |
| Prerequisites:   | Computer Networks | Continuous Evaluation: | 40 |
|                  |                | Semester end Evaluation: | 60 |
|                  |                | Total Marks: | 100 |

### COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

| CO1 | Understand the evolution of cloud computing paradigm and its architecture |
| CO2 | Explain and characterize different cloud deployment models and service models |
| CO3 | Identify the various technological drivers of cloud computing paradigm. |
| CO4 | Identify the security issues in cloud computing. |

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

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COURSE CONTENT

UNIT - I
Introduction

Cloud Computing Fundamentals
5-4-3 Principles of Cloud computing: Five Essential Characteristics, Four Cloud Deployment Models, Three Service Offering Models
Cloud Ecosystem, Requirements for Cloud Services, Cloud Application, Benefits and Drawbacks

UNIT - II
Cloud Computing Architecture and Management
Cloud Architecture, Anatomy of the Cloud, Network Connectivity in Cloud Computing, Applications on the Cloud, Managing the Cloud, Migrating Application to Cloud

Cloud Deployment Models
Private Cloud, Public Cloud, Community Cloud, Hybrid Cloud

Cloud Service Models
Infrastructure as a Service, Platform as a Service, Software as a Service, Other Cloud Service Models

UNIT - III
Technological Drivers for Cloud Computing
Virtualization: Approaches in Virtualization, Hypervisor and Its Role, Types of Virtualization, Multicore Technology, Memory and Storage Technologies, Networking Technologies Web 2.0, Web 3.0
Operating Systems
Role of OS in Cloud Computing, Features of Cloud OS, Cloud OS Requirements, Cloud-Based OS Application Environment

UNIT –IV
Application Environment
Need for Effective ADE, Application Development Methodologies, Power of Cloud Computing in Application Development,
Cloud Computing APIs: Rackspace, IBM, Intel
Networking for Cloud Computing
Overview of Data Center Environment, Networking Issues in Data Centers
Security Aspects

TEXT BOOKS

REFERENCE BOOKS

E-RESOURCES & OTHER MATERIAL
19CSCS2003
CYBER SECURITY

Course Category: Programme Core | Credits: 3
Course Type: Theory | Lecture -Tutorial-Practice: 3 - 0 - 0
Prerequisites: Cryptography and Network Security | Continuous Evaluation: 40
| Semester end Evaluation: 60
| Total Marks: 100

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

CO1 Understand the classification of cyber crimes.
CO2 Assess various security attacks.
CO3 Understand the process to counter the cyber crimes.
CO4 Analyze various tools and methods used in cyber crimes

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

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COURSE CONTENT

UNIT I

UNIT II
**Cyber offenses:** Criminals Plan: Categories of Cybercrime **Cyber Attacks:** Reconnaissance, Passive Attack, Active Attacks, Scanning/Scrutinizing gathered Information, Attack (Gaining and Maintaining the System Access), Social Engineering, and Classification of Social Engineering.

UNIT III
**Cyberstalking:** Types of Stalkers, Cases Reported on Cyberstalking, Working of Stalking, Real-Life Incident of Cyberstalking, Cybercafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Botnet, Attack Vector, **Tools and Methods:** Proxy Servers and Anonymizers, Phishing and Identity Theft: Working of Phishing, Identity Theft (ID Theft).

UNIT IV
**Password Cracking:** Online Attacks, Offline Attacks, Strong, Weak and Random Passwords, Random Passwords, **Keyloggers and Spywares:** Software Keyloggers, Hardware Keyloggers, Antikeylogger, Spywares. Case Study: N-Map Tool, Nessus Vulnerability Tool

TEXT BOOKS

REFERENCE BOOKS
### E-RESOURCES AND OTHER DIGITAL MATERIAL

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# 19CSCS2014A
**INTERNET OF THINGS**

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## COURSE OUTCOMES
Upon successful completion of the course, the student will be able to:

