Bansilal Ramnath Agarwal Charitable Trust's

Vishwakarma Institute of Information Technology, Pune-48

(An Autonomous Institute affiliated to Savitribai Phule Pune University)

Curriculum for

Final Year B. Tech.

(Computer Engineering)

2017 Pattern

Department of Computer Engineering

Vision and Mission of the Department

- **Vision**

"Excellence in the field of Computer Engineering for rendering services to the industry and society".

- **Mission**

➢ To empower our students for substantial contribution to **economical**, **technological**, **entrepreneurial** and **social progress** of the society.

➢ To strive for excellence at **different levels** and **diverse** dimensions in the field of computer engineering.

➢ To encourage students to pursue **research** and **advanced studies** for better adaptability towards **globalization**.

Program Specific Outcomes (PSOs)

At the end of program, students should be able to

- **PSO a:** Use knowledge to write programs and integrate them with the hardware/software products in the domains of embedded systems, data Science, networking and web technology.
- **PSO b:** Participate in planning and implement solutions to cater to business – specific requirements, displaying team dynamics and professional ethics.

Program Outcomes (POs)

At the end of program, students should be able to:

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.

2. **Problem analysis**: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.

3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety and the cultural, social and environmental considerations.

4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. **Modern tool usage**: Create, select and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts and demonstrate the knowledge of, and need for sustainable development.

8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. **Individual and team work**: Function effectively as an individual and as a member or leader in diverse teams and in multidisciplinary settings.

10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations and give and receive clear instructions.

11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12**. Life-long learning**: Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Final Year B.Tech.

Pattern 2017

Syllabus Structure

Vishwakarma Institute of Information Technology, Pune-48
(An Autonomous Institute affiliated to Savitribai Phule Pune University)
Department of Computer Engineering

FINAL YEAR B. TECH (COMPUTER ENGINEERING), SEMESTER VII (PATTERN 2017)

MODULE-I

Course Code	Course Title	Course Type	Teaching Scheme			Examination Scheme					Total	Credits
			L	T	P	CIE	ISE	SCE	ESE	PR/ OR/ TW		
CSUA40171	Design and Analysis of Algorithms *	TH	3	-	2	20	30	20	30	25	125	4
CSUA40172	Cloud Computing	TH	3	-	2	20	30	20	30	25	125	4
CSUA40173	Compiler Construction*	TH	3	-	2	20	30	20	30	25	125	4
CSUA40174/ ITUA40174	Elective-III	TH	3	-	2	20	30	20	30	25	125	4
CSUA40175	Intellectual Property Rights	CE	2	-	-	-	-	50	-	-	50	2
CSUA40176	Project Work*	CE-PR/OR	-	-	10	100	-	-	-	50	150	5
M4	Mandatory Course	AU	-	-	-	-	-	-	-	-	-	-
	Total	-	14	-	18	180	120	130	120	150	700	23

Note: * above indicates that the course has PR/OR component

Elective – III:

1. CSUA40174A: Advanced Computer Networks-II
2. CSUA40174B: Advance Machine Learning
3. CSUA40174C: Information and Cyber Security
4. ITUA40174: Business Intelligence

MODULE-II

Course Code	Course Title	Course Type	Teaching Scheme			Examination Scheme					Total	Credits
			L	T	P	CIE	ISE	SCE	ESE	PR/OR /TW		
CSUA40177	Semester Internship	CE-PR/OR	-	-	24	100	-	-	-	50	150	12
M4	Mandatory Course	AU	-	-	-	-	-	-	-	-	-	-
	Total	-	-	-	24	100	-	-	-	50	150	12

Semester Internship: For detailed syllabus see the Annexure A

List of Audit Courses: Professional Ethics; Cyber Security; Value Engineering and Human Rights; Legislative Procedures; Technical Writing/Documentation; Sports/Yoga; Performing Art such as music, dance, and drama etc.; Languages; Online certification course (minimum two weeks); Participation in Intercollegiate co-curricular and extra-curricular activities.

BoS Chairman **Dean Academics** **Director**

S.R.A.C. TRUST * Vishwakarma Institute of Information Technology * V.I.I.T. PUNE 48.

DIRECTOR
Vishwakarma Institute of Information Technology
Pune 411048.

