CO401U COMPILER DESIGN

Teaching Scheme: 03L + 00T, Total: 03 **Credit:** 03
Evaluation Scheme: 10 ISA + 30 MSE+ 60 ESE **Total Marks:** 100
Duration of ESE: 03 Hrs.

Course Description: This course gives the introduction to system programming and compiler construction. It also gives the knowledge role of a lexical analyzer, specification of tokens, recognition of tokens, Lexical analyzer generator LEX, role of parser, context free grammars, eliminating ambiguity, eliminating left recursion, Top-Down parser. This course also gives the idea about Syntax Directed Translation and Intermediate Code Generation using different techniques such as DAG, Three address codes, etc. At the end this course gives the information about the runtime environment and issues in code generation.

Desirable Awareness/skills:
Discrete Structure and Graph Theory, Theory of Computation

Course Objectives:
The objectives of offering this course are to:

1. describe the utility of different system programs & system tools.
2. familiarize with the trade-offs between run-time and compile-time processing (linking & loading techniques).
3. explore the use of compiler with its phases.
4. use of syntax directed scheme for intermediate code generation.
5. construct& use of different compiler tools as LEX, YACC for code generation & optimization.

Course Outcomes:
On the successful completion of this course, student shall be able to:

1. assess the functionalities & components of system software & tools into different layers for efficient code generation.
2. revise the knowledge & technique to develop solutions to real world problems by compiling application programs.
3. evaluate computer engineering problems with proper systematic & semantic approach

Course Outcomes (COs) and Program Outcomes (POs) , Course Outcomes (COs) and Program Specific Outcomes (PSOs) , mapping with strength of correlation

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	1	3	-	-	-	1	-	-	-	2	1	3	2	1
2	-				3	-	1	1	2	-		1	2	-	1
3	1	2	-	-	2	1	-		2	-		1	2	2	1

1-Weakly correlated 2 – Moderately correlated 3 – Strongly correlated

Course contents:

Introduction: Introduction to compiler, translators, interpreter, single and multi-pass compilers, phases of compilers, compiler construction tools, cross compilers

Lexical Analyzer: Role of lexical analyzer, specification of tokens, recognition of tokens, regular expression, finite automata, regular expression to finite automata transition diagrams, tool for lexical analyzer LEX.

Syntax Analysis and Parsing Techniques: Introduction to parsing techniques, bottom-up parsing and top down parsing. top down parsing , recursive descent parsing, predictive parsing ,bottom up parsing : operator precedence parsing, LR parsers, construction of SLR, canonical LR and LALR parsing tables, construction of SLR parse tables for ambiguous grammar, the parser generator tools – YACC, error recovery in top down and bottom up parsing.

Syntax Directed Translation & Intermediate Code Generation: Syntax directed definitions, synthesized and inherited attributes, dependency graph, construction of syntax trees, bottom up and top down evaluation of attributes, s-attributed and l-attributed definitions ,postfix notation, three address codes, quadruples, triples and indirect triples, translation of assignment statements, control flow, boolean expression, case statements and procedure calls.

Type Checking and Runtime Environments: Introduction, simple type checker, type conversions, overloading of functions and operators, source language issues, storage organization, storage allocation strategies, parameter passing, symbol tables, dynamic storage allocation techniques,

Code Optimization & Code Generation: Basic blocks and flow graphs, optimization of basic blocks, loop optimization, global data flow analysis, loop invariant computations, DAG representation of basic blocks, peephole optimization, issue in the design of code generator, register allocation, the target machine, and simple code generator.

Text Books:

1. Compilers-Principles, Techniques and Tools, Alfred V. Aho, Ravi Sethi and Ullman J.D.,Addison Wesley.
2. Principle of Compiler Design, Alfred V. Aho, and J.D. Ullman, Narosa Publication.
3. K C. Louden “Compiler Construction—Principles and Practice” India Edition, CENGAGE

Reference Books:

1. Compiler design in C, A.C. Holub, PHI.
2. Compiler construction (Theory and Practice), A.Barrett William and R.M. Bates, Galgotia Publication.
3. D. M. Dhamdhere, Compiler Construction—Principles and Practice, (2/e), Macmillan India

CO402U CRYPTOGRAPHY AND NETWORK SECURITY

Teaching Scheme: 03L + 00T, Total: 03 **Credit:** 03
Evaluation Scheme: 10 ISA + 30 MSE+ 60 ESE **Total Marks:** 100
Duration of ESE: 03 Hrs.

Course Description: This course will provide students with a practical and theoretical knowledge of cryptography and network security

Desirable Awareness/skills:
Computer network, Essential need of security

Course Objectives:
The objectives of offering this course are to:

1. understand Cryptography Theories, Algorithms and Systems.
2. understand necessary Approaches and Techniques to build protection mechanisms in order to secure computer networks.

Course Outcomes:
On the successful completion of this course student shall be able to;

1. revise concepts of finite mathematics and number theory.
2. examine common network vulnerabilities and attacks, defence mechanisms against network attacks, and cryptographic protection mechanisms.
3. justify possible threats to different defence mechanisms and different ways to protect against these threats.
4. analyzethe concepts related to applied cryptography, including plaintext, ciphertext, symmetric cryptography, asymmetric cryptography, and digital signatures

Course Outcomes (COs) and Program Outcomes (POs) , Course Outcomes (COs) and Program Specific Outcomes (PSOs) , mapping with strength of correlation

CO	Program Outcomes (POs)											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	2	1	1	1	3	2	1	2	1	1	3	2	1	1
2	3	1	1	2	2	1	1	2	1	2	3	1	2	1
3	3	1	1	1	2	2	1	2	1	1	3	3	1	2
4	2	1	1	2	3	2	1	2	1	1	3	3	2	2

1-Weakly correlated **2 – Moderately correlated** **3 – Strongly correlated**

Course Contents:

Computer and Network Security Concepts: Security Attacks, Security Mechanisms, Security Mechanisms, Fundamental Security Design Principles, Attack Surfaces and Attack Trees, A model for Network Security,

Introduction to Number Theory: Divisibility and Division Algorithm,The Euclidean algorithm, modular arithmetic, prime numbers, Fermat's and Euler's Theorems, Testing for primality, the Chinese remainder algorithm, discrete logarithms.

Symmetric Key Ciphers: Symmetric Key Ciphers, Substitution Techniques, Transposition techniques, Rotor machines, Steganography

Block ciphers and the DES: Traditional Block cipher Structure, DES, DES example, the strength of DES, block cipher design principles

Asymmetric Cryptography: RSA, Key Distribution and Management,Diffie-Hellman Key Exchange, Elliptic Curve Cryptography, hash functions: The MerkleDamgard Construction, **Message Digest algorithms**: MD5, Secure Hash algorithm (SHA), Message Authentication Codes **Authentication and Web Security:** Digital Signatures, Authentication Protocols, Kerberos, X.509 Digital Certificate Standard, Pretty Good Privacy, Secure Socket Layer, Secure Electronic Transaction. Zero knowledge proof

Network Security: Intruders, Intrusion Detection, Password Management, Worms, viruses, Trojans, Virus Countermeasures, Vulnerabilities in TCP/IP model, Firewalls, Firewall Design Principles, Next generation of Firewall

Text Books:

1. V. K. Pachghare, "Cryptography and Information Security", 2nd edition, PHI Learning, ISBN: 978-81-203-5082-3.
2. Charlie Kaufman, Radia Perlman, and Mike Speciner, Network Security: Private Communication in a Public World, Prentice Hall, ISBN 0-13-046019-2.

Reference Books:

1. William Stallings, "Cryptography and Network Security, Principles and Practices", Pearson Education, Fifth Edition, ISBN: 0-13-60970-9.
2. Christopher M. King, "Security architecture, design deployment and operations", Curtis Patton and RSA Press, ISBN: 0072133856.
3. Stephen Northcatt, Lenny Zeltser, "INSIDE Network Perimeter Security", Pearson Education Asia, Second Edition, ISBN: 978-0735712324.
4. Robert Bragge, Mark Rhodes, HeithStraggberg, "Network Security the Complete Reference", Tata McGraw Hill Publication, ISBN: 9780072226973.

CO403UA IMAGE PROCESSING

Teaching Scheme: 03L + 00T, Total: 03 **Credit:** 03
Evaluation Scheme: 10 ISA + 30 MSE+ 60 ESE **Total Marks:** 100
Duration of ESE: 03 Hrs.

Course Description:

This course is an introduction to the fundamental concepts and techniques in basic digital image processing and their applications to solve real life problems. The topics covered include Digital Image Fundamentals, Image Transforms, Image Enhancement, Restoration and Compression, Morphological Image Processing, Nonlinear Image Processing, and Image Analysis. Application examples are also included.

Desirable Awareness/skills :

Probability and Statistics,Applied Math and Algorithms,Distributed Computing

Course Objectives:

The objectives of offering this course are to:

1. study the image fundamentals and mathematical transforms necessary for image processing.
2. study the image enhancement techniques
3. study image restoration procedures.
4. study the image compression procedures.

Course Outcomes:

On the successful completion of this course student shall be able to;

1. revise a knowledge of a broad range of fundamental image processing and image analysis techniques and concepts (linear and non-linear filtering, denoising, deblurring, edge detection, line finding, detection, morphological operators, compression, shape metrics and feature based recognition)
2. select and justify knowledge by analysing image processing problems and recognising and employing (or proposing) effective solutions.
3. compose practical solutions to a range of common image processing problems and to critically assess the results of their solutions.

Course Outcomes (COs) and Program Outcomes (POs) , Course Outcomes (COs) and Program Specific Outcomes (PSOs) , mapping with strength of correlation

CO	Program Outcomes (POs)											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2	2	1	3	1	-	2	2	2	3	1	1	1
2	3	3	2	1	2	1	1	2	3	2	2	2	1	2
3	2	3	2	-	2	2	-	1	1	1	3	3	2	1

1-Weakly correlated 2 – Moderately correlated 3 – Strongly correlated

Course contents:

Introduction: Origins of digital image processing, uses in digital image processing, fundamental Steps in Digital Image Processing, Components of image processing system,

Digital Image Fundamentals: Elements of Visual Perception, Image Sensing and Acquisition, Image Sampling and Quantization, Relationships between pixels, Introduction to the Mathematical tools.

Image Enhancement and Restoration:

Basic Intensity transformation functions: image negatives, Log transformation, Power-law transformation, Piecewise linear transformations, Histogram processing. Fundamental of spatial filtering: Image smoothing, Image sharpening. Frequency domain enhancement: 2D DFT, FFT, DCT, Smoothing and Sharpening in frequency domain.

Homomorphic filtering & Restoration: Noise models, Restoration using inverse filtering and Wiener filtering**Color Image Processing:** Color fundamentals & models – RGB, HSI,YIQ, Pseudo color image processing and Full color image processing, Color transformation, color image compression. **Wavelets and Multi-resolution Processing:** Image pyramids, sub-band coding, the fast wavelet transform ,Wavelet transform in two dimensions.

Image Compression: Fundamentals,Image compression models,Elements of Information Theory –Error Free Compression – Lossy Compression – Compression Standards – JPEG/MPEG.

Image Segmentation and Morphological Operations: Image Segmentation: Point Detections, Line detection, Edge Detection,First order derivative Prewitt and Sobel. Second order derivative – LoG, DoG, Canny. Edge linking, Hough Transform, Thresholding – Global Thresholding, optimal global thresholding Otsu's Method. Region Growing, Region Splitting and Merging.**Morphological Operations:** Dilation, Erosion,Duality, Opening, Closing, Hit-or-Miss transform, Basic morphological algorithms

Image Features Representation, Description, and Object Recognition: Boundary representation, chain code, Boundary descriptors: shape number, Fourier Descriptor and Statistical moments, Region descriptors,use of principal components for description; patterns and pattern classes;decision theoretic and structural methods.

Text Books:

1. Rafael C. Gonzalez and Richard E. Woods, "Digital Image Processing", Third Edition, - Pearson Education
2. Anil K Jain, "Fundamentals of Digital Image Processing", PHI.
3. S Sridhar, "Digital Image Processing", Oxford University Press.

Reference Books:

1. Rafael C. Gonzalez and Richard E. Woods, "Digital Image Processing", Third Edition,Pearson Education,2008.
2. A. K. Jain, Fundamentals of Digital Image processing, Pearson Education, 2009.
3. S Sridhar, "Digital Image Processing", Oxford University Press.
4. R. C. Gonzalez, R. E. Woods and S. L. Eddins, Digital Image Processing using MATLAB, Pearson Education, 2004.

CO403UB BIOINFORMATICS

Teaching Scheme: 03L + 00T, Total: 03 **Credit:** 03
Evaluation Scheme: 10 ISA + 30 MSE+ 60 ESE **Total Marks:** 100
Duration of ESE: 03 Hrs.

Course Description: This course provides a comprehensive view of the BioInformatics principles and its applications in engineering. The goals of the course are to understand the basic principles of Bioinformatics and their applications in the field of Biotechnology.

Desirable Awareness/skills:
Biology,Basic Computer Network, Database management System

Course Objectives:
The objectives of offering this course are to:

1. identify various Bioinformatics tools to visualize and build small applications
2. make students familiar with the fundamental concepts of bioinformatics.
3. develop the algorithms for sequencing and alignments.
4. study and use various tools and biological databases for genomics.

Course Outcomes:
On the successful completion of this course student shall be able to;

1. rate the basics of biology required to work in the field of bioinformatics
2. estimate various algorithms for sequencing and alignments and measure the proof of concepts for the algorithm studied with some sample data
3. evaluate the molecular biology techniques for drug design for various diseases.

Course Outcomes (COs) and Program Outcomes (POs) , Course Outcomes (COs) and Program Specific Outcomes (PSOs) , mapping with strength of correlation

CO	Program Outcomes (POs)											PSO		
	1	2	3	4	5	6	7	8	9	1	1	1	2	3
1	1	2	1	3	3	1	-	2	2	1	2	2	2	1
2	2	3	3	1	2	1	1	2	3	2	3	3	2	1
3	3	2	3	1	1	2	3	3	3	2	2	2	1	1

1-Weakly correlated 2 – Moderately correlated 3 – Strongly correlated

Course contents:

Bioinformatics and internet-Historical overview of Bioinformatics, Bioinformatics Applications,Tools for web search, Genbank Sequence Databases-Introduction, primary and secondary databases, format v/s contents, Data mining of biological databases, the Genbank flat files and its format, submitting DNA sequence to database -DNA/RNA, Databases : DDBJ, EMBL, Genbank, Structure database- PDB, Molecular modelling database at NCBI, structure file format.