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<th>CO1</th>
<th>Understand the basic principles and architecture of IoT.</th>
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<td>Illustrate Standards and Key Technologies in IoT</td>
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<td>CO3</td>
<td>Identify the structure of various physical devices used for IoT</td>
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<td>CO4</td>
<td>Analyze security threats and reliability issues of IoT Technologies</td>
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Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

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## COURSE CONTENT

### UNIT I

**Introduction to Internet of Things** – Definition and Characteristics of IoT

**IoT Architectures**: SOA based architecture and API based architecture

**Physical Design of IoT** – Things in IoT, IoT Protocols
Logical Design of IoT – IoT Functional Blocks, IoT communication models, IoT Communication APIs


Domain Specific IOTs – Home Automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health and Lifestyle

UNIT II

IoT and M2M – Introduction, M2M, Difference between IoT and M2M

SDN and NFV for IoT - Software Defined Networking, Network Function Virtualization

IoT Data Management and Analytics - IoT and the Cloud, Real-Time Analytics in IoT and Fog Computing

IoT Communication Protocols - Network Layer, Transport and Application Layer

UNIT III

IoT System Management with NETCONF- YANG- Need for IoT Systems Management, Simple Network Management Protocol (SNMP), Network Operator Requirements, NETCONF, YANG, NETOPEER

IoT Physical Devices and Endpoints – What is an IoT Device, Introduction to Raspberry Pi, Board, Raspberry Pi Interfaces (serial, SPI, I2C)

Programming Raspberry PI with Python – Controlling LED with Pi, Interfacing LED and Switch with Pi, Interfacing a light sensor with Pi.

UNIT IV

Security and Privacy in the Internet of Things - Concepts, IoT Security overview, Security Frameworks for IoT, Privacy in IoT Networks

IoT- Robustness and Reliability- IoT Characteristics and Reliability Issues, Addressing Reliability

TEXT BOOKS

### REFERENCE BOOKS


### E-RESOURCES AND OTHER DIGITAL MATERIAL


19CSCS2014B
DIGITAL FORENSICS

Course Category: Programme Elective
Credits: 3

Course Type: Theory
Prerequisites: Computer Networks
Lecture -Tutorial-Practice: 3 - 0 - 0
Continuous Evaluation: 40
Semester end Evaluation: 60
Total Marks: 100

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

CO1 Understand the concepts of cyber forensics related Issues.

CO2 Analyse the process of various forensic systems.

CO3 Analyze Evidence capture mechanism and Recovery steps

CO4 Evaluate and Report electronic communications evidences.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

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COURSE CONTENT

UNIT I
Forensic overview:
Introduction, Use of Computer Forensics in Law Enforcement, Computer Forensics Assistance to Human Resources/ Employment Proceedings, Forensics
Services, Benefits of Professional Forensics Methodology, Steps Taken by Computer Forensics Specialists.


**UNIT II**

**Data Recovery:** Definition, Data Backup and Recovery, The Role of Backup in Data Recovery, The Data-Recovery Solution, Hiding and Recovering Hidden Data


**UNIT III**


**Computer Image Verification and Authentication:** Special Needs of Evidential Authentication, Practical Consideration, Practical Implementation, **Reconstructing Past Events:** Introduction, Useable File Formats, Unusable File Formats, Converting Files.

**UNIT IV**


**Network Forensics Scenario:** A Technical Approach, Destruction of Email, Damaging Computer Evidence, Tools Needed for Intrusion Response to the Destruction of Data, System Testing

**TEXT BOOKS**


REFERENCE BOOKS


E-RESOURCES AND OTHER DIGITAL MATERIAL

19CSCS2014C
GEOGRAPHIC INFORMATION SYSTEM

Course Category: Programme Elective
Credits: 3

Course Type: Theory
Lecture - Tutorial - Practice: 3 - 0 - 0

Prerequisites: Database Management Systems
Continuous Evaluation: 40
Semester end Evaluation: 60
Total Marks: 100

