CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

Kokapet (Village), Gandipet, Hyderabad, Telangana-500075. www.cbit.ac.in

ISO Certified 9001:2015

COMMITTED TO RESEARCH, INNOVATION AND EDUCATION 43 years

Scheme of Instruction and Syllabi

of
V - VI SEMESTERS

of
FOUR YEAR DEGREE COURSE

in
BE-COMPUTER SCIENCE AND ENGINEERING

(AICTE Model Curriculum with effect from AY 2022-23)

R-20 Regulation

CHAITANYABHARATHIINSTITUTEOFTECHNOLOGY

(An Autonomous Institution)

Affiliated to Osmania U niversity

Kokapet Village, Gandipet Mandal, Hyderabad–500075.Telangana

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CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY(A)

SCHEME OF INSTRUCTIONS AND EXAMINATION

Model Curriculum(R-20)

B.E. (Computer Science and Engineering)

SEMESTER - V

S. No	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per Week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
THEORY									
1.	20CSC19	Formal Language and Automata Theory	3	1	-	3	40	60	4
2.	20CSC20	Operating Systems	3	-	-	3	40	60	3
3.	20CSC21	Data Communication and Computer Networks	3	-	-	3	40	60	3
4.	20CSC22	Software Engineering	3	-	-	3	40	60	3
5.	20CSEXX	Professional Elective-I	3	-	-	3	40	60	3
6.	20XXXXX	Open Elective-I	3	-	-	3	40	60	3
PRACTICAL									
7.	20CSC23	Operating Systems Lab	-	-	3	3	50	50	1.5
8.	20CSC24	Data Communication and Computer Networks Lab	-	-	3	3	50	50	1.5
9.	20CSC25	Case Studies using UML Lab	-	-	2	3	50	50	1
10.	20CSI02	Internship-II (Industrial / Rural Internship)	3 to 4 weeks / 90 Hours			-	50	-	2
		Total	**18**	**1**	**8**	**-**	**440**	**510**	**25**

L: Lecture T: Tutorial D: Drawing P: Practical

CIE - Continuous Internal Evaluation SEE - Semester End Examination

Professional Elective – I	
20CSE01	Image Processing and Computer Vision
20CSE02	Advanced Databases
20CSE03	System Modelling and Simulation
20CSE04	Free and Open Source Technologies
20CSE05	Optimization Techniques

Open Elective - I	
20ECO10	Fundamentals of Wireless Communication
20EEO05	Waste Management
20MEO09	Organizational Behaviour
20MTO03	Quantum Computing
20BTO04	Bioinformatics

20CSC19

FORMAL LANGUAGE AND AUTOMATA THEORY

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

Pre-requisites: Discrete Mathematics, Data Structures, Design and analysis of algorithms

Course Objectives: The objectives of this course are,

1. To identify the hierarchy of formal languages, grammars, and Design finite automata to accept a set of strings of a language.
2. Should be able to prove that a given language is regular and able to apply the closure properties of languages and design context free grammars, conversions into normal forms.
3. To find equivalence of languages accepted by Push down Automata and distinguishes between computability Vs non-computability and Decidability Vs Undecidability.

Course Outcomes: On successful completion of the course, students will be able to,

1. Describe language basics like Alphabet, strings, grammars, productions, derivations, and Chomsky hierarchy.
2. Recognize regular expressions, formulate, and build equivalent finite automata for various languages.
3. Identify closure, decision properties of the languages and prove the membership.
4. Demonstrate context-free grammars, check the ambiguity of the grammars and design equivalent PDA to accept.
5. Use mathematical tools and abstract machine models to solve complex problems.
6. Analyze and distinguish between decidable and undecidable problem.

UNIT - I

Introduction: Alphabet, languages and grammars, productions and derivation, Chomsky hierarchy of languages. Regular languages and finite automata: Regular expressions and languages, Deterministic Finite Automata (DFA) and equivalence with regular expressions, Nondeterministic Finite Automata (NFA) and equivalence with DFA. Equivalence and Minimization of Automata.

UNIT - II

Regular Expressions and Finite Automata: Converting DFA's to Regular Expressions by Eliminating States, Converting Regular Expressions to Automata, Applications of Regular Expressions, and Algebraic Laws for Regular Expressions.