Sequence Alignment and Database searching -Introduction, types of sequence alignment, Algorithms for sequence alignment: Needlemen-Wunsch and Smith-Waterman algorithm, Methods of pairwise sequence alignment, Database similarity searching: FASTA, BLAST, Substitution Score and Gap penalties, PAM matrix, Multiple sequence alignment, Hidden markov models and threading methods.

Predictive Methods using DNA sequence -Introduction, Open reading frame based gene prediction, Procedure for gene prediction, Gene prediction in microbial genomes, Gene prediction in eukaryotes, Promoter prediction in E.Coli, Promoter prediction in eukaryotes, Gene finding methods: GRAIL, GENSCAN, PROCRUSTES, Gene parser.

Prediction of RNA structure: Introduction, Sequence and base pairing patterns for structure prediction, Methods predicting RNA structure: Energy minimization and identification of base covariation, Prediction of protein structure :- Introduction, Protein structure description, Protein structure classification in databases, Structural alignment methods, Protein structure prediction by amino acid sequence: use of sequence patterns, Prediction of secondary structure, Prediction of 3D structure.

Phylogenetic Analysis -Introduction, Elements of phylogenetic models, Phylogenetic data analysis, Relation between Phylogenetic analysis and multiple sequence alignment, Tree Evaluation, Methods for Tree building: Maximum Childhood, Parsimony method, Distance methods, Phylogenetic software,Internet accessible phylogenetic analysis software.

Public Domain Database and Analysis tools-Data visualization,Microarray/sage,Molecular dynamic simulation, bioinformatics programming tool kit, microscopic image analysis and automated gel analysis,protein drum docking,integratedsuite,mathematical tool.

Text Books:

1. Bioinformatics: A Modern Approach,Vittal.R.Srinivas,2005 by PHI.
2. Bioinformatics: Methods and Applications, S.C.Rastogi, N.Mendiratta, P.Rastogi, PHI.

Reference Books:

1. T.K.Attwood and Parry . Smith D.J, Introduction to Bioinformatics, 2nd Edition,Pearson Education Ltd, South Asia,ISBN 0471-383910
2. Bioinformatics,Andreas D. Baxevanis, Wiley International
3. Bioinformatics: Methods and Applications, S.C.Rastogi, N.Mendiratta, P.Rastogi, PHI.

CO403UC SOFTWARE METRICS AND QUALITY ASSURANCE

Teaching Scheme: 03L + 00T, Total: 03 **Credit:** 03
Evaluation Scheme: 10 ISA + 30 MSE+ 60 ESE **Total Marks:** 100
Duration of ESE: 03 Hrs.

Course Description: This course introduces the students about the concepts of software measurement and metrics. It includes scope of software metrics, internal product attributes, and external product attributes Software quality and quality assurance techniques. This course also describes cost estimation, documentation and testing tools, etc.

Desirable Awareness/Skills: Software Engineering

Course Objectives:

The objectives of offering this course are to:

1. learn the basics of software measurement
2. learn cost estimation of software.
3. learn different quality assurance techniques for software.

Course Outcomes:

On the successful completion of this course, students shall be able to

1. select the basics of software measurement.
2. estimate cost of software.
3. choose the correct testing tools.

Course Outcomes (COs) and Program Outcomes (POs) , Course Outcomes (COs) and Program Specific Outcomes (PSOs) , mapping with strength of correlation

CO	Program Outcomes (POs)											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	2	1	1	1	3	2	1	2	1	1	3	2	1	1
2	3	1	1	2	2	1	1	2	1	2	3	2	1	1
3	3	1	1	1	2	2	1	2	1	1	3	2	1	1

1-Weakly correlated **2 – Moderately correlated** **3 – Strongly correlated**

Course Contents:

Introduction to Software Measurement: measurement in everyday life, measurement in Software Engineering, the scope of software metrics, the representational theory of measurement, measurement

and Models,measurement scales and scales types, meaningfulness in measurement, classifying software measures and determining what to measure.

Measuring internal product attributes: measuring internal product attributes: size,aspects of software size, length & reuse, functionality & complexity measuring internal product attributes: Structure, types of structural measures - control flow structures, modularity and information flow attributes & data structures, difficulties with general complexity measures.

Measuring external product attributes: software quality - modelling software quality & measuring aspects of quality, software reliability:basics of reliability theory, the software reliability problem, parametric reliability growth models, predictive accuracy, the importance of the operational environment

Cost estimation & Documentation: making Process Predictions - Good Estimates,cost estimation-Problems and approaches,models of Effort and cost,software Documentation

Quality Assurance Techniques: quality assurance techniques- testing principles, goals, testing life cycle, phases of testing manual testing- test case design criteria, automated testing introduction of testing tools- Jmeter, Win Runner, QTP, selenium etc..ISO-9000 model, SEIís CMM Model, comparison of the ISO-9000 model with SEI's CMM model.

Text Books:

1. Flanton, Pfleeger, ìSoftware Metrics- A Rigorous and Practical Approach Thompson Learning.

2. Mordechai Ben-menachem/Garry S.Marliss, ìSoftwareQuality, Thompson Learning.

3. Software Testing, Second Edition By: Ron Patton,Pearson Education ISBN -13: 978-0-672-32798-8.

Reference Books:

1. Roger S. Pressman, ìSoftware Engineering- A PractitionerísApproach, TMH.

2. Paul C. Jorgensen, "Software Testing", IVth Edition, O'REILLY.

CO404UA WEB AND INTERNET

Teaching Scheme: 03L + 00T, Total: 03 **Credit:** 03
Evaluation Scheme: 10 ISA + 30 MSE+ 60 ESE **Total Marks:** 100
Duration of ESE: 03 Hrs.

Course Description: This course introduces the students about the concepts of publishing content on the World Wide Web. This includes the 'language of the Web' – HTML, the fundamentals of how the Internet and the Web function, a basic understanding of graphic production with a specific stress on creating graphics for the Web, and a general grounding introduction to more advanced topics such as programming and scripting. This will also expose students to the basic tools and applications used in Web publishing.

Desirable Awareness/skills: Web Designing and publishing

Course Objectives:

The objectives of offering this course are to:

1. Get familiar with the concept of Search Engine Basics.
2. Learn WebService Essentials.
3. Get familiar with the basics of the Internet.
4. Gain the ability to develop responsive web applications.

Course Outcomes:

On the successful completion of this course students shall be able to;

1. assess SEO Objectives and Develop an SEO plan prior to Site Development.
2. select different Web Services Standards.
3. interprete Rich Internet Application.
4. revise interactive web page(s) using HTML, CSS and JavaScript.

Course Outcomes (COs) and Program Outcomes (POs), Course Outcomes (COs) and Program Specific Outcomes (PSOs) , mapping with strength of correlation

CO	PO											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	2	3	3	2	3	1	1	2	2	1	2	1	1	1
2	3	2	2	1	2	1	1	1	2	1	1	1	1	1
3	2	2	2	-	2	-	2	3	3	2	2	1	-	-
4	3	3	3	2	3	2	1	3	1	-	3	1	1	1

1-Weakly correlated 2 – Moderately correlated 3 – Strongly correlated

Course Contents:

Introduction to Web and Internet: Basics of internet, Addresses of names for the internet,Web object and Sites,E-mail, World wide web, file transfer,the telnet,the usenet,Internet chat. Introduction to Web servers like Apache 1.1, IIS XAMPP(Bundle Server), WAMP(Bundle Server),Handling HTTP Request and Response, installations of above servers, HTML and CSS: HTML 5.0 , CSS 3, Proxy server.

Network and security Programming using java:Network Programming,URLClasse ,Socket and server socket Classes,Programming for security:java security and cryptographic packages.

Web browser and security, Web Publishing:,The fast ready connection on the web, web browser, Web Cache,Netscape navigator 4x and 5x.,Netscape communication suits, firewalls, data security, Overview, SGML, Web hosting, HTML. CGL, Documents Interchange Standards,,Components of Web Publishing, Document management, Web Page Design.

Creating the websites and home page:the HTML programming Basic, Syntax and rules, Tables, Frame,Forms, Example of HTML Pages,Choice of Pages colour, Banner,linking to other Pages, Labels, Image, Sound and video clip linking with HTML Page,Web page editing tool-Front page

Searching and web casting techniques :Introduction to search engine, Search Engine for internet, Spiders, Robots, Bots, Internet Agent,,Mobile agent,Meta Search Sites **.**Interactivity Tool: ASP, VB Script, JAVA Script, JAVA and Front Page, Flash, subscribing,Channels, how to get found or hidden data from search engine, Introduction to React .

Text Books:

1. Deitel and Deitel and Nieto, ―Internet and World Wide Web - How to Program‖, Prentice Hall, 5th Edition, 2011.
2. Raj Kamal, "Internet and Web Technologies", Tata McGraw-Hill.
3. Dr. Hiren Joshi, Web Technology and Application Development, DreamTech, ISBN No. 978-93-5004-088-1.
4. Roger S. Pressman, David Lowe, Web Engineering, Tata Mcgraw Hill Publication, Sixth Edition, ISBN No. 978-0073523293.
5. AchytGodbole, AtulKahate, Web Technologies, McGraw Hill, Second Edition, ISBN No.9383286571

Reference Books:

1.Mishra, "Web Engineering And Applications", Macmillan Publishers India
2. Emilia Mendes, and Nile Mosley, "Web Engineering", Springer

CO404UB MANAGEMENT INFORMATION SYSTEM

Teaching Scheme: 03L + 00T, Total: 03 **Credit:** 03
Evaluation Scheme: 10 ISA + 30 MSE+ 60 ESE **Total Marks:** 100
Duration of ESE: 03 Hrs.

Course Description:
Management Information Systems (MIS) is a formal discipline within business education that bridges the gap between computer science and well-known business disciplines such as finance, marketing, and management.

Desirable Awareness/skills: Enterprise Resource Planning, Finance Management information system.

Course Objectives:
The objectives of offering this course are to:

1. retrieve, propagate and store the data.
2. control the organizations.
3. make the system efficient with the help of effective planning.

Course Outcomes:
On the successful completion of this course student shall be able to;

1. revise sound managerial concepts and principles in the development and operation of information
2. prepare systems analysis, IS design and project management concepts.
3. revise technical concepts in information technology.

Course Outcomes (COs) and Program Outcomes (POs), Course Outcomes (COs) and Program Specific Outcomes (PSOs) , mapping with strength of correlation

CO	PO											PSO		
	1	2	3	4	5	6	7	8	9	1	1	1	2	3
1	2	1	2	1	3	1	1	2	1	2	3	1	1	1
2	3	3	3	1	3	2	2	3	2	2	3	1	1	1
3	2	3	2	3	2	1	3	3	3	2	3	1	1	1

1-Weakly correlated 2 – Moderately correlated 3 – Strongly correlated

Course contents:

Introduction to Management Information System: Introduction, Importance of Information, Role of Information in Management, MIS and its Definition, Systems Concept, Characteristics of Useful Information, Information System Process, Computer Based Information Systems, Aims of Studying MIS, MIS and Operational Information, Management Information System and Academics, MIS and the User.

MIS and Information Technology: Characteristics of IT Impacting Industries, Data Processing, Transaction Processing, Application Process, Information System Processing, Impact of the Management Information System, Management Information System and Computer.

Nature of Management Information: Levels of Management Focus, Levels of Organizational Groups, Nature of Collaboration, Objectives of Management Tasks, Information Flow Direction and Source, Managerial Tasks and Functions, Content and Presentation of Information, How Information Supply is Initiated.

Importance of Software and Hardware in MIS: Computer Hardware Basics, Computer Software Basics, Importance of Software Application in Management.

Communication and Computer Networks in MIS: Development of Telecommunication, Elements of Communication Systems, Computer Network: Local Area Network, Wide Area Network, Difference between LAN and WAN, Network Topology, The Internet.

Support Models and Knowledge Management: Transaction Processing Systems, Online Analytical Processing (OLAP), Decision Support System (DSS), Executive Information System (EIS), Groupware, Group Decision Support System, Barcode System, Barcode Applications.

Business Process and Design Development Processes: The Basic Business Processes: Basic Business Decision Making, Buying and Selling Activities, Conversion, Support Functions, Systems Concept: Control of Systems, System Performance Standards, Systems Approach.

Security and Ethical Issues: Introduction, A Model for thinking about Ethical, Social and Political Issues, Five Moral Dimensions of The Information Age, Key Technology Trends that Raise Ethical Issues, Acceptable Behavior on the Networks: New Standards of Conduct, Netiquette, Acceptable Use Policies, Exporting Through the Networks, Copyrights.

Text Books:

1. Management Information System, Prof. H. N. Verma, Dr.RajendraTakle, Prof. M. K. Ghadoliya.

Reference Books:

1. Management Information System, Managing the digital firm, Kenneth Laudon, Jane Laudon.
2. Management Information System, Ken J. Sousa, Effy Oz
3. Management Information System, Rayond McLeod, George Schell.

CO404UC DATA ANALYTICS

Teaching Scheme: 03L + 00T, Total: 03 **Credit:** 03
Evaluation Scheme: 10 ISA + 30 MSE+ 60 ESE **Total Marks:**100
Duration of ESE: 03 Hrs.

Course Description: Data Analysis is an ever-evolving discipline with lots of focus on new predictive modelling techniques coupled with rich analytical tools that keep increasing our capacity to handle big data.

Desirable Awareness/skills: Structured Query Language (SQL),R or Python-Statistical Programming, Machine Learning

Course Objectives:

The objectives of offering this course are to:

1. Develop problem solving abilities using Mathematics.
2. Apply algorithmic strategies while solving problems.
3. Develop time and space efficient algorithms.