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

**CO1** Understand the basic concepts of spatial and non spatial data.

**CO2** Analyze database issues in GIS.

**CO3** Create design principles for developing DEM and TIN

**CO4** Apply various real time problems in GIS

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

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COURSE CONTENT

UNIT I

GIS: Definitions and Development – Computer Components of GIS (Hardware and Software) – General Data Base concepts of Spatial and Non Spatial data - Elements of Spatial data - Sources of Spatial data – Data quality for GIS – Errors
and Error variations in GIS

UNIT II

UNIT III

UNIT IV

TEXT BOOKS

REFERENCE BOOKS
### 19CSCS2014D

**ALGORITHMS FOR BIOINFORMATICS**

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**COURSE OUTCOMES**

Upon successful completion of the course, the student will be able to:

| CO1 | Understand Dynamic programming algorithms for biological sequences. |
| CO2 | Understand graph algorithms and their applications |
| CO3 | Apply pattern matching and clustering with reference to Bioinformatics |
| CO4 | Analyze evolutionary trees and phylogeny related algorithms. |

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

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COURSE CONTENT

UNIT I


UNIT II


UNIT III

**Graph Algorithms:** Graphs and Genetics, DNA Sequencing Shortest Superstring Problem DNA Arrays as an Alternative Sequencing Technique Sequencing by Hybridization, SBH as a Hamiltonian Path Problem SBH as an Eulerian Path Problem, Fragment Assembly in DNA Sequencing, Protein Sequencing and Identification, The Peptide Sequencing Problem, Spectrum Graphs Protein Identification via Database Search Spectral Convolution, Spectral Alignment
UNIT IV
Combinatorial Pattern Matching: Repeat Finding, Hash Tables, Exact Pattern Matching, Keyword Trees, Suffix Trees, Heuristic Similarity Search Algorithms Approximate Pattern Matching, BLAST: Comparing a Sequence against a Database.

Clustering and Trees: Gene Expression Analysis, Hierarchical Clustering, k-Means Clustering and Corrupted Cliques, Evolutionary Trees, Distance-Based Tree Reconstruction, Reconstructing Trees from Additive Matrices, Evolutionary Trees and Hierarchical Clustering, Character-Based Tree Reconstruction, Small Parsimony Problem, Large Parsimony Problem

TEXT BOOKS

REFERENCE BOOKS
19CSCS2015A  
BLOCKCHAIN TECHNOLOGIES

Course Category: Programme Elective  
Credits: 3

Course Type: Theory  
Lecture -Tutorial-Practice: 3 - 0 - 0

Prerequisites: Cryptography and Network Security  
Continuous Evaluation: 40

Semester end Evaluation: 60

Total Marks: 100

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

CO1 Understand the block chain architecture and design

CO2 Analyze the consensus protocols Role in Block chain

CO3 Understand functioning of Bitcoins

CO4 Analyze security and privacy aspects of Bitcoin

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

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COURSE CONTENT

UNIT I

Blockchain: Introduction, Structure of a Block, Block Header, Block Identifiers - Block Header Hash and Block Height, The Genesis Block, Linking Blocks in the
Blockchain, Merkle Trees, Merkle Trees and Simplified Payment Verification (SPV).

**Mining and Consensus I:** Introduction, Bitcoin Economics and Currency Creation, De-centralized Consensus, Independent Verification of Transactions, Mining Nodes, Aggregating Transactions into Blocks, Transaction Age, Fees, and Priority

**UNIT II**

**Mining and Consensus II:** The Generation Transaction, Coin base Reward and Fees, Structure of the Generation Transaction, Coin base Data, Constructing the Block Header, Mining the Block, Proof-of-Work Algorithm, Difficulty Representation, Difficulty Target and Re-Targeting, Successfully Mining the Block, validating a New Block, Assembling and Selecting Chains of Blocks, Block chain Forks, Mining and the Hashing Race, The Extra Nonce Solution, Mining Pools, Consensus Attacks.