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Department of Computer Engineering

Final Year B.Tech

Pattern 2017

Syllabus

Semester-VII/VIII

(Module-I)

Design and Analysis of Algorithms (CSUA40171)

Teaching Scheme	**Examination Scheme**
Credits: 4 **Lectures: 3 Hrs/week** **Practical :2 Hrs/week**	**Continuous Internal Evaluation(CIE): 20 Marks** **In-Semester Examination(ISE): 30 Marks** **Skills & Competency Exam(SCE): 20 Marks** **End Semester Examination(ESE): 30 Marks** **PR/OR: 25 Marks**

Prerequisites: Discrete Mathematics, Data Structures and Theory Of Computation

Course Objectives

- Measure the performance of algorithms on the basis of time and space complexity.
- To explain different algorithmic strategies for solving given problems.
- To determine and solve the P and NP class of problem.
- To learn randomized and approximation algorithm.
- To understand the concepts of parallel programming paradigm.
- To understand the concepts of concurrent programming paradigm.

Course Outcomes

After completion of the course, student will be able to

1. Analyze algorithms for their time and space complexities in terms of asymptotic performance
2. Apply greedy method or dynamic programming algorithmic strategy for solving given problems.
3. Apply backtracking and branch and bound algorithmic strategy for solving given problems.
4. Apply principle of reducibility for solving intractable problems.
5. Understand randomized and approximation algorithm.
6. Apply concepts of parallel and concurrent programming to given problem.

Unit I: Introduction

Analysis of Algorithms, Best, Average and Worst case running times of algorithms, Mathematical notations for running times O, Ω, Θ. Master's Theorem
Problem solving principles: Classification of problem, problem solving strategies, classification of time complexities (linear, logarithmic etc.).
Divide and Conquer strategy: General strategy, Quick Sort and Merge Sort w.r.t. Complexity

Unit II: Greedy Method & Dynamic Programming

Greedy Method: General strategy, the principle of optimality, Knapsack problem, Job Sequencing With Deadlines, Huffman coding. Dynamic Programming: General Strategy, 0/1 Knapsack ,OBST, Multistage graphs,

Unit III: Backtracking, Branch and Bound

Backtracking: The General Method 8 Queen's problem, Graph Coloring **Branch and Bound**: 0/1 Knapsack, Traveling Salesperson Problem.

Unit IV: Intractable Problems and NP-Completeness

Time-Space tradeoff, Tractable and Non-tractable Problems, Polynomial and non-polynomial problems, deterministic and non-deterministic algorithms P-class problems, NP-class of problems, Polynomial problem reduction, NP complete problems- Vertex cover and 3-SAT and NP hard problem - Hamiltonian cycle

Unit V: Approximation and Randomized Algorithms, Natural Algorithms

Approximation algorithms, Solving TSP by approximation algorithm, approximating Max Clique
Concept of randomized algorithms, randomized quick sort algorithms
Natural Algorithms–Evolutionary Algorithms and Evolutionary Computing, Introduction to Genetic Algorithm, Simulated Annealing.

Unit VI: Parallel and Concurrent Algorithms

Parallel Algorithms: Sequential and parallel computing, RAM &PRAM models, Amdahl's Law, Brent's theorem, parallel algorithm analysis, multithreaded matrix multiplication, Concurrent Algorithms: Dining philosophers problem

Text Books

1. Gilles Brassard, Paul Bratley, ―Fundamentals of Algorithmic, PHI, ISBN 978-81-203-1131-2
2. Horowitz and Sahani, "Fundamentals of Computer Algorithms", 2ND Edition. University Press, ISBN: 978 81 7371 6126, 81 7371 61262.

Reference Books

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, ―Introduction to Algorithms‖, MIT Press; ISBN 978-0-262-03384-8
2. Algorithms and Parallel Computing, Fayez Gebali, Willy, ISBN 978-0-470-90210-3 (Indian Paperback Edition)
3. Michael T. Goodrich, Roberto Tamassia , ―Algorithm Design: Foundations, Analysis and Internet Examples‖, Wiley, ISBN 978-81-265-0986-7
4. Rajeev Motwani and PrabhakarRaghavan, ―Randomized Algorithms‖, Cambridge University Press, ISBN: 978-0-521-61390-3
5.Dan Gusfield, ―Algorithms on Strings, Trees and Sequences‖, Cambridge University Press, ISBN:0-521-67035-7
6.AnanyLevitin, "Introduction to the Design and Analysis of Algorithms" Pearson Education

List of Assignments (in C++/Java/Python)
1. Implement Quick Sort using divide and conquer strategy.
2. Implement 0/1 knapsack using Dynamic Programming.
3. Implement Travelling Salesman problem using branch and bound technique.
4. Implement Concurrent Dining Philosopher Problem.