Course Outcomes:

On the successful completion of this course student shall be able to:

1. Assess case studies in business analytic and intelligence using mathematical models.
2. Prepare a survey on applications for business analytic and intelligence.
3. Construct problem solutions for multi-core or distributed, concurrent/parallel environments.

Course Outcomes (COs) and Program Outcomes (POs), Course Outcomes (COs) and Program Specific Outcomes (PSOs) , mapping with strength of correlation

CO	PO											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2	3	3	2	2	3	3	2	2	3	3	2	2
2	1	2	2	1	3	3	2	2	2	1	2	3	2	1
3	3	2	3	3	2	2	2	3	3	2	3	3	2	1

1-Weakly correlated 2 – Moderately correlated 3 – Strongly correlated

Course contents:

Introduction and Life Cycle: Introduction: Big data overview, state of the practice in Analytics- BI Vs Data Science, Current Analytical Architecture, drivers of Big Data, Emerging Big Data Ecosystem and new approach. Data Analytic Life Cycle: Overview, phase 1- Discovery, Phase 2- Data preparation, Phase 3- Model Planning, Phase 4- Model Building, Phase 5- Communicate Results, Phase 6- Opearationalize. Case Study: GINA

Basic Data Analytic Methods: Statistical Methods for Evaluation- Hypothesis testing, difference of means, wilcoxon rank–sum test, type 1 type 2 errors, power and sample size, ANNOVA. Advanced Analytical Theory and Methods: Clustering- Overview, K means- Use cases, Overview of methods, determining number of clusters.

Association Rules and Regression: Advanced Analytical Theory and Methods: Association Rules- Overview, a-priori algorithm, evaluation of candidate rules, case study-transactions in grocery store, validation and testing, diagnostics. Regression- linear, logistics, reasons to choose and cautions, additional regression models.

Classification: Decision trees- Overview, general algorithm, decision tree algorithm, evaluating a decision tree. Naïve Bayes – Bayes‟ Algorithm, Naïve Bayes‟ Classifier, smoothing, diagnostics. Diagnostics of classifiers, additional classification methods.

Big Data Visualization:Introduction to Data visualization, Challenges to Big data visualization, Conventional data visualization tools, Techniques for visual data representations, Types of data visualization, Visualizing Big Data, Tools used in data visualization, Analytical techniques used in Big data visualization.

Advanced Analytics-Technology and Tools: Analytics for unstructured data- Use cases, Map Reduce, Apache Hadoop. The Hadoop Ecosystem- Pig, HIVE, HBase, Mahout, NoSQL. An Analytics Project- Communicating, operationalizing, creating final deliverables, Google Analytics.

Text Books:

1. David Dietrich, Barry Hiller, “Data Science and Big Data Analytics", EMC education services, Wiley publications, 2012, ISBN 0-07-120413-X

2. AshutoshNandeshwar , “Tableau Data Visualization Codebook”, Packt Publishing, ISBN 978-1-84968-978-6

Reference Books:

1. Maheshwari Anil, Rakshit, Acharya, “Data Analytics”, McGraw Hill, ISBN: 789353160258.

2. Mark Gardner, “Beginning R: The Statistical Programming Language”, Wrox Publication, ISBN: 978-1-118-16430-3

3. LuísTorgo, “Data Mining with R, Learning with Case Studies”, CRC Press, Talay and Francis Group, ISBN9781482234893

CO405UA SOFTWARE METRICS AND QUALITY ASSURANCE

Teaching Scheme: 03L + 00T, Total: 03 **Credit:** 03
Evaluation Scheme: 10 ISA + 30 MSE+ 60 ESE **Total Marks:** 100
Duration of ESE: 03 Hrs.

Course Description: This course introduces the students about the concepts of software measurement and metrics. It includes scope of software metrics, internal product attributes, and external product attributes Software quality and quality assurance techniques. This course also describes cost estimation, documentation and testing tools, etc.

Desirable Awareness/Skills: Software Engineering

Course Objectives:

The objectives of offering this course are to:

1. learn the basics of software measurement
2. learn cost estimation of software.
3. learn different quality assurance techniques for software.

Course Outcomes:

On the successful completion of this course, students shall be able to

1. select the basics of software measurement.
2. estimate cost of software.
3. choose the correct testing tools.

Course Outcomes (COs) and Program Outcomes (POs) , Course Outcomes (COs) and Program Specific Outcomes (PSOs) , mapping with strength of correlation

CO	Program Outcomes (POs)											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	2	1	1	1	3	2	1	2	1	1	3	2	1	1
2	3	1	1	2	2	1	1	2	1	2	3	2	1	1
3	3	1	1	1	2	2	1	2	1	1	3	2	1	1

1-Weakly correlated 2 – Moderately correlated 3 – Strongly correlated

Course Contents:

Introduction to Software Measurement: measurement in everyday life, measurement in Software Engineering,the scope of software metrics, the representational theory of measurement, measurement

and Models,measurement scales and scales types, meaningfulness in measurement, classifying software measures and determining what to measure.

Measuring internal product attributes: measuring internal product attributes: size,aspects of software size, length & reuse,functionality & complexity,measuring internal product attributes: Structure, types of structural measures - control flow structures, modularity and information flow attributes & data structures,difficulties with general complexity measures.

Measuring external product attributes: software quality - modelling software quality & measuring aspects of quality, software reliability:basics of reliability theory, the software reliability problem, parametric reliability growth models, predictive accuracy, the importance of the operational environment

Cost estimation & Documentation: making Process Predictions - Good Estimates,cost estimation-Problems and approaches,models of Effort and cost,software Documentation

Quality Assurance Techniques: quality assurance techniques- testing principles, goals, testing life cycle, phases of testing manual testing- test case design criteria, automated testing introduction of testing tools- Jmeter, Win Runner, QTP, selenium etc..ISO-9000 model, SEI's CMM Model, comparison of the ISO-9000 model with SEI's CMM model.

Text Books:

1. Flanton, Pfleeger, Software Metrics- A Rigorous and Practical Approach Thompson Learning.
2. Mordechai Ben-menachem/Garry S.Marliss, Software Quality , Thompson Learning.
3. Software Testing, Second Edition By: Ron Patton,Pearson Education ISBN -13: 978-0-672-32798-8.

Reference Books:

1. Roger S. Pressman, Software Engineering- A Practitioners Approach, TMH.
2. Paul C. Jorgensen, "Software Testing", IVth Edition, O'REILLY.

CO405UB INFORMATION STORAGE AND MANAGEMENT

Teaching Scheme: 03L + 00T, Total: 03 **Credit:** 03
Evaluation Scheme: 10 ISA + 30 MSE+ 60 ESE **Total Marks:** 100
Duration of ESE: 03 Hrs.

Course Description:
This course introduces the students to recent trends of information storage and management on cloud.

Desirable awareness/skills:
Basics of storage management and networking.

Course Objectives:
The objectives of offering this course are to:

1. understand data creation, the amount of data being created, the value of data to a business, challenges in data storage and data management,
2. understand solutions available for data storage, Core elements of a data center infrastructure, role of each element in supporting business activities

Course Outcomes:
On the successful completion of this course, students are able to;

1. arrange the concept of data storage in a distributed environment in a data centre,
2. compare challenges in data storage and management technologies.
3. design solutions available for data storage, Core elements of a data center infrastructure, role of each element in supporting business activities

Course Outcomes (COs) and Program Outcomes (POs) , Course Outcomes (COs) and Program Specific Outcomes (PSOs) , mapping with strength of correlation

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1		2		-	-	-	-	-	1	-		1	2	1	1
2	1	-		-	2	-	-	-		1	3	-	2	1	2
3		-	3	-	-	-	-	-	2	-		-	1	1	1

1-Weakly correlated 2 – Moderately correlated 3 – Strongly correlated

Course Contents:
Introduction to Information Storage and Management: Information Storage-Data, Types of Data, Information, Storage,Evolution of Storage Technology and Architecture,Data Center Infrastructure-Core Elements, Key Requirements for Data Center Elements, Managing Storage Infrastructure.Key Challenges in Managing Information. Information Lifecycle- Information Lifecycle Management, ILM Implementation, ILM Benefits.

Data Protection: Implementation of RAID- Software RAID, Hardware RAID.RAID Array Components.RAID Levels - Striping, Mirroring, Parity, RAID 0, RAID 1, Nested RAID, RAID 3, RAID 4, RAID 5, RAID 6,RAID Comparison.

Direct-Attached Storage and Introduction to SCSI: Types of DAS- Internal DAS, External DAS. DAS Benefits and Limitations. Disk Drive Interfaces- IDE/ATA, SATA, Parallel SCSI.Introduction to Parallel SCSI- Evolution of SCSI, SCSI Interfaces, SCSI-3 Architecture, Parallel SCSI Addressing.SCSI Command Model- CDB Structure, Operation Code, Control Field, Status

Storage Area Networks: Fibre Channel: Overview,The SAN and Its Evolution,Components of SAN-Node Ports, Cabling, Interconnect Devices, Storage Arrays, SAN Management Software.FC Connectivity- Point-to-Point, Fibre Channel Arbitrated Loop, Fibre Channel Switched Fabric.Fibre Channel Ports.Fibre Channel Architecture- Fibre Channel Protocol Stack, Fibre Channel Addressing, FC Frame, Structure and Organization of FC Data, Flow Control, Classes of Service, Zoning, Fibre Channel Login Types.FC Topologies- Core-Edge Fabric, Mesh Topology.

Network-Attached Storage: General-Purpose Servers vs. NAS Devices, Benefits of NAS, NAS File I/O- File Systems and Remote File Sharing, Accessing a File System, File Sharing,Components of NAS,NAS Implementations- Integrated NAS, Gateway NAS, Integrated NAS Connectivity, Gateway NAS Connectivity.NAS File-Sharing Protocols- NFS, CIFS.NAS I/O Operations- Hosting and Accessing Files on NAS, Factors Affecting NAS Performance and Availability.

IP SAN:
iSCSI - Components of iSCSI, iSCSI Host Connectivity, Topologies for iSCSI Connectivity, iSCSI Protocol Stack, iSCSI Discovery, iSCSI Names, iSCSI Session, iSCSI PDU, Ordering and Numbering, iSCSI Error Handling and Security.FCIP - FCIP Topology, FCIP Performance and Security.

Text Book:

1. John Wiley & Sons, Information Storage and Management, EMC Education Services. Wiley Publishing. Inc 2010

Reference Books:

1. Somasundaram G, AlokShrivastava, “ISM – Storing, Managing and Protecting Digital Information”, EMC Education Services, Wiley India, New Delhi, 2012.
2. Gerald J Kowalski, Mark T Maybury, “Information Storage and Retrieval Systems: Theory and Implementation”, BS Publications, New Delhi, 2009.
3. Robert Spalding, “Storage Networks: The Complete Reference”, Tata McGraw Hill, New Delhi, 2006

CO406U COMPILER DESIGN LAB

Teaching Scheme: 02P Total: 02 **Credit:** 01
Evaluation Scheme: 25 ICA + 25 ESE **Total Marks:** 50
Duration of ESE: 03 Hrs.

Course Description:

Minimum 10 experiments (five from group A and five from group B) shall be performed to cover the entire curriculum of course CO401U. The list given below is just a guideline. All assignments are to be implemented using open source technology (preferably). Every assignment should include use of syntax, use of command/function used for coding and printout of code with proper comment and output.

GROUP A

1. Design a lexical analyzer for a given language and the lexical analyzer should ignore redundant spaces, tabs and newlines.
2. Write a program to identify whether a given line is a comment or not.
3. Write a program to recognize strings under 'a*', 'a*b+', 'abb'.
4. Write a program to simulate lexical analyzer for validating operators.
5. Simulate First and Follow of a Grammar**.**
6. Write a program for constructing LL (1) parsing.
7. Write a program to Design LALR Bottom up Parser.

Group B

1. Write a program to implement operator precedence parsing
2. Design of a Predictive parser of given language
3. Write a program to generate machine code from abstract syntax tree generated by the parser
4. Write a program to check whether a string belongs to a grammar or not
5. Implement Deterministic Finite Automata
6. Implementation of shift reduce parsing algorithm

NOTE:

ICA – Internal Continuous Assessment shall support regular performance of practical and its regular assessment. In addition; it shall be based on knowledge/skill acquired and record submitted by the student (journal) based on practical performance by him/her. The performance shall be assessed experiment wise using internal continuous assessment format (S 10).

ESE – The End Semester Examination (ESE) for this laboratory course shall be based on performance in one of the experiments performed by student in the semester followed by sample questions to judge the depth of understanding/knowledge or skill acquired by the student. It shall be evaluated by two examiners out of which one examiner shall be out of institute.

CO407U CRYPTOGRAPHY AND NETWORK SECURITY LAB

Teaching Scheme: 02P Total: 02 **Credit:** 01
Evaluation Scheme: 25 ICA + 25 ESE **Total Marks:** 50
Duration of ESE: 03Hrs.

Course Description: Minimum 08 experiments from Group A shall be performed to cover the entire curriculum of course CO 402U. The list given below is just a guideline. All assignments are to be implemented using open source technology (preferably). Every assignment should include use of syntax, use of command/function used for coding and printout of code with proper comment and output.

Group A:

1. Study papers on a network security topic and write a study report
    a. Wireless Network Security,
    b. Key Exchange Protocols,
    c. Block chain.
2. Write a program that contains a string (char pointer) with a value \Hello World'. The program should AND or and XOR each character in this string with 127 and display the result
3. Design and implement a symmetric encryption algorithm based on Feistel structure.
4. Implement DES and RSA Algorithms.
5. Demonstrate how Diffie-Hellman key exchange works with Man-In-The-Middle attack.
6. Study different approaches for Anti-virus software and write one document.
    a. Examine files to look for viruses by means of a virus dictionary
    b. Identifying the suspicious behavior from any computer program which might indicate infection
7. Calculate the message digest of a text using the SHA-1 algorithm in JAVA.
8. Demonstrate intrusion detection system (ids) using any tool (snort or any other s/w)
9. Study and demonstrate system hacking and write a report.
    a. How to crack a password?
    b. How to use Ophcrack / Crowbar / John the Ripper / Aircrack-ng to Crack Passwords

NOTE:

ICA – Internal Continuous Assessment shall support regular performance of practical and its regular assessment. In addition; it shall be based on knowledge/skill acquired and record submitted by the student (journal) based on practical performance by him/her. The performance shall be assessed experiment wise using internal continuous assessment format (S 10).