**UNIT III**

**Bitcoin:** Introduction, History, Bitcoin Uses, Users and Their Stories, Getting Started, Quick Start, getting your first bitcoins, Sending and receiving bitcoins,

**Bitcoin Functioning:** Transactions, Blocks, Mining, and the Block chain, Bitcoin Overview, buying a cup of coffee, Bitcoin Transactions, Common Transaction Forms, constructing a Transaction, Getting the right inputs, Creating the outputs, Adding the transaction to the ledger, Bitcoin Mining, mining transactions in blocks, Spending the transaction

**UNIT IV**

**Bitcoin Transactions:** Bitcoin Transactions, Common Transaction Forms, constructing a Transaction, Getting the right inputs, Creating the outputs, Adding the transaction to the ledger, Bitcoin Mining, mining transactions in blocks, Spending the transaction

**Bitcoin Network:** Peer-to-Peer Network Architecture, Nodes Types and Roles, The Extended Bitcoin Network, Network Discovery, Full Nodes, Simplified Payment Verification (SPV) Nodes.

Alert Messages **Alt-Coins:** CryptoNote, Bytecoin, Monero, Zerocash/Zerocoin,
Darkcoin, Namecoin, Bitmessage, Ethereum

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<td>[1] <a href="https://onlinecourses.nptel.ac.in/noc18_cs47/announcements?force=true">https://onlinecourses.nptel.ac.in/noc18_cs47/announcements?force=true</a></td>
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19CSCS2015B
SOFTWARE DEFINED NETWORKS

Course Category: Programme Elective
Credits: 3

Course Type: Theory
Lecture -Tutorial-Practice: 3 - 0 - 0

Prerequisites: Wireless & Mobile Networks
Continuous Evaluation: 40
Semester end Evaluation: 60
Total Marks: 100

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

CO1 Understand the concepts of wireless communication.

CO2 Analyze WPAN, WMAN and WWAN technologies

CO3 Compare 3G and 4G technologies of communications.

CO4 Familiarize with concepts of Wireless Adhoc Networks

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

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COURSE CONTENT

UNIT I
INTRODUCING SDN

UNIT II
SDN ABSTRACTIONS

UNIT III
PROGRAMMING SDN'S
Network Programmability - Network Function Virtualization - NetApp Development, Network Slicing

UNIT IV
SDN APPLICATIONS AND USE CASES
SDN in the Data Center - SDN in Other Environments - SDN Applications - SDN Use Cases - The Open Network Operating System 3
SDN'S FUTURE AND PERSPECTIVES
SDN Open Source - SDN Futures - Final Thoughts and Conclusions

TEXT BOOKS

REFERENCE BOOKS
Publishing, 2013

19CSCS2015C
OPEN SOURCE PROGRAMMING

Course Category: Programme Elective
Credits: 3

Course Type: Theory
Lecture -Tutorial-Practice: 3 - 0 - 0

Prerequisites: 
Continuous Evaluation: 40
Semester end Evaluation: 60
Total Marks: 100

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

CO1 Understand the fundamentals of Open source Programming.

CO2 Develop codes in open source web applications

CO3 Understand the risks associated with the open source codes

CO4 Write secure CGI scripts

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

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COURSE CONTENT

UNIT I
INTRODUCTION: Introduction to open source programming languages, advantages and drawbacks of open source programming, threats and vulnerabilities in open source languages, Operating System – Ubuntu Linux – Introduction to
shell programming.

UNIT II
PHP: PHP Language Basics, Functions - calling a function, variable function, and anonymous function, Strings - cleaning, encoding and escaping, and comparing strings, Arrays – storing data in arrays, extracting multiple values, traversing, and sorting arrays, Objects – creation, introspection, and serialization, Web Techniques – processing forms and maintaining state.

UNIT III
WEB DATABASE APPLICATIONS: Three-tier architecture, Introduction to Object oriented programming with PHP 5, Database basics, MYSQL - querying web databases, writing to web databases, validation with Javascript, Form based authentication, protecting data on the web.