Cloud Computing (CSUA40172)

Teaching Scheme	**Examination Scheme**
Credits: 4 **Lectures: 3 Hrs/week** **Practical : 2Hrs/Week**	**Continuous Internal Evaluation(CIE): 20 Marks** **In-Semester Examination(ISE): 30 Marks** **Skills & Competency Exam(SCE): 20 Marks** **End Semester Examination(ESE): 30 Marks** **TW: 25 Marks**

Prerequisites: **Computer Networks**

Course Objectives

- To understand cloud computing concepts
- To study supporting technologies of cloud
- To study open research problems of cloud computing
- To study various platforms for cloud computing
- To explore the applications based on cloud computing
- To study and evaluate the contemporary technologies in cloud computing

Course Outcomes

After completion of the course, student will be able to

1.Summarize the basic concepts of cloud computing (Remember)
2. Explore the supporting technologies of cloud computing (Understand)
3. Analyze the challenges and opportunities in the cloud computing (Analyze)
4. Use the cloud services for deployment of his own applications (Create)
5. How technologies are interrelated and use with each other (Apply)
6. To explore future trends of cloud computing (Evaluate)

Unit I: 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. Case Study: Google Cloud Platform.

Unit II: 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 Security. Case study : VirtualBox, vmware

Unit III: Data Storage and Security in Cloud

Cloud file systems: GFS and HDFS, BigTable, HBase and Dynamo Cloud data stores: Datastore and Simple DB Cloud Storage-Overview, Cloud Storage Providers. Case study: Firebase. Securing the Cloud- General Security Advantages of Cloud-Based Solutions, Introducing Business Continuity and Disaster Recovery. Disaster Recovery- Understanding the Threats. Case study: Discuss research problems of cloud security

Unit IV: Approximation and Randomized Algorithms, Natural Algorithms

Approximation algorithms, Solving TSP by approximation algorithm, approximating Max Clique
Concept of randomized algorithms, randomized sort algorithms
Natural Algorithms–Evolutionary Algorithms and Evolutionary Computing, Introduction to Genetic Algorithm, Simulated Annealing, ANN

Unit V: Ubiquitous Clouds and the Internet of Things

Introduction to Ubiquitous computing, 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)

Unit VI: Future of Cloud Computing

Docker at a Glance: Process Simplification, Broad Support and Adoption, Architecture, TheDocker Workflow. Docker compose file, Docker volume, Docker storage.
Kubernetes : introduction to Kubernetes, Features of Kubernetes, Kubernetes API, Basic Architecture, Minikube.

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.Gautam Shrof, "ENTERPRISE CLOUD COMPUTING Technology Architecture, Applications, Cambridge University Press, *ISBN*: 9780511778476.
4. Docker Documentation (https://docs.docker.com/get-started/)
5. Kubernetes Documentation (https://kubernetes.io/docs/home/)

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
6. Tim Mather, Subra K, Shahid L.,Cloud Security and Privacy, Oreilly, ISBN-13 978-81-8404-815-5

Compiler Construction (CSUA40173)

Teaching Scheme	Examination Scheme
Credits: 4 **Lectures: 3 Hrs/week** **Practical : 2 Hrs/week**	**Continuous Internal Evaluation(CIE): 20 Marks** **In-Semester Examination(ISE): 30 Marks** **Skills & Competency Exam(SCE): 20 Marks** **End Semester Examination(ESE): 30 Marks** **PR/OR: 25 Marks**

Prerequisites:
Computer Organization and architecture, Processor Architecture and Interfacing, Data Structures, Theory of Computation: DFA, NFA, Regular expressions, Grammars.

Course Objectives

1. To study language processing fundamentals and assemblers.
2. To design macro processors.
3. To study and understand compiler design.
4. To understand working of syntax analyzer.
5. To understand importance of semantic analysis and storage allocation in compilation process.
6. To study different code optimization methods.

Course Outcomes

After completion of the course, student will be able to

1. Learn language processing fundamentals with detail designing of assembler.
2. Design and implement macro processors and understand working of linkers and loaders.
3. Understand various phases of compiler and use tool LEX for generation of Lexical Analyzer.
4. Understand working of parser and use YACC tool for generation of syntax analyzer..
5. Understand functions of Semantic Analysis.
6. Apply code optimization techniques in the compilation process.