Properties of Regular Languages: The pumping lemma for Regular Languages, Applications of Pumping Lemma, Closure Properties and Decision Properties of Regular Languages.

UNIT - III

Context-free Languages and Pushdown Automata: Context-free grammars (CFG) and languages (CFL), Chomsky and Greibach normal forms, nondeterministic pushdown automata (PDA) and equivalence with CFG, parse trees, ambiguity in CFG, pumping lemma for context-free languages, deterministic pushdown automata, Closure properties of CFLs.

UNIT - IV

Context-sensitive Languages: Context-sensitive grammars (CSG), linear bounded automata and equivalence with CSG.

Turing Machines: The basic model for Turing machines (TM), Turing recognizable (recursively enumerable) and Turing-decidable (recursive) languages and their closure properties, variants of Turing machines, nondeterministic TMs and equivalence with deterministic TMs.

UNIT - V

Unrestricted grammars and equivalence with Turing machines, TMs as enumerators.

Undecidability: universal Turing machine, reduction between languages and Rice s theorem, PCP and Modified PCP, Various translators.

Text Books:

1. John E. Hopcroft, Rajeev Motwani, Jeffery D Ullman, “Introduction to Automata Theory Languages and Computation”, Third edition, Pearson Education, 2011.

Suggested Reading:

1. John C Martin. “Introduction to Language and Theory of Computation”, 3rd edition, TMH, 2003.
2. Daniel Cohen, “Introduction to Computer Theory”, 2ndedition, Wiley Publications, 2007.
3. Mishra K., Chandrasekaran N., “Theory of Computer Science (Automata, Languages and Computation)”, 3rd edition, Prentice Hall of India 2008.
4. Shyamalendra Kandar, “Introduction to Automata Theory, Formal Languages and Computation”, Pearson, 2013.
5. Kamala Krithivasan, Rama R. “Introduction to Automata Theory, and Computation”, Pearson 2009.

Online Resources:

1. http://courses.cs.vt.edu/cs4114/spring2012/index.php
2. www.pearsoned.co.in/KamalaKrithivasan

20CSC20

OPERATING SYSTEMS

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

Prerequisites: Computer Architecture and Programming Fundamentals.

Course Objectives: The objectives of this course are,

1. Should be able to describe the operating system service, and the design of an operating system.
2. To understand the structure and organization of the file system, process synchronization, process scheduling, system calls and different approaches to memory management.
3. To understand about the cloud infrastructures and technologies.

Course Outcomes: On successful completion of the course, students will be able to,

1. Identify the basics of an operating systems and its major components.
2. Understand the concepts related to process synchronization and deadlocks.
3. Distinguish various memory management techniques.
4. Interpret various threats and defense mechanisms used to protect the system.
5. Evaluate various file allocation methods.
6. Apply security as well as recovery features in the design of algorithms.

UNIT - I

Concepts of Operating Systems: Computer System over view, concept of an operating system, Types of operating systems, general system architecture, system components, operating system services, system calls, system programs, approaches to OS design and implementation: Micro-kernel, Layered, Kernel Approach.

UNIT - II

Processes and Threads: Concept of process, process states, process state transitions, process control block, operations on processes, concurrent processes, mutual exclusion and synchronization, principles of deadlocks, integrated deadlocks strategy, scheduling levels, scheduling criteria, algorithms, Inter Process Synchronization, Inter Process Communication, Linux IPC Mechanisms, RPC, RPC exception handling, Security issues.

UNIT - III

Memory Management and Data Management: Logical and physical address space, storage allocation and management techniques, swapping concept of multi-programming, paging, segmentation, virtual storage management strategies, demand paging, page replacement algorithms, thrashing, File organization, record blocking, access methods, directory structure, protection file system structure, allocation methods, free space management, directory implementation, disk structure, disk scheduling, disk management, buffering, swap space management, RAID levels.

UNIT - IV

OS Security: Types of threats in OS, basic security mechanisms, understanding the threats, malware taxonomy, viruses, worms, rootkits; Defense: overview, logging, auditing, and recovery, OS-level memory protection.