UNIT IV
PERL, TCL: Numbers and Strings, Control Statements, Lists and Arrays, Files, Pattern matching, Hashes, Functions. Introduction to TCL/TK

SECURITY IN WEB APPLICATIONS: Recognizing web application security threats, Code Grinder, Building functional and secure web applications, Security problems with Javascript, vulnerable GCI scripts, Code Auditing and Reverse Engineering, types of security used in applications

TEXT BOOKS

REFERENCE BOOKS
19CSCS2015D
MODERN SOFTWARE ENGINEERING

Course Category: Programme Elective
Credits: 3

Course Type: Theory
Lecture -Tutorial-Practice: 3 - 0 - 0

Prerequisites: Object Oriented Programming fundamental, UML
Continuous Evaluation: 40
Semester end Evaluation: 60
Total Marks: 100

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

**CO1** Apply Modern Agile Development and Service Oriented Architecture Concept of Industry.

**CO2** Apply the concept of Functional Oriented and Object-Oriented Approach for Software Design

**CO3** Recognize how to ensure the quality of software product, different quality standards and software review techniques.

**CO4** Apply various testing techniques and test planning.

**CO5** Create SRS (Software Requirement Specification) document and SPMP (Software Project Management Plan) document.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

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COURSE CONTENT

UNIT I
Introduction to Software and Software Engineering

Agile Development
Agility and Agile Process model, Extreme Programming, Other process models of Agile Development and Tools.

Managing Software Project
Software Metrics (Process, Product and Project Metrics), Software Project Estimations, Software Project Planning (MS Project Tool), Project Scheduling & Tracking, Risk Analysis & Management (Risk Identification, Risk Projection, Risk Refinement, Risk Mitigation).

UNIT II
Requirement Analysis and Specification

Software Design

Software Coding & Testing
UNIT III

Quality Assurance and Management

Software Maintenance and Configuration Management

UNIT IV

Software Engineering and Software as a Service

Advanced Topics in Software Engineering:

TEXT BOOKS

[2] Ian Sommerville, Software engineering, Pearson education Asia

REFERENCE BOOKS

[4] Engineering Software as a Service An Agile Software Approach, Armando Fox and David Patterson
## E-RESOURCES AND OTHER DIGITAL MATERIAL

[1] PROF. RAJIB MALL Dept. of Computer Science and Engineering IIT Kharagpur, Software Engineering  
   https://nptel.ac.in/courses/106/105/106105182/

   https://nptel.ac.in/courses/106/105/106105218/

[3] PROF. MEENAKSHI D'SOUZA Dept. of Computer Science and Engineering IIIT Bangalore, Software Testing,  
   https://nptel.ac.in/courses/106/101/106101163/
19MTAC2036
TECHNICAL REPORT WRITING

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COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

| CO1 | Understand the significance of Technical Report writing. |
| CO2 | Develop Proficiency in writing technical reports. |
| CO3 | Apply the basic principles to prepare documentation using LATEX. |
| CO4 | Understanding the need of Bibliography and references for quality report writing |

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

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COURSE CONTENT

UNIT I

Writing scientific and engineering papers: Title, Abstract, Introduction, Materials And Methods, Result, Discussion, Conclusion, References, Acknowledgements, Appendices, Hedging and Criticizing, Paraphrasing and
Plagiarism.

UNIT II

Effective use of charts, graphs and tables - Bar Chart, Line Chart, Pie Chart, Area Chart, Cylindrical Chart, Column Bars, Bubble Chart, Flow Diagram, Screen Capture, Tables


UNIT III

LATEX - Introduction, Document Structure - Creating a Title, Sections, Labeling, Table of Contents

Typesetting Text - Font Effects, Colored Text, Font Sizes, Lists, Comments & Spacing, Special Characters

UNIT IV

Tables, Figures, Equations - Inserting Equations, Mathematical Symbols, Practical.

Inserting References - Introduction, The BibTeX file, Inserting the bibliography, Citing references, Styles, Practical.