Unit I: Introduction To Systems Programming And Assemblers

Introduction: Need of System Software, Components of System Software, Language Processing Activities, Fundamentals of Language Processing. Assemblers: Elements of Assembly Language Programming, A simple Assembly Scheme, Pass structure of Assemblers, Design of Two Pass Assembler.

Unit II: Macro processors, Loaders And Linkers

Unit III: Introduction To Compilers

Phase structure of Compiler and entire compilation process.Lexical Analyzer: The Role of the Lexical Analyzer, Input Buffering. Specification of Tokens, Recognition Tokens, Design of Lexical Analyzer using Uniform Symbol Table, Lexical Errors.LEX: LEX Specification, Generation of Lexical Analyzer by LEX.

Role of parsers, Classification of Parsers: Top down parsers- recursive descent parser and predictive parser (LL parser), Bottom up Parsers – Shift Reduce parser, LR parser. YACC specification and Automatic construction of Parser (YACC).

Unit V: Semantic Analysis And Storage Allocation

Need, Syntax Directed Translation, Syntax Directed Definitions, Translation of assignment Statements, iterative statements, Boolean expressions, conditional statements, Type Checking and Type conversion. Intermediate Code Formats: Postfix notation, Parse and syntax tress, Three address code,quadruples and triples.Storage Allocation: Storage organization and allocation strategies.
Unit VI: Code Generation And Optimization
Code Generation: Code generation Issues. Basic blocks and flow graphs, A Simple Code Generator. Code Optimization: Machine Independent: Peephole optimizations: Common Sub-expression elimination, Removing of loop invariants, Induction variables and Reduction in strengths, use of machine idioms, Dynamic Programming Code Generation. Machine dependent Issues: Assignment and use of registers
Text Books
1.D. M. Dhamdhere, Systems Programming and Operating Systems, Tata McGraw-Hill, ISBN 13:978-0-07-463579-7, Second Revised Edition. 2.Alfred V. Aho, Ravi Sethi, Jeffrey D. Ullman, Compilers Principles, Techniques and Tools, Addison Wesley, ISBN:981–235–885 - 4, Low Price Edition. 3.John R. Levine, Tony Mason & Doug Brown, "Lex &Yacc", O'Reilly
Reference Books
1. J. J. Donovan, Systems Programming, McGraw-Hill, ISBN 13:978-0-07-460482-3, Indian Edition.

List of Assignments
Note : Course Coordinator can ask students to implement some assignments from following suggested list of assignments. Students can implement following assignments using LEX/YACC, C/C++, JAVA, Python.
1.Generate Symbol table, Literal table, Pool table & Intermediate code of a two-pass Assembler for the given source code.
2. Implement pass-II of a two-pass Assembler and generate m/c language code for the given intermediate code.
3. Design suitable data structures & implement pass-I of a two-pass Macro processor
4. Design suitable data structures & implement pass-II of a two-pass Macro processor
5. Write a program to implement a lexical analyzer for parts of speech.
6.Write a program to evaluate arithmetic expression, built-in functions and variables using Yacc specification.
7.Write a program to generate three address code for simple expression.
8.Write a program to apply various code optimization techniques for given three address code.
9.Write a program to generate assembly language code for given three address code.

Elective-III (CSUA40174 / ITUA40174)

Advanced Computer Networks-II (CSUA40174A)

Teaching Scheme	**Examination Scheme**
Credits: 4 **Lectures: 3 Hrs/week** **Practical : 2 Hrs/week**	**Continuous Internal Evaluation(CIE): 20 Marks** **In-Semester Examination(ISE): 30 Marks** **Skills & Competency Exam(SCE): 20 Marks** **End Semester Examination(ESE): 30 Marks** **TW: 25 Marks**

Prerequisites: Fundamentals of Computer Networks, Computer Networks-I, Computer Networks-II

Course Objectives

- To understand the WAN concepts
- To identify the requirements for point to point and branch connections
- To illustrate the concept of security using access control lists
- To identify network security and monitoring requirements
- To understand QoS and parameters
- To perform network troubleshooting

Course Outcomes

After completion of the course, student will be able to

1. Explore the WAN concepts- REMEMBER.
2. Analyze the connection types- ANALYSE
3. Describe and Demonstrate the Access Control Lists– UNDERSTAND & APPLY
4. Analyzing the network security requirements ANALYSE
5. Analyze QoS parameters- ANALYSE
6. Planning and implementing network troubleshooting- CREATE

Unit I: WAN Concepts

Introduction to WAN, WAN Topologies and Types of Networks, WAN Operations: Circuit Switching and Packet Switching, Selecting A WAN, Public WAN Infrastructure, Selecting WAN Services

Unit II: Point to Point and Branch Connections

Serial Communication, HDLC Encapsulation, PPP, PPP implementation, PPP Troubleshooting, Remote Access Connection, PPPoE, PPPoE implementation, VPN. GRE, GRE implementation, eBGP.