UNIT - V

Case studies and OS Abstractions: Linux/Unix OS design and architecture, Unix shell, Unix OS services, user perspective, representation of files in Unix, system processes and their structure, I/O system, memory management in Unix. Processes management, file management, IPC and network related system calls,

Text Books:

1. Galvin, Silberschatz, “Operating system Concepts”, 10th Edition, John Wiley & Sons, 2018.
2. Dhananjay Dhamdhare, “Operating Systems-A Concept Based Approach”, 3rd Edition, McGraw Hill Education, 2017.

Suggested Reading:

1. Ekta Walia, “Operating System Concepts”, Khanna Book Publishing, 2020.

2. William Stallings, “Operating Systems Internals and Design Principles”, Pearson Edition, 2012.
3. Charles Crowley, “Operating Systems –A Design Oriented Approach”, McGraw Hill Education, 2017.
4. Andrew S. Tanenbaum, Albert S Woodhull, “Operating systems Design and Implementation”, Pearson Edition, 2009.

20CSC21

DATA COMMUNICATION AND COMPUTER NETWORKS

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

Pre-requisites: Programming for problem solving and data structures.

Course Objectives: The objectives of this course are,

1. To understand the principles of data communication and organization of computer networks,
2. To analyze various routing protocols and congestion control algorithms.
3. To study the functions of the transport layer and to understand application layer protocols.

Course Outcomes: On Successful completion of this course, student will be able to,

1. Learn the communication protocol suites like ISO-OSI and TCP/IP.
2. Illustrate and explain Data Communications System and its components.
3. Identify and analyze various congestion control algorithms.
4. Distinguish the internet protocols like IP, ARP, ICMP, IGMP, routing protocols and DHCP.
5. Understand the transport layer protocols like TCP, UDP, RTCP.
6. Identify various application layer protocols like HTTP, WWW, DNS, Email Protocols, FTP and the underlying protocols.

UNIT - I

Introduction: Data communication, network types and models, TCP/IP and OSI Protocol Suite, transmission media (wired and wireless), switching.

UNIT - II

Data Link Layer: Design issues, error detection and correction, elementary data link protocols, sliding window protocols, HDLC, point to point protocols, multiple access protocols.
LAN: Wired LAN, wireless LAN, connecting devices and Virtual LAN.

UNIT - III

Network Layer: Network layer design issues, routing algorithms, congestion control algorithms, Quality of service, IPV4, IPV6, network layer protocols: ARP, RARP, ICMP, IGMP and DHCP.

UNIT - IV

Transport Layer: Process to Process Communication, User Datagram Protocol (UDP), Transmission ControlProtocol (TCP), SCTP, congestion control, quality of service.

UNIT - V

Application Layer: DNS, DDNS, SMTP, POP, IMAP, SSH, SFTP,WWW, HTTP, SNMP, Firewalls.

Text Books:

1. Behrouz A. Forouzan, “Data communication and Networking”, Tata McGraw Hill, Fifth Edition, 2017.
2. S. Tanenbaum, "Computer Networks", Pearson Education, Fifth Edition, 2013.
3. William Stallings, “Data and Computer Communication”, Eighth Edition, Pearson Education, 2007.

Suggested Reading:

1. Larry L.Peterson, Peter S. Davie, “Computer Networks”, Elsevier, Fifth Edition, 2012.
2. James F. Kurose, Keith W. Ross, “Computer Networking: A Top–Down Approach Featuring the Internet”, Pearson Education, 2005.

Online Resources:

1. https://nptel.ac.in/courses/106/105/106105081/
2. https://nptel.ac.in/courses/106/106/106106091/

20CSC22

SOFTWARE ENGINEERING

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

Pre-requisites: Object oriented programming, Programming for problem solving, database management systems.

Course Objectives: The objectives of this course are,

1. To understand the Software Engineering Practice and Process Models.
2. To understand Design Engineering and Project Management in Software Development.
3. To gain knowledge in software testing and overall project activities.

Course Outcomes: On Successful completion of this course, student will be able to,

1. State the software process and explain perspective process model, evolutionary process models.
2. Understand the agile Software process models and demonstrate the skills necessary to specify the requirements of software product so as to prepare SRS document.
3. Recall the modeling concepts and estimate the cost of software using empirical models
4. Enlist the design principles and construct a product using coding principles and standards.
5. Develop test cases and apply software testing methods in conventional and O-O approaches and estimates software quality of SW.