TEXT BOOKS


REFERENCE BOOKS

E-RESOURCES AND OTHER DIGITAL MATERIAL

[1] https://www.futurelearn.com/courses/technical-report-writing-for-engineers
19CSCS2063
TERM PAPER

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COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

- **CO1**: Identify a real world problem in specific domain
- **CO2**: Understand requirements and specifications of the problem
- **CO3**: Explore the existing technologies/ Methodologies
- **CO4**: Formulate a real world problem and develop its requirements
- **CO5**: Express technical ideas strategies and methodologies in written form
- **CO6**: Prepare and conduct oral presentations

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

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**19CSCS2051**

**HIGH PERFORMANCE COMPUTING LABORATORY**

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**COURSE OUTCOMES**

Upon successful completion of the course, the student will be able to:

**CO1**
Understand parallel programming platforms and parallel algorithms on parallel computer systems.

**CO2**
Analyze the working group communication operations of MPI.

**CO3**
Understand the accelerator technologies of GPGPU’s with CUDA, OpenCL.

**CO4**
Implement algorithms for Matrix, Sorting and Graphs using OpenMP, Pthreads, MPI and CUDA language/library.

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

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</table>
### COURSE CONTENT

Task 1: Implement Basic of MPI Programs.
Task 2: Implement a Program for Communication between MPI processes.
Task 3: Implement advance communication between MPI processes
Task 4: Implement MPI collective operations using ‘Synchronization’
Task 5: Implement MPI collective operations using ‘Data Movement’
Task 6: Implement MPI collective operations using ‘Collective Computation’
Task 7: Write a program for MPI Non-Blocking operation
Task 8: Implement Matrix-Matrix multiplication - Cannon’s.
Task 9: Implement Sorting using MPI– Shell sort, Quick sort, Bucket.
Task 10: Implement Problems using OpenMP.
Task 12: Implement Problems using CUDA.
Task 13: Implement problems using OpenCL.

### TEXT BOOKS


### REFERENCE BOOKS


### E-RESOURCES AND OTHER DIGITAL MATERIAL

1. nptel.ac.in/courses/106108055/
# 19CSCS2052
## CLOUD COMPUTING LABORATORY

<table>
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### COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

- **CO1** Understand the evolution of cloud computing paradigm and its architecture.
- **CO2** Explain and characterize different cloud deployment models and service models.
- **CO3** Identify the various technological drivers of cloud computing paradigm.
- **CO4** Identify the security issues in cloud computing.

### Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

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</table>
COURSE CONTENT

Task 1: Create a cloud based google app engine project and deploy using any cloud based IDEs like codenvy, cloud9 or codeanywhere.

Task 2: Install and configure guest Operating System in another host OS using virtual box to implement para-virtualization.

Task 3: Develop and deploy a Node.js app using IBM BlueMix PAAS services.

Task 4: Create sample battle station Application in salesforce.com developer interface.

Task 5: Simulate the cloud environment of three data centers in different geographical locations and add virtual machines to them along with resources like storage, compute and bandwidth using Cloud Analyst.

Task 6: Create and launch windows server virtual machine using YELLOW CIRCLE cloud platform.

Task 7: Create Node.js sample application using redhatopenshift cloud application platform.

Task 8: Create a virtual machine and install guest OS in Amazon AWS cloud platform.

Task 9: Using Cloudsim simulate a datacenter with one host and run one cloudlet on it.

Task 10: Using Cloudsim simulate two datacenters with one host and a network topology each and run two cloudlets on them.

TEXT BOOKS


REFERENCE BOOKS

SEMESTER III
M.Tech(CSE) Syllabus

19CSCS3011A
JOY OF COMPUTING USING PYTHON

Course Category: Programme Elective

Course Type: Theory
Prerequisites: Data Structures, Computer Organization & Architecture

Credits: 3
Lecture -Tutorial-Practice: 0 - 0 - 0
Continuos Evaluation: -
Semester end Evaluation: 100
Total Marks: 100

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

CO1 Understand python lexical features and syntax.

CO2 Understand basic data structures with python.