Unit III: Access Control Lists

Introduction to ACL, ACL Operation, Types of IPv4 ACLs, Configuration and implementation of Standard and Extended IPv4 ACLs, IPv6 ACL Creation, Configuring IPv6 ACL, Troubleshooting ACLs.

Unit IV: Network Security and Monitoring

LAN Security: LAN Security Attacks, Best Practices, SNMP: Operation, Configuration, Cisco Switch Port Analyzer (SPAN): Overview, Configuration, SPAN as a troubleshooting tool

Unit V: Quality of Service

QoS overview, Traffic characteristics, Queuing algorithms QoS Models, QoS implementation techniques.

Unit VI: Network Evolution and Network Troubleshooting

Internet of Things: IoT Elements, IoT Pillars, Cloud and Virtualization: Cloud Computing, Virtualization, Virtual Network Infrastructure, Network Programming: Software Defined Networking, Controllers, Network Troubleshooting: Troubleshooting methodology, Troubleshooting process, isolating issues using layered models. Troubleshooting scenarios: Using IP SLA, Tools, Symptoms and causes of troubleshooting, Troubleshooting IP Connectivity.
Text Books
1.Fourauzan B., "Data Communications and Networking", 5th edition, McGraw-Hill Publications **2.**Stallings William., "Data and Computer Communications", Sixth Edition, Prentice Hall of India . **3.**Andrew S. Tanenbaum ,"Computer Networks", Pearson
Reference Books
1. CCNA Basics and Fundamentals-Cisco. 2.CCNA Routing and Switching 200-125 Official Cert. Guide Library. 3.Cisco CCNA Command Guide- An introductory Guide for complete beginners

List of Assignments
1. (Packet Tracer Index-2.1.2.5)Troubleshooting serial interfaces
2. (Packet Tracer Index-2.3.2.6)Configuring PAP and CHAP authentication
3. (Packet Tracer Index-2.4.1.4)Troubleshooting PPP with authentication
4. (Packet Tracer Index-3.4.2.4 and 3.4.2.5)Configuring and troubleshooting GRE
5. (Packet Tracer Index-3.5.3.4)Configuring and verify eBGP
6. (Packet Tracer Index-4.3.1.5 and 4.3.2.6)Configure standard IPv4 and IPv6 ACL
7. (Packet Tracer Index-)4.4.2.9 and 4.4.2.10Troubleshooting IPv4 and IPv6 ACLs
8. (Packet Tracer Index-8.2.4)Troubleshooting IP connectivity

Elective-III (CSUA40174 / ITUA40174)

Advanced Machine Learning (CSUA40174B)

Teaching Scheme	**Examination Scheme**
Credits: 4 **Lectures: 3 Hrs/week** **Practical : 2 Hrs/week**	**Continuous Internal Evaluation(CIE): 20Marks** **In-Semester Examination(ISE): 30 Marks** **Skills & Competency Exam(SCE): 20 Marks** **End Semester Examination(ESE): 30 Marks** **TW: 25 Marks**

Prerequisites: Knowledge of Programming, Engineering Mathematics III

Course Objectives

- To understand human learning aspect and relate it with machine learning concepts.
- To understand nature of the problem and apply machine learning algorithm.
- To find optimized solution for given problem.
- To learn- to implement train, and validate neural network,
- To learn to improve understanding of the on-going research in computer vision and multimedia field.
- To know programming of algorithms

Course Outcomes

After completion of the course, student will be able to

1. Understand the basics of machine learning and concepts of good dataset.
2. Identify supervised, unsupervised machine learning approaches and estimate the different algorithms with examples.
3. Summarize the basic concepts of Deep Learning .
4. Understand data, training parameters, network structure, and other strategies to increase performance and capability
5. Describe and compare different architectures of Convolutional Neural Networks.
6. Describe and Analyze the working of Recurrent Neural Networks.