ESE – The End Semester Examination (ESE) for this laboratory course shall be based on performance in one of the experiments performed by student in the semester followed by sample questions to judge the depth of understanding/knowledge or skill acquired by the student. It shall be evaluated by two examiners out of which one examiner shall be out of institute.

CO408UA IMAGE PROCESSING LAB

Teaching Scheme: 02P Total: 02 **Credit:** 01
Evaluation Scheme: 25 ICA + 25 ESE **Total Marks:** 50
Duration of ESE: 03 Hrs.

Course Description: Minimum 10 experiments (five from group A and five from group B) shall be performed to cover the entire curriculum of course CO403U-A. The list given below is just a guideline. All assignments are to be implemented using open source technology (preferably). Every assignment should include use of syntax, use of command/function used for coding and printout of code with proper comment and output.

GROUP A

1. Write a program to enhance an image using image arithmetic and logical operations.

2. Program for image enhancement using histogram equalization in python

3. Program for digital Image Processing using Fourier Transform in Python.

4. Program to filter an image using averaging low pass filter in spatial domain and median filter in Python.

5. Program for smooth an image using Low and High pass filtering on images using FFT.

6. Program for Geometric transformation in image processing using python code.

GROUP B

1. Python program to Colour Detection using Pandas &OpenCV

2. Point Processing in Image Processing using Python-OpenCV

3. Python program to edge detection using OpenCV in Python using Sobel edge detection and laplacian method

4. Python program to illustrate Dilation and Erosion morphological operation on an image.

5. Python program to illustrate Opening and Closing morphological operation on an image.

6. Program to demonstrate how to add watermarks to an image using a python pillow.

Text Books:

1. Rafael C. Gonzalez and Richard E. Woods, “Digital Image Processing”, Third Edition, - Pearson Education
2. Anil K Jain, “Fundamentals of Digital Image Processing”, PHI.
3. S Sridhar, “Digital Image Processing”, Oxford University Press.

Reference Books:

1. Rafael C. Gonzalez and Richard E. Woods, “Digital Image Processing”, Third Edition - Pearson Education, 2008.
2. A. K. Jain, Fundamentals of Digital Image processing, Pearson Education, 2009.
3. S Sridhar, “Digital Image Processing”, Oxford University Press.
4. R. C. Gonzalez, R. E. Woods and S. L. Eddins, Digital Image Processing using MATLAB, Pearson Education, 2004.
5. W. K. Pratt, Digital Image Processing, John Wiley & Sons, 2006.
6. S. Ahmed, Image Processing, McGraw -Hill, 1994.
7. S. J. Solari, Digital Video and Audio Compression, McGraw-Hill, 1997

NOTE:

ICA – Internal Continuous Assessment shall support regular performance of practical and its regular assessment. In addition; it shall be based on knowledge/skill acquired and record submitted by a student (journal) based on practical performance by him/her. The performance shall be assessed experiment wise using internal continuous assessment format (S 10).

ESE – The End Semester Examination (ESE) for this laboratory course shall be based on performance in one of the experiments performed by students in the semester followed by sample questions to judge the depth of understanding/knowledge or skill acquired by the student. It shall be evaluated by two examiners out of which one examiner shall be out of institute.

CO408UB BIOINFORMATICS LAB

Teaching Scheme: 02P Total: 02 **Credit:** 01
Evaluation Scheme: 25 ICA + 25 ESE **Total Marks:** 50
Duration of ESE: 03 Hrs.

Course Description:

Minimum 10 experiments (five from group A and five from group B) shall be performed to cover the entire curriculum of course CO403U-B. The list given below is just a guideline. All assignments are to be implemented using open source technology (preferably). Every assignment should include use of syntax, use of command/function used for coding and printout of code with proper comment and output.

GROUP A

1. Biological Databases with Reference to Expasy and NCBI.

2. Sequence similarity searching using BLAST.

3. Pairwise sequence alignment.

4. Finding the official symbol,alias name ,chromosome number and ID for gene using NCBI.

5. Retrieval and analysis of a gene sequence “AF375082” in FASTA format

6.Retrieval of a Genbank Entry using an accession number.

GROUP B

1.Primary structure analysis of a protein.

2. Secondary structure analysis of a protein.

3. Retrieval and analysis of protein sequence from protein database.

4. Pairwise sequence alignment and multiple sequence alignment using BLAST.

5. Conversion of Gene sequence into its corresponding amino acid sequence

6. To search the similar sequence of given query using Basic Local Alignment Search Tool (BLAST).

Text Books:

1. Andreas D. Baxevanis and B. F. Francis Ouellette, Bioinformatics A Practical Guide to the Analysis of Genes and Proteins by, Second Edition, a john wiley& sons, inc., publication
2. Arthur M. Lesk, Introduction to Bioinformatics , Oxford University Press Inc., New York
3. Janusz M. Bujnicki, Practical Bioinformatics, SPRINGER (SIE)
4. Bioinformatics Concepts, Skills and Applications by, S. C. Rastogi, CBS; 2 edition.

Reference Books:

1. T.K.Attwood and Parry. Smith D.J, Introduction to Bioinformatics, 2nd Edition,Pearson Education Ltd, South Asia,ISBN 0471-383910
2. Bioinformatics,Andreas D. Baxevanis, Wiley International
3. Bioinformatics: Methods and Applications, S.C.Rastogi, N.Mendiratta, P.Rastogi, PHI.

NOTE:

ICA – Internal Continuous Assessment shall support regular performance of practical and its regular assessment. In addition; it shall be based on knowledge/skill acquired and record submitted by a student (journal) based on practical performance by him/her. The performance shall be assessed experiment wise using internal continuous assessment format (S 10).

ESE – The End Semester Examination (ESE) for this laboratory course shall be based on performance in one of the experiments performed by students in the semester followed by sample questions to judge the depth of understanding/knowledge or skill acquired by the student. It shall be evaluated by two examiners out of which one examiner shall be out of institute.

CO408UC SOFTWARE METRICS AND QUALITY ASSURANCE LAB

Teaching Scheme: 02P Total: 02 **Credit:** 01
Evaluation Scheme: 25 ICA + 25 ESE **Total Marks:** 50
Duration of ESE: 03 Hrs.

Course Description:

Minimum 8 experiments from Group A shall be performed to cover the entire curriculum of course CO403U-C. The list given below is just a guideline. All assignments are to be implemented using open source technology (preferably). Every assignment should include use of syntax, use of command/function used for coding and printout of code with proper comment and output. Use of Open source tools/ technology is recommended for laboratory assignments.

1. To perform the effort estimation based on project specification.
2. Program for finding Length of program.
3. Implementation of program for finding Length of program using Lines of Code.
4. Program for measuring Size of program using AlbrechtsMethod.Implementationof program for measuring size of program using Function Point Calculation Albrechts method.
5. Write a test case for any known application.
6. Create a test plan document for any application.
7. Study of any testing tool.
8. Study of any web testing tool.
9. Study of any test management tool.
10. Schedule estimation using Gantt chart.

NOTE:

ICA – Internal Continuous Assessment shall support regular performance of practical and its regular assessment. In addition; it shall be based on knowledge/skill acquired and record submitted by the student (journal) based on practical performance by him/her. The performance shall be assessed experiment wise using internal continuous assessment format (S 10).

ESE – The End Semester Examination (ESE) for this laboratory course shall be based on performance in one of the experiments performed by student in the semester followed by sample questions to judge the depth of understanding/knowledge or skill acquired by the student. It shall be evaluated by two examiners out of which one examiner shall be out of institute.

CO409U PROFESSIONAL INTERNSHIP

Teaching Scheme: 00P Total: 00 **Credit:** 01
Evaluation Scheme: 25 ICA + 0 ESE **Total Marks:** 25

Course Description:

This course gives opportunity to students to explore the knowledge of industry organization, new trends in manufacturing, maintenance and safety and also gives actual work experience with exposure to industrial environment or boosts entrepreneurial aspirations or analytical skills to solve real life problem as per student interest

Desirable awareness/skills:

Listening, understanding and analyzing ability along with the knowledge of concepts, principles and techniques studied earlier.

Course Objectives:

The objectives of offering this course are to:

1. introduce the basic industries and the process/product development cycle.
2. be familiar with the industrial environment and work culture
3. learn the importance of entrepreneurial skills.
4. emphasizes intuitive understanding and practical implementations of the theoretical concepts conducive to quest for knowledge and its applicability on the job.

Course Outcomes:

On the successful completion of this course, students are able to;

1. demonstrate the ability to face industrial environment/ world of work
2. evaluate and analyze the role of various sections such as manufacturing, material handling, maintenance, safety and environmental considerations, hr and top and middle management in industry
3. organize work culture in core or IT industry as a employee or employer

Course Outcomes (COs) and Program Outcomes (POs) , Course Outcomes (COs) and Program Specific Outcomes (PSOs) , mapping with strength of correlation

CO	PO											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	3	3	1	3	-	-	-	3	-	2	3	2	3
2	3	1	-	2	-	1	2	1	3	-	2	2	2	2
3	2	3	2	3	2	2	2	2	3	3	3	2	2	3

1-Weakly correlated 2 – Moderately correlated 3 – Strongly correlated

Course Content-cum-instructions:

This course shall be completed preferably during the summer vacation after sixth semester but in exceptional cases can be completed during the winter vacation after seventh semester or during the weekends of seventh semester. Under any circumstances; this course shall be completed before the commencement of eighth semester. Industrial visit Industry visits for minimum four industries local or outstation shall be carried out by each student. Department shall arrange the industrial visits during the summer/winter vacations after sixth/seventh semester or in exceptional cases weekends during the seventh semester. Industries shall be related to solar energy/ power electronics/ telecom sector/ computer hardware-software/ manufacturing/ automobile automation/ bio-tech-agriculture sector/power station, Tv-radio station/ sugar-chemical factory/ any other relevant industry approved by course coordinator.

For this course, the instructions andr guidelines of AICTE shall be followed. The guidelines, instructions and various format Can be obtained using following link:

https://www.aicte-india.org/sites/default/files/AICTE%20Internship%20Policy.pdf

In addition to above Industrial Training:

Individual or group of students shall undergo industrial training in any industry of own interest and convenience related to any interdisciplinary topic/field/ nature for minimum one week fulltime or two weeks part time so that total training period should be more than 40 hours

Course Deliverable

Every student shall submit the appropriate (visit/training/attendance/visit for special study) certificate along with a report in the format provided by department/course coordinator duly signed by course coordinator and HoD. Evaluation system It includes Internal Continuous Assessment (ICA) and Guidelines for ICA are given bellow.

Internal Continuous Assessment (ICA) The ICA shall be evaluated by course coordinator appointed by the HoD. Course coordinator shall judge the student on the basis of presentation, deliverables of the course described earlier. The guidelines and format prescribed by AICTE may be used for ICA

https://www.aicte-india.org/sites/default/files/AICTE%20Internship%20Policy.pdf

CO410U INDUSTRIAL LECTURE

Teaching Scheme: 01TH Total: 01 **Credit:** 01
Evaluation Scheme: 25 ICA + 00 ESE **Total Marks**: 25
Duration of ESE: 00 Hrs

Course Description:

This course introduces institutes committed to creation and growth of technological knowledge of students. Also, it helps to bridge the gap between industry needs and the academic community.

Course Objectives:

The objectives of offering this course are to:

1. bridge the gap between industry needs and the academic community.
2. develop the ability of students as per expectations of the industrialists from the fresh engineers.
3. make students familiar with the industrial environment.
4. communicate the industrial experience, attitudes, needs, and viewpoints of industrial experts to students.
5. provide appropriate exposure to the world of work.

Course Outcomes:

On the successful completion of this course, students are able to:

1. demonstrate the ability to face industrial environment/ world of work
2. evaluate and analyze the role of various sections such as manufacturing, material handling, maintenance, safety and environmental considerations, hr and top and middle management in industry
3. organize work culture in core or IT industry as a employee or employer

Course Outcomes (COs) and Program Outcomes (POs) , Course Outcomes (COs) and Program Specific Outcomes (PSOs) , mapping with strength of correlation

CO	PO											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	3	3	1	3	-	-	-	3	-	2	3	2	3
2	3	1	-	2	-	1	2	1	3	-	2	2	2	2
3	2	3	2	3	2	2	2	2	3	3	3	2	2	3

4. 1-Weakly correlated 2 – Moderately correlated 3 – Strongly correlated

Course Content:

1. There shall be a minimum 6 lectures of 60 -90 minutes duration by industry persons.
2. The lecture shall include presentation, informal discussions with students and faculty, and laboratory tours (if required).
3. Topics of Industrial Lectures shall be Technical in nature and should not be the specific part of the curriculum.
4. Typically speakers should:
    i. Their own career following (and sometimes including) university
    ii. Interesting jobs they've had or projects they've worked on
    iii. What areas of work they're currently involved in
    iv. The type of work graduates could expect
    v. Current job opportunities that may be available
    vi. Any suggestions for students with regard to job hunting / CV writing / interviews etc.
5. Course coordinator shall discuss with students on the content of lecture and may conduct oral or give written assignments to judge the depth of understanding of students.
6. Students shall submit the report based on a minimum five lectures giving a summary of the lecture delivered.
7. The summary should contain a brief resume of the expert, brief information of his organization and brief summary of the lecture in the format provided by the institute/department.

Industrial Lecture deliverables: An industrial lecture report as per the specified format (available on in the department and institutes website) and assignments given by course coordinator (if any).

NOTE:

ICA-Internal Continuous Assessment shall support the regular performance of industrial lecture and its regular assessment. In addition; it shall be based on knowledge/skill acquired and record submitted by the student based on lectures attended by him/her.