CO3 Implement Exception Handling and files.

CO4 Create GUI Applications using Python.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

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</table>
COURSE CONTENT

Motivation for Computing | Welcome to Programming.

Variables and Expressions, Design your own calculator | Loops and Conditionals, Hopscotch once again.


Counting Candies: Crowd to the rescue | Birthday Paradox : Find your twin.

Google Translate: Speak in any Language | Currency Converter : Count your foreign trip expenses.

Monte Hall: 3 doors and a twist | Sorting : Arrange the books.

Searching: Find in seconds | Substitution Cipher : What’s the secret !!

Sentiment Analysis: Analyse your Facebook data | I can read your mind.

Permutations: Jumbled Words | Spot the similarities : Dobble game.

Count the words: Hundreds, Thousands or Millions | Rock, Paper and Scissor : Cheating not allowed !!

Lie detector: No lies, only TRUTH | Calculation of the Area : Don’t measure. | Six degrees of separation: Meet your favourites | Image Processing : Fun with images.

Tic tac toe: Let’s play | Snakes and Ladders : Down the memory lane | Recursion : Tower of Hanoi | Page Rank : How Google Works !!

TEXT BOOKS


REFERENCE BOOKS


**E-RESOURCES AND OTHER DIGITAL MATERIAL**

   URL: https://nptel.ac.in/courses/106/106/106106182/#
   Accessed on: 22-08-2019

   URL: https://www.coursera.org/course/pythonlearn
   Course Schedule (coursera): May 2019

   URL: https://www.coursera.org/learn/interactive-python-1
   Course Schedule (coursera): Starts May 2nd 2019, 5 weeks

19CSCS3011B
USER INTERFACE DESIGN

Course Category: Programme Elective
Credits: 3

Course Type: Theory
Lecture -Tutorial-Practice: 0 - 0 - 0

Prerequisites:

Continuous Evaluation: -
Semester end Evaluation: 100
Total Marks: 100

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

CO1 Understand the key terms of User interface

CO2 Use appropriate prototypes for presenting information using UI and UX.

CO3 Apply design principles for developing sophisticated User interfaces.

CO4 Identify faults and test cases in the interfaces and suggest alternative designs.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

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**COURSE CONTENT**

**Introduction to User Interface Design**
- Introduction to UI Design
- Brief History of UI Design
- UI Design Methodology
- User Experience design component in Interface Design
- User Research and Design
- Prototyping and Design
- Evaluating User Interfaces
- Human Factor in Interaction Design
- Visual Communication design component in Interface Design
- Visual Cognition
- Contemporary Visual Language in Design
- Usage of Typography in User Interface Design
- Testing User interfaces

**TEXT BOOKS**


**REFERENCE BOOKS**


**E-RESOURCES AND OTHER DIGITAL MATERIAL**

[1] Dr. Samit Battacharya IIT Guwahati , Department of Computer Science & Engineering, NPTEL Videos, Available:https://nptel.ac.in/courses/106103115/ Last accessed on
August 2019.

[2] Prof. Pradeep Yammiyavar IIT Guwahati, Department of Design, NPTEL Videos
   Available: https://nptel.ac.in/courses/106103115/ Last accessed on August 2019.
19CSCS3011C
DEEP LEARNING

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**COURSE OUTCOMES**

Upon successful completion of the course, the student will be able to:

- **CO1** Understand the Linear Classifiers and Optimization Techniques
- **CO2** Understand various types of Neural networks
- **CO3** Apply Classical Supervised Tasks with Deep Learning
- **CO4** Understand LSTM Networks