Unit I: Introduction and Feature Engineering

Introduction-Classic and adaptive machines, Relationship between Artificial Intelligence, Machine Learning, and Data Science, Definition and Features of Machine Learning, Machine Learning Approaches, Machine
Learning Techniques, Applications of Machine Learning.
Feature Engineering- Creating training and test sets, managing categorical data, Managing missing features, Data scaling and normalization, Feature selection and Filtering, Principle Component Analysis(PCA)-non
negative matrix factorization, Sparse PCA, Kernel PCA

Unit II: Supervised Learning

Linear regression- Linear models, A bi-dimensional example, Linear Regression and higher dimensionality, Ridge, Lasso and ElasticNet, Polynomial regression, Isotonic regression,
Logistic regression-Linear classification, Logistic regression, Implementation and Optimizations,
Bayes Theorom, Naïve Bayes Classifiers.
Support Vector Machine(SVM)- Linear Support Vector Machines, Kernel based classification, Non-linear Examples. Controlled Support Vector Machines, Support Vector Regression.

Unit III: Unsupervised Learning

Clustering Fundamentals- Basics, K-means: Finding optimal number of clusters, DBSCAN, Spectral Clustering. Evaluation methods based on Ground Truth- Homogeneity, Completeness, Adjusted Rand Index, Hierarchical Clustering, Expectation maximization clustering, Agglomerative Clustering- Dendrograms.

Unit IV: Introduction to Deep Learning

History of Deep Learning McCulloch Pitts Neuron, Thresholding Logic, Perceptrons, Perceptron Learning Algorithm, Multilayer Perceptrons (MLPs), Representation Power of MLPs, Sigmoid Neurons, Gradient
Descent, Feed forward Neural Networks, Representation Power of Feed forward Neural Networks.

Unit V: Gradient Descent and Regularization

Gradient Descent -Gradient Descent (GD), Momentum Based GD, Nesterov Accelerated GD, Stochastic GD, AdaGrad, RMSProp
Regularization- Bias Variance Tradeoff, L2 regularization, Early stopping, Dataset augmentation, Parameter sharing and tying, Injecting noise at input, Ensemble methods, Dropout

Unit VI: Convolutional Neural Networks and Recurrent Neural Networks

Convolutional Neural Networks- Convolutional Neural Networks,Architectures, convolution / pooling layers, LeNet, AlexNet, ZF-Net, VGGNet, GoogLeNet, ResNet, Visualizing Convolutional Neural Networks, Guided Backpropagation, Deep Dream, Deep Art, Fooling Convolutional Neural Networks.
Recurrent Neural Networks- Recurrent Neural Networks, Backpropagation through time (BPTT), Vanishing and Exploding Gradients, Truncated BPTT, GRU, LSTMs
Deep Learning research: Object recognition, Sparse coding, Computer Vision, Natural Language Processing

Text Books

1. Giuseppe Bonaccorso, "Machine Learning Algorithms", Packt Publishing Limited**,** ISBN-10: 1785889621, ISBN-13: 978-1785889622
2. EthemAlpaydin, " Introduction to Machine Learning", PHI 2nd Edition-2013, ISBN 978-0-262-01243-0
3. Goodfellow, I., Bengio,Y., and Courville, A., Deep Learning, MIT Press, 2016.

Reference Books

1. Tom Mitchell "Machine Learning" McGraw Hill Publication, ISBN : 0070428077 9780070428072
2. Nikhil Buduma, "Fundamentals of Deep Learning", O"REILLY publication, second edition 2017, ISBN*:* 1491925612
3. Josh Patterson, Adam Gibson, "Deep Learning: A Practitioners Approach", O"REILLY, SPD, ISBN: 978-93-5213-604-9, 2017 Edition 1st.

List of Assignments:- 6-8 assignments will be based on above syllabus.

Elective-III (CSUA40174 / ITUA40174)

Information and Cyber Security (CSUA40174C)

Teaching Scheme	**Examination Scheme**
Credits: 4 **Lectures: 3 Hrs/week** **Practical : 2 Hrs/week**	**Continuous Internal Evaluation(CIE): 20 Marks** **In-Semester Examination(ISE): 30 Marks** **Skills & Competency Exam(SCE): 20 Marks** **End Semester Examination(ESE): 30 Marks** **TW: 25 Marks**

Prerequisites: Computer Networks

Course Objectives

- To know the need and basic of security
- To learn various types of Cryptographic algorithm
- To learn various authentication techniques
- To acquire knowledge of protocols employed to provideConfidentiality and integrity
- To understand various methods for network security
- To acquaint with current security scenario