CO411U PROJECT PHASE -I

Teaching Scheme: 00L + 00T + 02P, Total: 02 **Credit:** 02
Evaluation Scheme: 25 ICA+25 ESE **Total Marks**: 50

Course Description: The project is one of the most important single pieces of work in the degree programme. It is introduced in the curriculum to put into practice some of the techniques that have been taught to students in earlier years. It also provides the opportunity to students to demonstrate independence and originality, to plan and organise a large project over a long period. The project topic should be selected to ensure the satisfaction of the need to establish a direct link between the techniques they learnt and productivity. Thus it should reduce the gap between the world of work and the world of study.

Desirable awareness/skills:

Knowledge of concepts, principles and techniques studied in all earlier courses.

Course Objectives:

The objectives of offering this course are to:

1. design or investigation of a technical problem.
2. explores the knowledge of design, experiment and analysis of data.
3. develop ability to synthesize knowledge and skills previously gained and to put some of them into practice
4. make students capable of selecting from different methodologies, methods and forms of analysis studied to produce a suitable system or subsystem.
5. plan and organise a large project over a long period.
6. inculcate ability to present the findings of their technical solution in a written report.

Course Outcomes:

On the successful completion of this course student shall be able to

1. organize work in a team.
2. manage leadership quality among students.
3. apply techniques and engineering skills.

Course Outcomes (COs) and Program Outcomes (POs), Course Outcomes (COs) and Program Specific Outcomes (PSOs) , mapping with strength of correlation

CO	PO											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	1	2	-		3	3	1	1	1	1	3	1	1	1
2	-	-	1		1	-		-	-	-	-	2	1	1
3		3		1	1	-		-	-	-	-	3	2	1

1-Weakly correlated 2 – Moderately correlated 3 – Strongly correlated

Guidelines for completing the Project phase I:

1. It is expected that the broad area of Project phase-I shall be finalized by the student in the beginning of the VII semester.

2. A group of Maximum 4 students shall be allotted for Project phase-I and same project group for Project phase-II

3. Exhaustive survey of literature based on a clear definition of the scope andfocus of the topic should be carried out by the students. The **Synopsis/Abstract** on the selected topic, after a detailed literature survey, should be submitted to the Project coordinator appointed by the Head of the department.

4. Project phase -I may involve literature survey, problem identification, work methodology preparing specification and material procurement, collection of data. The project work shall involve sufficient work so that students get acquainted with different aspects of fabrication, design or analysis.

5. Approximately more than 40% work should be completed by the end of VII semester.

6. Each student group is required to maintain a logbook for documenting various activities of Project-I and submit group project report in the form of thermal bound as per the guidelines at the end of semester –VII.

7. Evaluation Committee composed of the Guide, Project Coordinator and Expert appointed by the Head of the department will award the marks based on the work completed by the end of semester and the presentation based on the project work.

Guidelines for ICA: The Internal Continuous Assessment shall be based on the active participation of the students in the Project work and knowledge / skill acquired, originality of the work, innovations brought in, research and developmental efforts, depth and applicability, etc.

Assessment of the project-I for award of ICA marks shall be done jointly by the guide and departmental committee as per the guidelines given in the following table.

Assessment of Project phase-I (ICA)

Title of the Project: _____

Name of the Guide: _____

Sr. No	**Problem Identification and project objectives (5M)**	**Literature Survey (10M)**	**Progress Status (5M)**	**Project Methodology/ Design/PCB/ hardware/ simulation/ programming (10M)**	**Report Writing (5M)**	**Depth of Understanding (5M)**	**Presentation (10)**	**Total (50M)**

CO451U DISTRIBUTED SYSTEMS

Teaching Scheme: 03L + 00T, **Total:** 03 **Credit:** 03
Evaluation Scheme: 10 ISA + 30 MSE+ 60 ESE **Total Marks:** 100
Duration of ESE: 03 Hrs.

Course Description: The course introduces the main principles underlying distributed systems, processes, communication, naming, synchronization, consistency, fault tolerance, and security.

Desirable awareness/skills:
Students shall have the basic knowledge of operating systems and networks.

Course Objectives:
The objectives of offering this course are to:
1. study the concepts of Distributed Operating System
2. study Methods of understanding clock synchronization protocols.
3. introduce the concepts of file system implementation in DOS.

Course Outcomes:
At the end of this course, students shall be able to:
1. apply the core concepts of distributed systems: the way in which several machines orchestrate to correctly solve problems in an efficient, reliable and scalable way.
2. compare the middleware technologies that support distributed applications such as RPC, RMI and object based middleware.
3. interpret the techniques, skills, and modern engineering tools necessary for engineering practices learned in the distributed system
4. assess distributed systems/applications.

Course Outcomes (COs) and Program Outcomes (POs) , Course Outcomes (COs) and Program Specific Outcomes (PSOs) , mapping with strength of correlation

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	1	2	3	-	-	-	-	-	1	-	3	1	2	1	1
2	1	-	3	-	2	-	-	-	2	1	3	1	3	2	1
3	1	-	3	-	-	-	-	-	2	-	3	1	3	2	2
4	1	2	3	-	-	-	-	-	1	-	3	1	2	2	1

1-Weakly correlated 2 – Moderately correlated 3-Strongly correlated

Course Contents:
Fundamentals: What is a distributed computing system, Evolution of distributed computing systems, distributed computing system models, Why are distributed computing systems gaining popularity,

What is a distributed operating system?, Issues in designing a distributed operating system, Introduction to distributed computing environment(DCE).

Message Passing: Introduction, Desirable features of a good message-passing system, Issues in IPC by message passing, Synchronization, Buffering, Multidatagram messages, Encoding and decoding of message data, Process addressing, Failure handling, Group communication, Case study:4.3BSD UNIX IPC mechanism.

Remote Procedure Calls: Introduction, The RPC model, Transparency of RPC, Implementing RPC mechanism, Stub generation, RPC messages, Marshaling arguments and results, Server management, Parameter-passing semantics, Call semantics , Communication protocols for RPCs, Complicated RPCs, Client- server binding, Exception handling, Security, Some special types of RPCs,RPC in heterogeneous environments, lightweight RPC, optimizations for better performance, Case studies: Sun RPC, DCE, RPC.

Distributed Shared Memory: Introduction, General architecture of DSM systems, Design and implementation issues of DSM, Granularity, Structure of shared memory space, Consistency models, Replacement strategy, Thrashing, Other approaches to DSM, Heterogeneous DSM, Advantages of DSM.

Synchronization: Introduction, Clock synchronization, Event ordering, Mutual exclusion, Deadlock, Election algorithms.

Resource Management: Introduction, Desirable features of a good global scheduling algorithm, Task assignment approach, Load-balancing approach, Load-sharing approach.

Process Management: Introduction, Process migration, Threads.

Distributed File System: Introduction, Desirable features of a good distributed file system, File models, file- accessing models, File-sharing semantics, File-caching schemes, File replication, Fault tolerance, Atomic transactions, Design principles, Case study:DCE Distributed file service.

Text Books:

1. Pradeep K.Sinha, Distributed Operating Systems Concepts and Design, PHI.,1998

Reference Books:

1. S.Ghosh, Chapman and Hall/CRC, Distributed Systems, Taylor & Francis Group, 2010.
2. M Singhal, N G Shivarathri, Advanced Concepts in Operating Systems, Tata McGraw-Hill Edition., 2001
3. A.S.Tanenbaum, Distributed Operating Systems, Pearson Education, 1995

CO452U CLOUD COMPUTING

Teaching Scheme: 03L + 00T, Total: 03 **Credit:** 03
Evaluation Scheme: 10 ISA + 30 MSE+ 60 ESE **Total Marks:** 100
Duration of ESE: 03 Hrs.

Course Description: The course introduces the main principles underlying cloud computing, virtualization, data storage, synchronization, consistency, fault tolerance, and security.

Desirable awareness/skills:
Students shall have the basic knowledge of cloud and networks.

Course Objectives:
The objectives of offering this course are to:

1. understand cloud computing concepts;
2. study various platforms for cloud computing
3. explore the applications based on cloud computing

Course Outcomes:
On the successful completion of this course student shall be able to;

1. design cloud computing environments.
2. select any one type of cloud
3. propose future trends of cloud computing

Course Outcomes (COs) and Program Outcomes (POs) , Course Outcomes (COs) and Program Specific Outcomes (PSOs) , mapping with strength of correlation

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	1	2	3	-	-	-	-	-	1	-	3	1	2	2	1
2	1	-	3	-	2	-	-	-	2	1	3	1	2	2	1
3	1	-	3	-	-	-	-	-	2	-	3	1	2	2	1

1-Weakly correlated 2 – Moderately correlated 3– Strongly correlated

Course contents:

Basics of Cloud Computing : Overview, Applications, Intranets and the Cloud. Your Organization and Cloud Computing- Benefits, Limitations, Security Concerns. Software as a Service (SaaS)-Understanding the Multitenant Nature of SaaS Solutions, Understanding SOA. Platform as a Service (PaaS)-IT Evolution Leading to the Cloud, Benefits of Paas Solutions, Disadvantages of PaaS Solutions. Infrastructure as a Service (IaaS)-Understanding IaaS, Improving Performance through Load Balancing, System and Storage Redundancy, Utilizing Cloud-Based NAS Devices, Advantages, Server Types. Identity as a Service (IDaaS).

Data Storage and Security in Cloud: Cloud file systems: GFS and HDFS, BigTable, HBase and Dynamo Cloud data stores: Datastore and Simple DB GautamShrauf, Cloud Storage-Overview, Cloud Storage Providers. [Anthony T. Velte]3 Securing the Cloud- General Security Advantages of Cloud-Based Solutions, Introducing Business Continuity and Disaster Recovery. Disaster Recovery-Understanding the Threats.

Virtualization : Implementation Levels of Virtualization, Virtualization Structures/Tools and Mechanisms, Types of Hypervisors, Virtualization of CPU, Memory, and I/O Devices, Virtual Clusters and Resource Management, Virtualization for Data-Center Automation. Common Standards: The Open Cloud Consortium, Open Virtualization Format, Standards for Application Developers: Browsers (Ajax), Data (XML, JSON), Solution Stacks (LAMP and LAPP),Syndication (Atom, Atom Publishing Protocol, and RSS), Standards for Security.

Amazon Web Services: Services offered by Amazon Hands-on Amazon, EC2 - Configuring a server, Virtual Amazon Cloud, AWS Storage and Content Delivery Identify key AWS storage options Describe Amazon EBS Creating an Elastic Block Store Volume Adding an EBS Volume to an Instance Snap shotting an EBS Volume and Increasing Performance Create an Amazon S3 bucket and manage associated objects. AWS Load Balancing Service Introduction Elastic Load Balancer Creating and Verifying Elastic Load Balancer.

Ubiquitous Clouds and the Internet of Things : Cloud Trends in Supporting Ubiquitous Computing, Performance of Distributed Systems and the Cloud, Enabling Technologies for the Internet of Things (RFID, Sensor Networks and ZigBee Technology, GPS), Innovative Applications of the Internet of Things (Smart Buildings and Smart Power Grid, Retailing and Supply-Chain Management, Cyber-Physical System), Online Social and Professional Networking.

Future of Cloud Computing : How the Cloud Will Change Operating Systems, Location-Aware Applications, Intelligent Fabrics, Paints, and More, The Future of Cloud TV, Future of Cloud-Based Smart Devices, Faster Time to Market for Software Applications, Home-Based Cloud Computing, Mobile Cloud, Autonomic Cloud Engine, Multimedia Cloud, Energy Aware Cloud Computing, Jungle Computing. Docker at a Glance: Process Simplification, Broad Support and Adoption, Architecture, Getting the Most from Docker, The Docker Workflow.

Text Books:

1. Anthony T. Velte Toby J. Velte, Robert Elsenpeter, "Cloud Computing: A Practical Approach", 2010, The McGraw-Hill.

2. Dr. Kris Jamsa, " Cloud Computing: SaaS, PaaS, IaaS, Virtualization and more" , Wiley Publications, ISBN*:* 978-0-470-97389-9

3. GautamShrof, "ENTERPRISE CLOUD COMPUTING Technology Architecture, Applications, Cambridge University Press, *ISBN*: 9780511778476

Reference Books:

1. Dr. Kumar Saurabh,"Cloud Computing", Wiley Publication, ISBN10: 8126536039

2. Buyya, “Mastering Cloud Computing”, Tata McGraw Hill, ISBN-13: 978-1-25-902995-0,

3. Barrie Sosinsky,"Cloud Computing", Wiley India, ISBN: 978-0-470-90356-8

4. Kailash Jayaswal, “Cloud computing", Black Book, Dreamtech Press

5. Thomas Erl, Zaigham Mahmood and Ricardo Puttini, “Cloud Computing: Concepts, Technology and Architecture”, Pearson, 1st Edition, ISBN :978 9332535923, 9332535922

4. Tim Mather, Subra K, ShahidL.,Cloud Security and Privacy, Oreilly,ISBN-13 978-81-8404-815-5

CO453UA FUNDAMENTALS OF ARTIFICIAL NEURAL NETWORKS

Teaching Scheme: 03L + 00T, Total: 03 **Credit:** 03
Evaluation Scheme: 30 MSE + 10 ISA + 60 ESE **Total Marks:** 100
Duration of ESE: 03 Hrs.

Course Description: This course introduces the student Neural Network and some ANN algorithms.

Desirable awareness/skills:
It is assumed that the student shall have knowledge of probability theory and linear algebra. It is also assumed that the students have some experience of programming in a scientific computing environment.

Course Objectives:
The objectives of offering this course are to:

1. introduce the fundamental algorithms for pattern recognition
2. investigate the various classification and clustering techniques

Course Outcomes:
On the successful completion of this course student shall be able to;

1. examine ANN system
2. rate the major approaches in MLP.

Course Outcomes (COs) and Program Outcomes (POs) , Course Outcomes (COs) and Program Specific Outcomes (PSOs) , mapping with strength of correlation

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	1	2		-	-	-	-	-	1	-		1	1	1	1
2	1	-	3	-	2	-	-	-		1	3	1	2	1	1

1-Weakly correlated 2 – Moderately correlated 3 – Strongly correlated

Course Contents:
Unit 1: Introduction & History of Artificial Neural Networks, McCulloch Pitts Neuron, Thresholding Logic, Perceptrons, Perceptron Learning Algorithm.