UNIT - I

Introduction to Software Engineering: The nature of Software, Software Engineering, Software Engineering Practice, The Software Process**,** Software Engineering Practice **Process Models:** A Generic Process Model, Process assessment and Improvement, Prescriptive Process Models: Waterfall Model, Incremental Process Models, RAD Model, Evolutionary Process Models - Prototyping, The Spiral Model, Concurrent Models, Specialized Process Models.

UNIT - II

An Agile Development: Agility, Agile Process, and Agile Process Models- Extreme Programming (XP), Adaptive Software Development (ASD), Scrum, Dynamic Systems Development Method (DSDM), Feature Driven Development (FDD), Agile Modeling (AM), **Requirement Engineering,** Establishing the groundwork, Eliciting Requirements, Negotiating Requirements, and Validating Requirements. **Software Requirements Analysis and Specification**: Value of a Good SRS, Problem Analysis, Requirements Specification, Components SRS, Structure of a Requirements Document

UNIT - III

Flow-Oriented Modeling, **Planning a software Project**: Effort Estimation, Project Schedule and Staffing, Quality Planning, Risk Management, **Estimation for Software Projects:** Decomposition Techniques - Software Sizing, Problem-Based Estimation, An Example of LOC-Based Estimation, An Example of FP-Based Estimation.

UNIT - IV

Design Concepts: Coupling, Cohesion, The Open-Closed Principle, Function-Oriented Design - Structure Charts, Structured Design Methodology, An Example, Software Architecture, A Brief Taxonomy of Architectural Styles, C**omponent-Level Design:** Definition, Basic Design Principles, Design Guidelines, Designing Traditional Components, Coding Principles and guidelines, Incremental Development of Code, Code Inspection – Planning, Self-Review, Group Review Meeting.

UNIT - V

Testing - Testing Concepts, Testing Process, **Testing Strategies**: A Strategic approach to software testing, strategic issues, test strategies for Conventional Software, Validation Testing, System Testing, White Box Testing, Black Box. Software Review Techniques - Informal Reviews Formal Technical Reviews, Quality Concepts - What is Quality, Software Quality.

Text Books:

1. Roger S. Pressman “Software Engineering: A practitioner's approach”, McGraw Hill, 7th Edition, 2010.
2. Pankaj Jalote “A concise Introduction to Software Engineering”, Springer, Kindle Edition, 2008.

Suggested Reading:

1. Sommerville “Software Engineering”, 10th Edition, Pearson, 2016.
2. Rajib Mal “Fundamental of Software Engineering”, 4th Edition, PHI Learning, 2014.

Online Resources:

1. https://nptel.ac.in/courses/106101061/

20CSE01

IMAGE PROCESSING AND COMPUTER VISION
(Professional Elective – I)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

Pre-requisites: Linear Algebra and calculus.

Course Objectives: The objectives of this course are,
1. To understand the Fundamental Concepts Related To Multi-Dimensional Signal Processing.
2. To understand Feature Extraction algorithms.
3. To understand Visual Geometric Modeling and Stochastic Optimization.

Course Outcomes: On successful completion of the course, students will be able to,
1. Understand basic principles of image processing and its significance in real world.
2. Interpret and evaluate various approaches for image. Transformation, segmentation, and restoration.
3. Determine and compute object, scene recognition and categorization algorithms for real time images.
4. Analyze images and videos for problems such as tracking and structure from motion.
5. Appraise recovery of 3D structure of ill-posed scenes.
6. Apply various techniques to build computer vision applications.

UNIT - I
Image Formation and Description: Fundamental steps of image processing, the image model and Image acquisition, Relationship between pixels. Sampling and Quantization, Elements of Digital Image Processing Systems.
Image Transforms: Digital Image Transforms - Fourier Transform, Extension to 2D.Properites of Fourier transformations.

UNIT - II
Image Enhancements: Histogram Equalization, Image Smoothing, Image Sharpening, Edge Detection.
Segmentation: Active contours, Split and merge, Mean shift and mode finding, Normalized cuts.
Feature-based alignment: 2D and 3D feature-based alignment, Pose estimation.

UNIT - III
Structure from motion: Triangulation, Two-frame structure from motion, Factorization, Bundle adjustment, constrained structure and motion
Dense motion estimation: Translational alignment, parametric motion, Spline-based motion, Optical flow, Layered motion.