Course Outcomes

After completion of the course, student will be able to

1.Identify the need and basic of security (Knowledge)
2. Summarize various Cryptographic algorithm (Understand)
3. Infer various authentication techniques (Understand)
4. Summarize protocols for confidentiality and integrity (Understand)
5. Identify various techniques used securing a network (Knowledge)
6. Relate with current industry trends (Understand)

Unit I: Security Basics and Introduction to cryptography

Introduction, Elements of Information Security, Understanding concepts: threat, exploit, privacy, vulnerability and policy, Types of Attacks, Operational Model of Network Security, Cryptography, Substitution Ciphers, Transposition Ciphers, Stenography applications and limitations

Unit II: Symmetric Key Cryptography

Introduction, Encryption Methods: Symmetric, Asymmetric, Block Ciphers and methods of Operations, Data Encryption Standard (DES), Advance Encryption Standard (AES).

Unit III: Asymmetric Key Cryptography

Public Key Cryptography, RSA Algorithm: Working, Key length, Security, Key Distribution, Deffie-Hellman Key Exchange, Authentication methods, Message Digest, Kerberos, X.509 Authentication service, Digital Signatures: Implementation, Algorithms, Standards (DSS), Authentication Protocol.

Unit IV: Network Layer Security

IP Security: IPSec protocols, and Operations, AH Protocol, ESP Protocol, ISAKMP Protocol, Oakkey determination Protocol, VPN. WEB Security: Introduction, Secure Socket Layer (SSL), SSL Session and Connection, SSL Record Protocol, Change Cipher Spec Protocol, Alert Protocol, Handshake Protocol. Electronic Mail Security: Introduction, Pretty Good Privacy, MIME, S/MIME, Comparison. Secure Electronic Transaction(SET)
Unit V: Firewall And Intrusion
Introduction, Computer Intrusions. Firewall Introduction, Characteristics and types, Benefits and limitations. Firewall architecture, Trusted Systems, Access Control. Intrusion detection, IDS:Need, Methods, Types of IDS, Password Management, Limitations and Challenges.
Unit VI: Introduction to OWASP
Introduction, Top 10 Vulnerabilities, understanding Top 10 Vulnerabilities
Text Books
1. Atul Kahate, "Cryptography and Network Security", Mc Graw Hill Publication, 2nd Edition, 2008, ISBN : 978-0-07-064823-4. **2.** Dr. V.K.Pachgare, "Cryptography and Network Security", PHI, 2nd Edition, 2015.
Reference Books
1. William Stallings, "Cryptography and network security principles and practices", Pearson, 6th Edition, ISBN : 978-93-325-1877-3. 2. Forouzan, "Cryptography and Network Security (SIE)", Mc Graw Hill, ISBN, 007070208X, 9780070702080 .
Web Resource:
1.www.owasp.org

List of Assignments
Student are free to choose any programming language from C++, Java and Python
1.Implement Symmetric key algorithm DES
2.Implement Symmetric key algorithm AES
3.Implement ASymmetric key algorithm RSA
4.Implement Asymmetric key algorithm Diffie-Helman Key exchange
5.Study and implement SSL
6.Study and implement IDS
7.Study and implement any 3 Vulnerabilities of OWASP

Intellectual Property Rights (CSUA40175)

Teaching Scheme	**Examination Scheme**
Credits: 2 **Lectures: 2 Hrs/week**	**Skills & Competency Exam(SCE): 50 Marks**

Prerequisites: NA

Course Objectives

- Explain the importance of ideas, concept and creativity.
- Transfer the knowledge about the IPR required for Engineer's
- Describe the how IPR creates National wealth
- Teach National and International IP System

Course Outcomes

After completion of the course, student will be able to

1. Infer that tomorrow's world will be ruled by ideas, concept, and creativity.
2. Gather knowledge about Intellectual Property Rights which is important for students of engineering as they are tomorrow's technocrats and creator of new technology.
3. Discover how IPR are regarded as a source of national wealth and mark of an economic leadership in context of global market scenario.
4. Study the national & International IP system.