Unit 2: Multilayer Perceptrons (MLPs), Representation Power of MLPs, Sigmoid Neurons, Gradient Descent, Feed forward Neural Networks, Representation Power of Feedforward Neural Networks.

Unit 3: Backpropagation, Momentum Based Gradient Descent (GD), Nesterov Accelerated GD, Stochastic GD, AdaGrad, RMSProp, Adam.
Unit 4: Eigenvalues & eigenvectors, Eigenvalue Decomposition, Basis, Principal Component Analysis and its interpretations, Singular Value Decomposition.

Unit 5: Auto encoders & relation to PCA, Regularization in auto encoders, Denoising auto encoders, Sparseautoencoders, Contractive auto encoders.

Unit 6: L1, L2 Regularization, Early stopping, Dataset augmentation, Parameter sharing and tying, Injecting noise at input, any other recent topics.

Text Books:

1. Deep Learning, Ian Goodfellow, YoshuaBengio, Aaron Courville, MIT Press, 2016
2. Neural Networks: A Systematic Introduction, Raúl Rojas, 1996

Reference Books:

1. NPTEL Video Lectures on Deep Learning, Weeks 1-6, by Prof.Prof.Mitesh M. Khapra
2. Introduction to artificial neural systems by Jacek M. Zurada
3. Pattern Recognition and Machine Learning, Christopher Bishop, 2007

CO453UB BIG DATA ANALYTICS

Teaching Scheme: 03L + 00T, Total: 03 **Credit:** 03
Evaluation Scheme: 30 MSE + 10 ISA + 60 ESE **Total Marks:** 100
Duration of ESE: 03 Hrs.

Course Description:

This course introduces the student about big data and big data analysis. also the tools required to manage and analyze big data like Hadoop, NoSql Map-Reduce

Desirable awareness/skills:

Data mining and data analysis, R/python/java

Course Objectives:

The objectives of offering this course are to:

1. understand big data for business intelligence.
2. learn business case studies for big data analytics.
3. Understand nosql big data management.
4. perform map-reduce analytics using Hadoop and related tool

Course Outcomes:

On the successful completion of this course, students are able to;

1. revise big data and use cases from selected business domains
2. setup NoSQL big data management
3. interpret installation, configuration, and run Hadoop and HDFS
4. propose map-reduce analytics using Hadoop
5. analyze Hadoop related tools such as HBase, Cassandra, Pig for big data analytics

Course Outcomes (COs) and Program Outcomes (POs) , Course Outcomes (COs) and Program Specific Outcomes (PSOs) , mapping with strength of correlation

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1		2		-	-	-	-	-		-		1	1	1	1
2		-		-	2	-	-	-	2	1	3	1	2	1	1
3	1	-	3	-	-	-	-	-		-		-	2	2	1
4	1	2	3	-	-	-	-	-	1	-	3	-	2	1	1
5		-		-	2	-	-	-	2	1	3	1	2	1	1

1-Weakly correlated 2 – Moderately correlated 3 – Strongly correlated

Course Contents:

Introduction to Big Data: Introduction to big data,convergence of key trends, unstructured data, industry examples of big data, web analytics, big data and marketing, fraud and big data, risk and big data, credit risk management, big data and algorithmic trading, big data and healthcare, big data in medicine, advertising and big data, big data technologies

Introduction to NoSQL, aggregate data models, aggregates, key-value and document data models, relationships, graph databases, schemaless databases, materialized views, distribution models, sharding, master-slave replication, peer-peer replication, sharding and replication, consistency, relaxing consistency, version stamps, map-reduce, partitioning and combining, composing map-reduce calculations

Introduction to Hadoop: Data format, analyzing data with Hadoop, scaling out, Hadoop streaming, Hadoop pipes, design of Hadoop distributed file system (HDFS), HDFS concepts, Java interface, data flow, Hadoop I/O, data integrity, compression, serialization, Avro, file-based data structure

MapReduce: MapReduce workflows, unit tests with MRUnit, test data and local tests, anatomy of MapReduce job run, classic Map-reduce, YARN, failures in classic Map-reduce and YARN, job scheduling, shuffle and sort, task execution, MapReduce types, input formats, output format. Algorithms Using MapReduce: Matrix-Vector Multiplication by MapReduce , Relational-Algebra Operations, Computing Selections by MapReduce, Computing Projections by MapReduce, Union, Intersection, and Difference by MapReduce, Computing Natural Join by MapReduce, Grouping and Aggregation by MapReduce, Matrix Multiplication, Matrix Multiplication with One MapReduce Step

Hbase: data model and implementations, Hbase clients, Hbase examples, praxis.Cassandra, Cassandra data model, Cassandra examples, Cassandra clients, Hadoop integration

Introduction to Pig, Grunt, pig data model, Pig Latin, developing and testing Pig Latin scripts. Hive, data types and file formats, HiveQL data definition, HiveQL data manipulation, HiveQL queries.

Text Books:

1. AnandRajaraman and Jeff Ullman “Mining of Massive Datasets”, Cambridge University Press, 2014
2. Alex Holmes “Hadoop in Practice”, Manning Press, Dreamtech Press. , 2014
3. Dan McCreary and Ann Kelly “Making Sense of NoSQL” – A guide for managers and the rest of us, Manning Press, 2013

Reference Books:

1. Michael Minelli, Michele Chambers, AmbigaDhiraj, “Big Data Big Analytics: Emerging Business Intelligence And Analytic Trends For Today's Businesses”, Wiley India , 2013
2. Judith Hurwitz, Alan Nugent, Dr. Fern Halper, Marcia Kaufman, “Big Data for Dummies”, Wiley India, 2013
3. Paul Zikopoulos, Chris Eaton, “Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data’, McGraw Hill Education., 2019

CO453UC INFORMATION STORAGE AND MANAGEMENT

Teaching Scheme: 03L + 00T, Total: 03 **Credit:** 03
Evaluation Scheme: 30 MSE + 10 ISA + 60 ESE **Total Marks:** 100
Duration of ESE: 03 Hrs.

Course Description:
This course introduces the student to recent trends of information storage and management on cloud.

Desirable awareness/skills:
Basics of storage management and networking.

Course Objectives:
The objectives of offering this course are to:
1. understand data creation, the amount of data being created, the value of data to a business, challenges in data storage and data management,
2. understand solutions available for data storage, Core elements of a data center infrastructure, role of each element in supporting business activities

Course Outcomes:
On the successful completion of this course, students are able to;
1. interpret the concept of data storage in a distributed environment in a data center,
2. examine challenges in data storage and management technologies.
3. justify solutions available for data storage, Core elements of a data center infrastructure, role of each element in supporting business activities

Course Outcomes (COs) and Program Outcomes (POs) , Course Outcomes (COs) and Program Specific Outcomes (PSOs) , mapping with strength of correlation

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1		2		-	-	-	-	-	1	-		1	1	1	1
2	1	-		-	2	-	-	-		1	3		1	1	1
3		-	3	-	-	-	-	-	2	-			1	2	1

1-Weakly correlated 2 – Moderately correlated 3 – Strongly correlated

Course Contents:
Introduction to Information Storage and Management:
Information Storage-Data, Types of Data, Information, Storage, Evolution of Storage Technology and Architecture.

Data Center Infrastructure: Core Elements, Key Requirements for Data Center Elements, Managing Storage Infrastructure. Key Challenges in Managing Information. Information Lifecycle-Information Lifecycle Management, ILM Implementation, ILM Benefits.

Data Protection: Implementation of RAID- Software RAID, Hardware RAID,RAID Array Components,RAID Levels - Striping, Mirroring, Parity, RAID 0, RAID 1, Nested RAID, RAID 3, RAID 4, RAID 5, RAID 6,RAID Comparison.

Direct-Attached Storage and Introduction to SCSI: Types of DAS- Internal DAS, External DAS. DAS Benefits and Limitations. Disk Drive Interfaces- IDE/ATA, SATA, Parallel SCSI,Introduction to Parallel SCSI- Evolution of SCSI, SCSI Interfaces, SCSI-3 Architecture, Parallel SCSI Addressing.

SCSI Command Model- CDB Structure, Operation Code, Control Field, Status

Storage Area Networks:

Fibre Channel: Overview,The SAN and Its Evolution,Components of SAN- Node Ports, Cabling, Interconnect Devices, Storage Arrays, SAN Management Software,FC Connectivity- Point-to-Point, Fibre Channel Arbitrated Loop, Fibre Channel Switched Fabric. Fibre Channel Ports.Fibre Channel Architecture- Fibre Channel Protocol Stack, Fibre Channel Addressing, FC Frame, Structure and Organization of FC Data, Flow Control, Classes of Service, Zoning, Fibre Channel Login Types.FC Topologies- Core-Edge Fabric, Mesh Topology.

Network-Attached Storage:

General-Purpose Servers vs. NAS Devices, Benefits of NAS.NAS File I/O- File Systems and Remote File Sharing, Accessing a File System, File Sharing.Components of NAS.NAS Implementations-Integrated NAS, Gateway NAS, Integrated NAS Connectivity, Gateway NAS Connectivity.NAS File-Sharing Protocols- NFS, CIFS.NAS I/O Operations- Hosting and Accessing Files on NAS, Factors Affecting NAS Performance and Availability.

IP SAN:

iSCSI - Components of iSCSI, iSCSI Host Connectivity, Topologies for iSCSI Connectivity, iSCSI Protocol Stack, iSCSI Discovery, iSCSI Names, iSCSI Session, iSCSI PDU, Ordering and Numbering, iSCSI Error Handling and Security.FCIP - FCIP Topology, FCIP Performance and Security.

Content-Addressed Storage(CAS):

Fixed Content and Archives, Types of Archives, Features and Benefits of CAS, CAS Architecture, Object Storage and Retrieval in CAS.CAS Examples- Health Care Solution: Storing Patient Studies, Finance Solution: Storing Financial Records.

Introduction to Business Continuity:

Information Availability- Causes of Information Unavailability, Measuring Information Availability, Consequences of Downtime.BC Terminology, BC Planning Lifecycle.Failure Analysis- Single Point of Failure, Fault Tolerance.Multipathing Software, Business Impact Analysis, BC Technology Solutions.

Text Book:

1. John Wiley & Sons, Information Storage and Management, EMC Education Services. Wiley Publishing. Inc 2010

Reference Books:

1. Somasundaram G, AlokShrivastava, “ISM – Storing, Managing and Protecting Digital Information”, EMC Education Services, Wiley India, New Delhi, 2012.
2. Gerald J Kowalski, Mark T Maybury, “Information Storage and Retrieval Systems: Theory and Implementation”, BS Publications, New Delhi, 2009.
3. Robert Spalding, “Storage Networks: The Complete Reference”, Tata McGraw Hill, New Delhi, 2006

CO454UA AD-HOC SENSOR NETWORKS

Teaching Scheme: 03L + 00T, Total: 03 **Credit:** 03
Evaluation Scheme: 10 ISA + 30 MSE+ 60 ESE **Total Marks:** 100
Duration of ESE: 03 Hrs.

Course Description:

This course introduces the student with different wireless network and routing protocols.

Desirable Awareness/skills :

Computer Network, basics of MANET

Course Objectives:

The objectives of offering this course are to:

1. understand the concepts of sensor networks
2. understand the MAC and transport protocols for adhoc networks
3. understand the security of sensor networks
4. understand the applications of adhoc and sensor networks
5. understand the concept of nod simulators

Course Outcomes:

On the successful completion of this course student shall be able to;

1. assess the basics of Ad hoc networks and Wireless Sensor Networks.
2. revise the knowledge to identify appropriate physical and MAC layer protocols
3. understand the transport layer and security issues possible in Ad hoc and sensor networks.
4. categorize OS used in Wireless Sensor Networks

Course Outcomes (COs) and Program Outcomes (POs) , Course Outcomes (COs) and Program Specific Outcomes (PSOs) , mapping with strength of correlation

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	-			3	-	-		2		3		1	1	1
2	2				2				1				2	2	1
3	2		2		1				1				1	1	1
4					1								1	1	1

1-Weakly correlated 2 – Moderately correlated 3 – Strongly correlated

Course contents:

Introduction to Ad Hoc Wireless Networks: Characteristics of MANETs, Applications of MANETs, Challenges.**Routing in MANETs:** Topology-based versus Position-based approaches, Topology based routing protocols, Position based routing, Other Routing Protocols.

Data Transmission In MANETs: The Broadcast Storm, Multicasting, Geocasting

TCP over Ad Hoc Networks: TCP Protocol overview, TOP and MANETs, Solutions for TOP over Ad Hoc.**Basics of Wireless Sensors and Applications:** The Mica Mote, Sensing and Communication Range, Design issues, Energy consumption, Clustering of Sensors, Applications**Data Retrieval In Sensor Networks:** Classification of WSNs, MAC layer, Routing layer, High-level application layer support, Adapting to the inherent dynamic nature of WSNs.

Security: Security in Ad hoc Wireless Networks, Key Management, Secure Routing, Cooperation in MANETs, Intrusion Detection Systems. Sensor Network Platforms and Tools: Sensor Network Hardware, Sensor Network Programming Challenges, Node-Level Software Platforms**Operating System — TinyOS Imperative Language**: nesC, Dataflow style language: T1nyGALS, Node-Level Simulators, ns-2 and its sensor network extension, TOSSIM

Text Books:

1. Ad Hoc and Sensor Networks — Theory and Applications, Car/osCorderlo Dharma R Aggarwal, World Scientific Publications /Cambridge University Press, March 2006
2. Wireless Sensor Networks: An Information Processing Approach, Feng Zhao, Leonidas Guibas, Elsevier Science imprint, Morgan Kauffman Publishers, 2005, rp 2009

Reference Books:

1. Adhoc Wireless Networks — Architectures and Protocols, C.Siva Ram Murthy, B.S.Murthy, Pearson Education, 2004
2. Wireless Sensor Networks — Principles and Practice, Fei Hu, Xiaojun Cao, An Auerbach book, CRC Press, Taylor & Francis Group, 2010
3. Wireless Ad hoc Mobile Wireless Networks — Principles, Protocols and Applications, Subir Kumar Sarkar, et al., Auerbach Publications, Taylor & Francis Group, 2008.
4. Ad hoc Networking, Charles E.Perkins, Pearson Education, 2001.
5. Wireless Ad hoc Networking, Shih-Liri Wu, Yu-Chee Tseng, Auerbach Publications, Taylor & Francis Group, 2007
6. Wireless Ad hoc and Sensor Networks — Protocols, Performance and Control, JagannathanSarangapani, CRC Press, Taylor & Francis Group, 2007, rp 2010.
7. Security in Ad hoc and Sensor Networks, Raheem Beyah, et al., World Scientific Publications / Cambridge University Press, 2010
8. Ad hoc Wireless Networks — A communication-theoretic perspective, OzanK.Tonguz, Gianluigi Ferrari, Wiley India, 2006, rp2009

CO454UB ADVANCED DEEP LEARNING

Teaching Scheme: 03L + 00T, Total: 03 **Credit:** 03
Evaluation Scheme: 10 ISA + 30 MSE+ 60 ESE **Total Marks:** 100
Duration of ESE: 03 Hrs.