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

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**COURSE CONTENT**

Introduction to Deep Learning, Bayesian Learning, Decision Surfaces
Linear Classifiers, Linear Machines with Hinge Loss
Optimization Techniques, Gradient Descent, Batch Optimization
Introduction to Neural Network, Multilayer Perceptron, Back Propagation
Learning.
Unsupervised Learning with Deep Network, Autoencoders
Convolutional Neural Network, Building blocks of CNN, Transfer Learning
Revisiting Gradient Descent, Momentum Optimizer, RMSProp, Adam
Effective training in Deep Net- early stopping, Dropout, Batch Normalization, Instance Normalization, Group Normalization
Recent Trends in Deep Learning Architectures, Residual Network, Skip Connection Network Fully Connected CNN etc.
Classical Supervised Tasks with Deep Learning, Image Denoising, Semantic segmentation Object Detection etc.
LSTM Networks

TEXT BOOKS

REFERENCE BOOKS

E-RESOURCES AND OTHER DIGITAL MATERIAL
[1] Prof. Prabir Kumar Biswas, IITKGP,
   https://swayam.gov.in/nd1_noc19_cs54/preview, Accessed on 22-08-2019
### 19CSCS3011C
#### DATA VISUALISATION

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### COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

- **CO1**: Understand Visualization stages for different types of data
- **CO2**: Apply Visualization algorithms for good visualization
- **CO3**: Analyze various visualization and modelling techniques
- **CO4**: Use Visualization relationships for correlation, distribution and to Identify Outliers

### Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

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COURSE CONTENT

The minimum content to be covered

Foundations for an applied science of data visualization, Gibson’s Affordance theory

A Model of Perceptual Processing, Visual working memory, Costs and Benefits of Visualization

Types of Data: entities, relationships, attributes of entities or relationships, data dimensions, types of numbers, uncertainty, and operations considered as data.

The Visualization Pipeline: Conceptual Perspective, Implementation Perspective.

Algorithm Classification, Scalar Visualization: Color Mapping, Designing Effective Color maps, Contouring, Height Plots

Vector Visualization: Vector Glyphs, Vector Color Coding, Displacement Plots, Texture-Based Vector Visualization

Domain- Modeling Techniques: Cutting, Selection, Grid Construction from Scattered Points

Image Visualization: Image Data Representation, Image Processing and Visualization

Information Visualization: What Is Infovis Table Visualization, Visualization of Relations, Multivariate Data Visualization, Text Visualization

Visualizing Proportions: what to look for in proportions, parts of a whole, proportions over a time

visualizing relationships: what relationships to look for, correlation, distribution, comparison

Spotting Differences: comparing across multiple variables, reducing dimensions, searching for outliers

Visualizing spatial relationships: specific locations, regions, over space and time

TEXT BOOKS


REFERENCE BOOKS


E-RESOURCES AND OTHER DIGITAL MATERIAL

[1] Prof. Han-Wei Shen Introduction to Data Visualization, http://web.cse.ohio-state.edu/~shen.94/5544/
[2] University of Illinois at Urbana-Champaign
   https://www.coursera.org/learn/datavisualization
SEMESTER – III
19CSCS3061
PROJECT – PART A

Course Category: Project
Credits: 3
Course Type: Lecture -Tutorial-Practice: 0 - 0 - 20
Prerequisites: Continuous Evaluation: 40
Semester end Evaluation: 100
Total Marks: 100

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

CO1 Identify a real world problem in specific domain and its feasibility
CO2 Explore the existing technologies/ Methodologies
CO3 Apply the techniques for data preparation and formulization
CO4 Design a prototype
CO5 Prepare the technical Report
CO6 Prepare and conduct oral presentations

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

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## COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

| CO1 | Understand the practices of the particular company and industry in which they are working |
| CO2 | Apply their knowledge and skills acquired in the classroom to a professional context |
| CO3 | Identify, write and carry out performance objectives related to their job assignment |
| CO4 | Successfully reflect on the quality of the contribution they have made to the organization |

### Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

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SEMESTER – IV
### 19CSCS4061
**PROJECT – PART B**

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## COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

- **CO1** Develop and implement proposed methodologies
- **CO2** Validate the methodology with the requirements of the problem
- **CO3** Compare proposed methodology with existing technologies to do performance analysis.
- **CO4** Prepare the quality technical Report with professional ethics
- **CO5** Prepare and conduct oral presentations

### Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

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