Unit I: Introduction

Introduction to the concepts Property and Intellectual Property, Nature and Importance of Intellectual Property Rights, Objectives of understanding Intellectual Property Rights , IPR and IITs

Unit II: Types of IPRs

Understanding the types of Intellectual Property Rights: - Patents, Designs, Trademarks (Registered and unregistered trademarks), Copyright, Traditional Knowledge, Geographical Indications, Trade Secrets, Idea Patenting, (Case Studies)

Unit III: IPR Development Cycle

New Developments in IPR , Process of Patenting and Development: technological research, innovation, patenting, development, International Scenario: WIPO, TRIPs, Indian Patent Office and its Administration .

Unit IV: Patent System

Administration of Patent System – Patenting under Indian Patent Act , Patenting under PCT , Patent Rights and its Scope, Licensing and transfer of technology, Patent information and database. Provisional and Non Provisional Patent Application and Specification

Text Books

1. Resisting Intellectual Property by Halbert, Taylor & Francis Ltd ,2007 .
2. Industrial Design by Mayall, Mc Graw Hill.
3. Intellectual Property in New Technological Age by Robert P. Merges, Peter S. Menell, Mark A. Lemley

Project Work (CSUA40176)

Teaching Scheme:	**Examination Scheme:**
Practical :10 Hrs/week **Credit 5**	**Continuous Internal Evaluation (CIE): 100 Marks** **PR/OR:50 Marks**

Course Objectives:

- To apply SDLC and meet the objectives of proposed development or research work
- To test rigorously before deployment of work in previous objective
- To validate the work undertaken during two objectives
- To consolidate the development or research work as project report.

Course Outcomes:

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

1. Produce evidence of independent investigation and imbibe inquisitiveness
2. Analyze the results and their interpretation intensively and critically.
3. Report and present the original results in an orderly way and placing the open questions in the right perspective.
4. Participate as a team with appropriate engineering and research practices to provide sustainable solution.
5. Exhibit practical implications and constraints of the specialist subject

Guidelines

The student shall complete the work of the Project which will consist of problem statement, literature review, SRS, Model and Design, Selection of Technology and Tools, Installations, UML implementations, testing, Results, performance discussions using data tables per parameter considered for the improvement with existing/known algorithms/systems and comparative analysis and validation of results and conclusions. The candidate shall deliver a presentation on the advancement in Technology pertaining to the selected project topic. The examinee will be assessed by a panel of examiners of which one is necessarily an external examiner. The assessment will be broadly based on work undergone, content delivery, presentation skills, documentation, question-answers and report. The student shall prepare and submit the report of Project work in standard format for satisfactory completion of the work that is the duly certified by the concerned guide and head of the Department/Institute.

Semester-VII/VIII

(Module-II)

Semester Internship (CSUA40177)

Teaching Scheme:	**Examination Scheme:**
Practical: 24 Hrs/week **Credits: 12**	**Continuous Internal Evaluation (CIE): 100 Marks** **PR/OR:50 Marks**

Course Objectives:

- To provide exposure to the industrial environment, with possible opportunities to learn, understand and sharpen the real time technical / managerial skills required at the job
- To give exposure of the current technological developments, processes, and products of IT industry
- To learn to apply the Technical knowledge in real industrial situations
- To gain experience in writing Technical reports/projects
- To expose students to the engineer's responsibilities and ethics
- To promote academic, professional and/or personal development.
- To expose the students to future employers
- To understand the social, economic and administrative considerations that influence the working environment of industrial organizations
- To understand the psychology of the workers and their habits, attitudes and approach to problem solving

Course Outcomes:

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

1. Understand the industrial requirement in terms of ethics, skill sets for future employees/entrepreneurs
2. Apply knowledge gained in academics to the industrial applications
3. Function effectively as an individual and as a member of the multidisciplinary team
4. Provide students an opportunity to be industry ready.

Guidelines:

The student shall complete the work of the Semester Internship, in consultation with the Faculty Mentor, who serves as the instructor of record for internships. The student needs to complete the following steps to set up, conduct and receive a grade for an Industrial Internship. Initially, write and submit Internship Proposal to faculty mentor, for approval. Next, submit application and consent form to company. As there will be regular reviews and assessment of activities being performed at the company, by the Faculty Mentor and the Industry Mentor, the student shall be ready to deliver presentations on tasks performed. Towards the end of the internship the student should submit the training report to the faculty mentor, and prepare for a final assessment by a panel of examiners, including Faculty Mentor and Industry Mentors. The assessment will be broadly based on work undergone, content delivery, presentation skills, documentation, question-answers and training report. After completion of internship, the student shall submit to the Faculty Mentor, the internship completion letter provided by the company.