Course Description: The goal of this course is to give learners a basic understanding of modern neural networks and their applications in computer vision and natural language understanding. The course starts with a recap of linear models and discussion of stochastic optimization methods that are crucial for training deep neural networks.

Desirable Awareness/skills: Machine Learning ,Applied Mathematics,Neural Networks

Course Objectives:

The objectives of offering this course are to:

1. learn deep learning methods for working with sequential data.
2. learn deep recurrent and memory networks
3. learn deep turing machines.
4. design deep learning mechanisms to various learning problems.
5. know the open issues in deep learning, and have a grasp of the current research directions

Course Outcomes:

On the successful completion of this course student shall be able to;

1. inspect the theory behind deep learning methods such as Convolutional Neural Networks.
2. inspectopen issues and trends in deep learning research.
3. comparewhen to use or avoid deep learning methods.

Course Outcomes (COs) and Program Outcomes (POs) , Course Outcomes (COs) and Program Specific Outcomes (PSOs) , mapping with strength of correlation

CO	PO											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	2	3	2	1	3	1	2	2	3	-	2	2	1	1
2	2	2	3	-	2	-	-	2	2	-	2	1	1	1
3	-	-	2	3	3	2	-	3	2	1	3	2	2	1

1-Weakly correlated 2 – Moderately correlated 3 – Strongly correlated

Course contents:

Introduction of Machine Learning and AI: Learning Algorithms Capacity, Overfitting and Underfitting, Hyper parameters and Validation Sets, Estimators, Bias and Variance, Maximum Likelihood Estimation. Bayesian Statistics Supervised Learning Algorithms and Unsupervised Learning Algorithms Building a Machine Learning Algorithm, Challenges Motivating Deep Learning.

Deep Learning Computation Layers and Blocks, Parameter Management, Deferred Initialization, Custom Layers, File I/O, GPUs.

Regularization for Deep Learning: Parameter Norm Penalties, Norm Penalties as Constrained Optimization, Regularization and Under-Constrained Problems, Dataset Augmentation, Noise Robustness, Semi-Supervised Learning, Multitask , Learning, Early Stopping, Parameter Tying and Parameter Sharing, Sparse presentations, Bagging and Other Ensemble Methods, Dropout, Adversarial Training, Tangent Distance, Tangent Prop and Manifold, Tangent Classifier .

ConvolutionalNetworks: The Convolution Operation, Motivation, Pooling, Convolution and Pooling as an Infinitely Strong Prior, Variants of the Basic Convolution Function, Structured Outputs, Data Type, Efficient Convolution Algorithms, Random or Unsupervised Features, The neuroscientific Basis for Convolutional, Networks, Convolutional Networks and the History of Deep Learning.

Sequence Modelling: Recurrent and Recursive Nets Unfolding Computational Graphs, Recurrent Neural Networks, Bidirectional RNNs, Encoder-Decoder, Sequence-to-Sequence, Architectures, Deep Recurrent Networks, Recursive Neural Networks, The Challenge of Long-Term Dependencies, Echo State Networks, Leaky Units and Other Strategies for Multiple Time Scales, The Long Short-Term Memory and Other Gated RNNs.

Text Books:

1.“Dive into Deep Learning” Release 0.16.1,Aston Zhang, Zachary C. Lipton, Mu Li, and Alexander J. Smola, Jun 2, 2021.

2.“Deep Learning”, Ian Goodfellow, YoshuaBengio ,AaronCourville, Published:10 November 2016, SBN:9780262337373, 0262337371

3. Deep Learning, Ian Goodfellow, YoshuaBengio, Aaron Courville, MIT Press, 2016

Reference books-

1.“Dive into Deep Learning” Release 0.16.1,Aston Zhang, Zachary C. Lipton, Mu Li, and Alexander J. Smola, Jun 2, 2021.

2.“Deep Learning”, Ian Goodfellow, YoshuaBengio ,AaronCourville, Published:10 November 2016, SBN:9780262337373, 0262337371

3. Neural Networks: A Systematic Introduction, Raúl Rojas, 1996
4. Introduction to artificial neural systems by Jacek M. Zurada
5. . Pattern Recognition and Machine Learning, Christopher Bishop, 2007

CO454UC DATA WAREHOUSING AND DATA MINING

Teaching Scheme: 03L + 00T, Total: 03 **Credit:** 03
Evaluation Scheme: 10 ISA + 30 MSE+ 60 ESE **Total Marks:** 100
Duration of ESE: 03 Hrs.

Course Description: This course introduces the students to learn and practice data modeling using various techniques of data mining. It also encourages use of data warehouse, OLAP to extract knowledgeable information for decision support systems.

Desirable Awareness/skills :

Knowledge of Database Management System

Course Objectives:

The objectives of offering this course are to:

1. understand the fundamentals of Data Mining
2. identify the appropriateness and need of mining the data
3. learn the preprocessing, mining and post processing of the data
4. understand various methods, techniques and algorithms in data mining

Course Outcomes:

On the successful completion of this course student shall be able to;

1. arrange basic, intermediate and advanced techniques to mine the data
2. measure the output generated by the process of data mining
3. evaluate the hidden patterns in the data
4. assess the mining process by choosing best data mining technique

Course Outcomes (COs) and Program Outcomes (POs) , Course Outcomes (COs) and Program Specific Outcomes (PSOs) , mapping with strength of correlation

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	1	2	3	-	-	-	-	-	1	-	3	1	2	1	1
2	1	-	3	-	2	-	-	-	2	1	3	1	3	1	2
3	1	-	3	-	-	-	-	-	2	-	3	1	2	1	1
4	1	2	3	-	-	-	-	-	1	-	3	1	2	1	1

1-Weakly correlated 2 – Moderately correlated 3– Strongly correlated

Course contents:

Introduction of Data Mining- Data Mining Task Primitives, Data: Data, Information and Knowledge; Attribute Types: Nominal, Binary, Ordinal and Numeric attributes, Discrete versus Continuous Attributes; Introduction to Data Preprocessing, Data Cleaning: Missing values, Noisy data; Data integration: Correlation analysis; transformation: Min-max normalization, z-score

normalization and decimal scaling; data reduction: Data Cube Aggregation, Attribute Subset Selection, sampling; and Data Discretization: Binning, Histogram Analysis.

Data Warehouse- Operational Database Systems and Data Warehouses(OLTP Vs OLAP), A Multidimensional Data Model: Data Cubes, Stars, Snowflakes, and Fact Constellations Schemas; OLAP Operations in the Multidimensional Data Model, Concept Hierarchies, Data Warehouse Architecture, The Process of Data Warehouse Design, A three-tier data warehousing architecture, Types of OLAP Servers: ROLAP versus MOLAP versus HOLAP.

Measuring Data Similarity and Dissimilarity- Proximity Measures for Nominal Attributes and Binary Attributes, interval scaled; Dissimilarity of Numeric Data: Minkowski Distance, Euclidean distance and Manhattan distance; Proximity Measures for Categorical, Ordinal Attributes, Ratio scaled variables; Dissimilarity for Attributes of Mixed Types, Cosine Similarity.

Association Rules Mining-Market basket Analysis, Frequent item set, Closed item set, Association Rules, a-priori Algorithm, Generating Association Rules from Frequent Item sets, Improving the Efficiency of a-priori, Mining Frequent Item sets without Candidate Generation: FP Growth Algorithm; Mining Various Kinds of Association Rules: Mining multilevel association rules, constraint based association rule mining, Meta rule-Guided Mining of Association Rules.

Classification-Introduction to: Classification and Regression for Predictive Analysis, Decision Tree Induction, Rule-Based Classification: using IF-THEN Rules for Classification, Rule Induction Using a Sequential Covering Algorithm. Bayesian Belief Networks, Training Bayesian Belief Networks, Classification Using Frequent Patterns, Associative Classification, Lazy Learners-k-NearestNeighbor Classifiers, Case-Based Reasoning.

Multiclass Classification- Semi-Supervised Classification, Reinforcement learning, Systematic Learning, Wholistic learning and multi-perspective learning. Metrics for Evaluating Classifier Performance: Accuracy, Error Rate, precision, Recall, Sensitivity, Specificity; Evaluating the Accuracy of a Classifier: Holdout Method, Random Sub sampling and Cross-Validation.

Text Books:

1. Han, Jiawei Kamber, Micheline Pei and Jian, “Data Mining: Concepts and Techniques”, Elsevier Publishers, ISBN:9780123814791, 9780123814807.
2. Parag Kulkarni, “Reinforcement and Systemic Machine Learning for Decision Making” by Wiley-IEEE Press, ISBN: 978-0-470-91999-6

Reference Books:

1. Matthew A. Russell, "Mining the Social Web: Data Mining Facebook, Twitter, LinkedIn, Google+, GitHub, and More" , Shroff Publishers, 2nd Edition, ISBN: 9780596006068
2. Maksim Tsvetovat, Alexander Kouznetsov, "Social Network Analysis for Startups:Finding connections on the social web", Shroff Publishers , ISBN: 10: 1449306462

CO455U DISTRIBUTED SYSTEMS LAB

Teaching Scheme: 02P Total: 02 **Credit:** 01
Evaluation Scheme: 25 ICA + 25 ESE **Total Marks:** 50

Minimum 10 experiments (five from Group A and five from Group B) shall be performed to cover the entire curriculum of course CO451U. The list given below is just a guideline. All assignments are to be implemented using open source technology (preferably). Every assignment should include use of syntax, use of command/function used for coding and printout of code with proper comment and output. Use of Open source tools/ technology is recommended for laboratory assignments.

Group A:

1. Design a distributed application using RMI for remote computation where client submits two strings to the server and server returns the concatenation of the given strings
2. Design a distributed application using RPC for remote computation where client submits an integer value to the server and server calculates factorial and returns the result to the client program.
3. Design a Distributed Application using Message passing Interface for remote computation.
4. Write a program to simulate the Distributed Mutual Exclusion.
5. Design distributed application which consists of a server and client using threads.
6. To study the World Wide Web
7. To study MPI
8. To study Enterprise JavaBeans and Fractal.
9. To study Java RMI

Group B:

1. Design and develop a distributed Hotel booking application using Java RMI.
A distributed hotel booking system consists of the hotel server and the client machines. The server manages hotel rooms booking information. A customer can invoke the following operations at his machine
i) Book the room for the specific guest
ii) Cancel the booking of a guest
2. Implement distributed system using lock server
3. Design and develop a distributed application to find the coolest/hottest year from the available weather data. Use weather data from the Internet and process it using MapReduce.
4. Write a program to implement a Distributed chat server using TCP sockets.
5. Implement RPC mechanism for a file transfer across a network.
6. Write a code to implement sliding window protocol.
7. To study Squirrel
8. To study Coda
9. To study BitTorrent and End System Multicast.
10. To study Kerberos

Text Book:

1. Pradeep K.Sinha, Distributed Operating Systems Concepts and Design, PHI.,1998

Reference Books:

1. S.Ghosh, Chapman and Hall/CRC, Distributed Systems, Taylor & Francis Group, 2010.
2. M Singhal, N G Shivarathri, Advanced Concepts in Operating Systems, Tata McGraw-Hill Edition., 2001
3. A.S.Tanenbaum, Distributed Operating Systems, Pearson Education, 1995

NOTE:

ICA – Internal Continuous Assessment shall support regular performance of practical and its regular assessment. In addition; it shall be based on knowledge/skill acquired and record submitted by a student (journal) based on practical performance by him/her. The performance shall be assessed experiment wise using internal continuous assessment format (S 10).

ESE – The End Semester Examination (ESE) for this laboratory course shall be based on performance in one of the experiments performed by students in the semester followed by sample questions to judge the depth of understanding/knowledge or skill acquired by the student. It shall be evaluated by two examiners out of which one examiner shall be out of institute.

CO456U CLOUD COMPUTING LAB

Teaching Scheme: 02P Total: 02 **Credit:** 01
Evaluation Scheme: 25 ICA + 25 ESE **Total Marks:** 50

Course Description: Minimum 10 experiments (five from Group A and five from Group B) shall be performed to cover the entire curriculum of course CO451U. The list given below is just a guideline. All assignments are to be implemented using open source technology (preferably). Every assignment should include use of syntax, use of command/function used for coding and printout of code with proper comment and output. Use of Open source tools/ technology is recommended for laboratory assignments.

Group A:

1. Installation and configuration of own Cloud

2. Implementation of Virtualization in Cloud Computing to Learn Virtualization Basics, Benefits of Virtualization in Cloud using Open Source Operating System.

3. Study and implementation of infrastructure as Service using OpenStack.

4. Write a program for Web feed using PHP and HTML.

5. Write a Program to Create, Manage and group User accounts in your own Cloud by Installing Administrative Features.

6. Case study on Amazon EC2 to learn about Amazon EC2,Amazon Elastic Compute Cloud is a central part of Amazon.com's cloud computing platform, Amazon Web Services. EC2 allows users to torrent virtual computers on which to run their own computer applications.

Group B:

1. Case study on Microsoft Azure to learn about Microsoft Azure is a cloud computing platform and infrastructure, created by Microsoft, forbuilding, deploying and managing applications and services through a global network of Microsoft-managed datacenters. How it works, different services provided by it.

2. Design and develop custom Application (Mini Project) using Salesforce Cloud.

3. Assignment to install and configure Google App Engine.

4. Design an Assignment to retrieve, verify, and store user credentials using Firebase Authentication, the Google App Engine standard environment, and Google Cloud Data store.

5. Creating an Application in SalesForce.com using Apex programming Language.

6. Design an Assignment based on Working with Mangrasoft Aneka Software.

NOTE:

ICA – Internal Continuous Assessment shall support regular performance of practical and its regular assessment. In addition; it shall be based on knowledge/skill acquired and record submitted by a student (journal) based on practical performance by him/her. The performance shall be assessed experiment wise using internal continuous assessment format (S 10).

ESE – The End Semester Examination (ESE) for this laboratory course shall be based on performance in one of the experiments performed by students in the semester followed by sample questions to judge the depth of understanding/knowledge or skill acquired by the student. It shall be evaluated by two examiners out of which one examiner shall be out of institute.

CO457UA FUNDAMENTALS OF ARTIFICIAL NEURAL NETWORKS LAB

Teaching Scheme: 02PR **Total:** 01 **Credits:** 01
Evaluation Scheme: 25 ICA+25 ESE **Total Marks:** 50

Course Description: Minimum 08 experiments shall be performed to cover the entire curriculum of course CO453U-A. The list given below is just a guideline. All assignments are to be implemented using open source technology (preferably). Every assignment should include use of syntax, use of command/function used for coding and printout of code with proper comment and output. Use of Open source tools/ technology is recommended for laboratory assignments. The concerned faculty member must conduct group-A contents in theory lectures.

Group A

1. To Write a program to implement Perceptron.
2. To write a program to implement AND OR gates using Perceptron.
3. To implement Crab Classification using pattern net
4. To write a program to implement Wine Classification using Back propagation.
5. To write a MatLab Script containing four functions Addition, Subtraction, Multiply and Divide functions
6. Write a program to implement classification of linearly separable Data with a perceptron
7. To study Long Short Term Memory for Time Series Prediction
8. To study Convolutional Neural Network and Recurrent Neural Network
9. To study ImageNet, GoogleNet, ResNet convolutional Neural Networks
10. To study the use of Long Short Term Memory / Gated Recurrent Units to predict the stock prices based on historic data

Text Books:

1. Deep Learning, Ian Goodfellow, YoshuaBengio, Aaron Courville, MIT Press, 2016
2. Neural Networks: A Systematic Introduction, Raúl Rojas, 1996

Reference Books:

1. NPTEL Video Lectures on Deep Learning, Weeks 1-6, by Prof.Prof.Mitesh M. Khapra
2. Introduction to artificial neural systems by Jacek M. Zurada
3. Pattern Recognition and Machine Learning, Christopher Bishop, 2007

NOTE:

ICA – Internal Continuous Assessment shall support regular performance of practical and its regular assessment. In addition; it shall be based on knowledge/skill acquired and record submitted by a student (journal) based on practical performance by him/her. The performance shall be assessed experiment wise using internal continuous assessment format (S 10).

ESE – The End Semester Examination (ESE) for this laboratory course shall be based on performance in one of the experiments performed by students in the semester followed by sample questions to judge the depth of understanding/knowledge or skill acquired by the student. It shall be evaluated by two examiners out of which one examiner shall be out of institute.

CO457UB BIG DATA ANALYTICS LAB

Teaching Scheme: 02PR, Total**:** 01 **Credits:** 01
Evaluation Scheme: 25 ICA+25 ESE **Total Marks:** 50

Course Description: Minimum 8 experiments (four from Group A and four from Group B) shall be performed to cover the entire curriculum of course CO453U-B. The list given below is just a guideline. All assignments are to be implemented using open source technology (preferably). Every assignment should include use of syntax, use of command/function used for coding and printout of code with proper comment and output. Use of Open source tools/ technology is recommended for laboratory assignments. The concerned faculty member must conduct group-A contents in theory lectures.

Group A

1. Install Hadoop system
2. Implement the following file management tasks in Hadoop: i. Adding files and directories ii. Retrieving files iii. Deleting files
3. Write a Map Reduce program that mines weather data. Hint: Weather sensors collecting data every hour at many locations across the globe gather a large volume of log data, which is a good candidate for analysis with Map Reduce, since it is semi structured and record oriented
4. Run a basic word count Map Reduce program to understand Map Reduce Paradigm.
5. Implement matrix multiplication with Hadoop Map Reduce.

Group B

1. Installation of PIG.
2. Study of Pig latin script
3. Write Pig Latin scripts sort, group, join, project, and filter your data.
4. Run the Pig Latin Scripts to find Word Count.
5. Run the Pig Latin Scripts to find a max temp for each and every year.
6. Mini Project(Compulsory): One real life large data application to be implemented (Use standard Datasets available on the web)
   a) Twitter data analysis b) Fraud Detection c) Text Mining etc.

Text books

1. AnandRajaraman and Jeff Ullman “Mining of Massive Datasets”, Cambridge University Press,
2. Alex Holmes “Hadoop in Practice”, Manning Press, Dreamtech Press.
3. Dan McCreary and Ann Kelly “Making Sense of NoSQL” – A guide for managers and the rest of us, Manning Press

Reference Books:

1. Michael Minelli, Michele Chambers, AmbigaDhiraj, “Big Data Big Analytics: Emerging Business Intelligence And Analytic Trends For Today's Businesses”, Wiley India
2. Judith Hurwitz, Alan Nugent, Dr. Fern Halper, Marcia Kaufman, “Big Data for Dummies”, Wiley India
3. Paul Zikopoulos, Chris Eaton, “Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data’, McGraw Hill Education.

NOTE:

ICA – Internal Continuous Assessment shall support regular performance of practical and its regular assessment. In addition; it shall be based on knowledge/skill acquired and record submitted by a student (journal) based on practical performance by him/her. The performance shall be assessed experiment wise using internal continuous assessment format (S 10).

ESE – The End Semester Examination (ESE) for this laboratory course shall be based on performance in one of the experiments performed by students in the semester followed by sample questions to judge the depth of understanding/knowledge or skill acquired by the student. It shall be evaluated by two examiners out of which one examiner shall be out of institute.

CO457UC INFORMATION STORAGE AND MANAGEMENT LAB

Teaching Scheme: 02PR **Total:** 01 **Credits:** 01
Evaluation Scheme: 25 ICA+25 ESE **Total Marks:** 50

Course Description: Minimum 04 experiments shall be performed to cover the entire curriculum of course CO453U-C. The list given below is just a guideline. All assignments are to be implemented using open source technology (preferably). Every assignment should include use of syntax, use of command/function used for coding and printout of code with proper comment and output. Use of Open source tools/ technology is recommended for laboratory assignments.

1. DATA CENTER ENVIRONMENT (Review and understand the components and systems in a data center.)
   a) Installation of VNXE Simulator
   b) Discover the Infrastructure
2. INTELLIGENT STORAGE SYSTEM (To explore the management interface and general tasks to be performed within an intelligent storage system.)
   a) Navigate the Storage System
   b) Create a Block Device
   c) Create a File Device
3. FC SAN (To explore the management interface and general tasks to be performed within a Fibre Channel SAN.)
   a) FC SAN Configuration
   b) FC SAN Trace
4. IP SAN (To configure the interface and provision storage within an iSCSI SAN.)
   a) IPSAN Configuration
   b) iSCSI SAN Trace
5. MANAGING PROTECTION SERVICES (To review the use of local protection systems to provide highly available resources within a storage network.)
   a) Array Based Protection
   b) Configuring LUN Configuration
6. Managing Storage Infrastructure (Review reports and data collections in order to determine operational status and health of the infrastructure)
   a) Monitoring and Reporting

Text Book:

1. John Wiley & Sons, “Information Storage and Management”, EMC Education Services. Wiley Publishing. Inc 2010

Reference Books:

1.Somasundaram G, AlokShrivastava, “ISM – Storing, Managing and Protecting Digital Information”, EMC Education Services, Wiley India, New Delhi, 2012.
11. Gerald J Kowalski, Mark T Maybury, “Information Storage and Retrieval Systems: Theory and Implementation”, BS Publications, New Delhi, 2009.

12. Robert Spalding, “Storage Networks: The Complete Reference”, Tata McGraw Hill, New Delhi, 2006

NOTE:

ICA – Internal Continuous Assessment shall support regular performance of practical and its regular assessment. In addition; it shall be based on knowledge/skill acquired and record submitted by a student (journal) based on practical performance by him/her. The performance shall be assessed experiment wise using internal continuous assessment format (S 10).

ESE – The End Semester Examination (ESE) for this laboratory course shall be based on performance in one of the experiments performed by students in the semester followed by sample questions to judge the depth of understanding/knowledge or skill acquired by the student. It shall be evaluated by two examiners out of which one examiner shall be out of institute.

CO458U PROJECT PHASE -II

Teaching Scheme: 00L + 00T + 04P, Total: 04 **Credit:** 06

Evaluation Scheme: 75 ICA+75 ESE **Total Marks**: 150

Course Description:

The course explores the knowledge of design, experiment and analysis of the data. The Course develops the ability to work on multidisciplinary teams, identify, formulate, and solve engineering problems in view of economic, environmental and societal context.

Course Objectives:

The course objectives are to:

1. apply algorithmic strategies while solving problems.
2. practice the process of solving the problem in a team.
3. apply management principles and testing techniques
4. select and use engineering fundamentals and modern IT tools.
5. Exposure to Learning and knowledge access techniques using Conferences, Journal papers and participation in research activities.
6. encourage and expose students for participation in National/ International paper presentation activities.

Course Outcomes:

After successful completion of this course, students will be able to:

1. combine solutions for framed problem statements.
2. test and analyze different modules of planned projects and integrate them into a single module.
3. design hardware and/or software techniques for identified problems.
4. arrange a project report and deliver a presentation.

Course Outcomes (COs) and Program Outcomes (POs) , Course Outcomes (COs) and Program Specific Outcomes (PSOs) , mapping with strength of correlation

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	1	2	-		3	3	1	1	1	1	3		3	2	3
2	-	-	1		1	-		-	-	-	-		3	2	3
3		3		1	1	-		-	-	-	-	1	3	3	3
4	1		3	1		-	1	-	-	-	-	1	3	1	3

1-Weakly correlated 2 – Moderately correlated 3 – Strongly correlated

Guidelines for completing the Project:

1. Project phase-I work decided in VII semester shall be continued as Project in VIII semester.
2. Students should complete implementation of ideas given in synopsis/Abstract, so that project work should be completed before the end of semester.
3. Projects may involve fabrication, design, experimentation, data analysis within realistic constraints such as economic, environmental, social, ethical, health and safety, manufacturability, and sustainability. The stage also includes testing, possible results and report writing.
4. Each student project group is required to maintain a log book for documenting various activities of Project-II and submit group project report at the end of Semester-VIII in the form of Hard bound.

Guidelines for ICA :ICA shall be based on continuous evaluation of students performance throughout the semester in project-II and report submitted by the students project group in the form Hard bound. Assessment of the project-II for award of ICA marks shall be done jointly by the guide and departmental committee as per the guidelines given in the following table**.**

Assessment of Project phase-II (ICA)

Title of the Project: _____

Name of the Guide: _____

Sr No.	**Project Methodology/ Design /PCB/ hardware/ simulation/ programming (15M)**	**Progress Status (10M)**	**Attendance (5M)**	**Report Writing (15M)**	**Depth of Understanding (15M)**	**Presentation (15M)**	**Total (75M)**

Guidelines for ESE:-

1. In ESE the student may be asked for demonstration and questions on Project.
2. Evaluation will be based on answers given by students in oral examination.

CO459U INDUSTRIAL VISIT/INDUSTRIAL TRAINING

Teaching Scheme: 00 Total: 00 **Credit:** 01
Evaluation Scheme: 50 ICA+00 ESE **Total Marks**: 50

Course Description: The course explores the knowledge of industry organization, new trends in manufacturing, maintenance and safety. The industrial visit provides the practical visualization of theoretical study of various engineering subjects.

Course objectives:
The course objectives are to:
1. provide an excellent opportunity to interact with industries and know more about the industrial environment.
2. provide students an insight regarding internal working of companies.
3. give them exposure to current work practices used in industry.
4. prepare graduates to quickly become productive upon entering the workforce.

Course outcomes:
On successful completion of this course, students will be able to:
1. analyze subject to its core and its deeper practical experience in real field situations.
2. examine prior acquired knowledge in problem solving.
3. analyze given engineering problem, formulate an appropriate problem solving methodology, construct the methodology and propose a meaningful solution.

Course Outcomes (COs) and Program Outcomes (POs) mapping with strength of correlation

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	1	2	-		3	3	1	1	1	1	3		2	1	1
2	-	-	1		1	-		-	-	-	-		2	2	2
3		3		1	1	-		-	-	-	-	1	3	2	2

1-Weakly correlated 2 – Moderately correlated 3 – Strongly correlated

Guidelines for Industry visit:
1. Industry visits to minimum two industries shall be carried out by each student preferably or college shall arrange the industrial visit during the vacation period otherwise during the regular VIII

semester.

2. The student should obtain appropriate certificates of visit from the concerned organizations just after the visits.
3. Every Student should submit Industrial Visit report individually at the end of Semester-VIII (Second Term of Final Year).
4. The report should contain information about the following points:
    a. The organization - activities of organization and administrative setup technical personnel and their main duties.
    b. The project / industry brief description with sketches and salient technical information.
    c. The work / processes observed with specification of materials, products, equipment etc. and role of engineers in that organization.
    d. Suggestions (if any) for improvement in the working of those organizations.
5. The evaluation of the report of technical visits will be made by panel of three teachers appointed by Head of the department based on following points:

Guidelines for ICA: ICA shall be based on knowledge gained by student and Industrial Visit Report submitted by the student in the form of Thermal bound. Assessment of the Industrial Visit for award of ICA marks shall be done jointly by industrial visit coordinators departmental committee based on viva - voce as per the guidelines given in following table.

Sr.No.	**Total**	**Depth of Understanding**	**Report writing**	**Name of Industry**	**Name of Student**
	25	**10**	**15**		