UNIT - VI
Recognition: Object detection, Face recognition, Instance recognition, Category recognition, Context and scene understanding.

UNIT - V
3D Reconstruction: Shape from X, Active range finding, Surface representations, Point-based representations, volumetric representations, Model-based reconstruction.

Text Books:
1. R. C. Gonzalez, R. E. Woods “Digital Image Processing” Addison Wesley, 2008.
2. Richard Szeliski “Computer Vision: Algorithms and Applications” Springer-Verlag London Limited 2011.

Suggested Reading:
1. Robert J. Schallkoff “Pattern Recognition: Statistical. Structural and Neural Approaches”, John Wiley & Sons, 1992.
2. D. A. Forsyth, J. Ponce. “Computer Vision: A Modern Approach”, Pearson Education; 2003.

3. Richard Hartley, Andrew Zisserman, “Multiple View Geometry in Computer Vision”, Second Edition, Cambridge University Press, 2004.
4. K. Fukunaga, "Introduction to Statistical Pattern Recognition", Second Edition, Academic Press, Morgan Kaufmann, 1990.

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc18_ee40.
2. CV online: http://homepages.inf.ed.ac.uk/rbf/CVonline.
3. Computer Vision Homepage: http://www2.cs.cmu.edu/afs/cs/project/cil/ftp/html/vision.html.

20CSE02

ADVANCED DATABASES
(Professional Elective – I)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

Pre-requisites: Programming for problem solving, Database management systems.

Course Objectives: The objectives of this course are,

1. To design high-quality relational databases and database applications.
2. To translate complex conceptual data models into logical and physical database designs.
3. To gain an understanding of Oracle11g and XML.
4. To perceive knowledge about Parallel and Distributed Databases.
5. To get exposed in Performance Tuning.

Course Outcomes: On Successful completion of this course, student will be able to,

1. Analyze and evaluate modeling and development methods/techniques in Object-based Databases.
2. Understand and analyze query processing and optimization.
3. Understand how distributed and parallel databases are implemented, and how applications can be designed for those databases.
4. Develop applications for mobility and personal databases.
5. Understand and implement cloud-based databases.
6. Gain insight into some advanced topics in database such as Performance Tuning, spatial databases, temporal databases.

UNIT - I

Object Based Databases: Overview, complex Data Types, Structured Types and Inheritance in SL, table Inheritance, Array and Multiset Types in SQL, Object –Identity and Reference Types in SQL, Implementing O-R features, Persistent Programming Languages, Object Relational Mapping, Object Oriented versus Object Relational.

UNIT - II

XML: Motivation, Structure of XML data, XML Document schema, Querying and Transformation, Application Program Interface to XML, Storage of XML data, XML applications.

UNIT - III

Query processing: Overview, Measures of Query Cost, Selection operating, sorting, Join Operation, Other Operations, Evaluation of Expressions.

Query Optimization: Overview, Transformation of Relational Expressions, Estimating Statistics of Expressing Results, Choice of Evaluation plans, Materialized Views.

UNIT - IV

Parallel Databases: Introduction, I/O Parallelism, Inter-query Parallelism, Intra-query Parallelism, Interoperation Parallelism Query Optimization, and Design of Parallel Systems.

Distributed Databases: Homogenous and Heterogeneous Databases, distributed data storage, Distributed Transactions, Commit Protocols, concurrency Control in Distributed Databases, Availability, Distributed Query Processing, Heterogeneous Distributed Databases, cloud Based Databases, Directory systems.

UNIT - V

Advanced Application development: Performance Tuning, Performance Benchmarks Other Issues in Application Development, Standardization.

Spatial and Temporal Data and Mobility: Motivation, Time in Databases, spatial and Geographical Data, Multimedia Databases, Mobility and Personal databases.

Test Books:

1. Abraham Silbershatz, Henry F Korth, S Sudharshan, “Database System Concepts”, McGraw Hill

International Edition, Sixth Edition, 2010.
2. ElmasriNavathe, Somayajulu, Gupta, “Fundamentals of Database Systems”, Pearson Education, Fourth Edition, 2006.

Suggested Reading:

1. CJ Date, A Kannan, S Swamynathan, “An Introduction to database Systems”, Pearson Education, Eight Edition, 2006
2. Ramakrishna, Gehrke, “Database Management”, International Edition, Third Edition, 2003.

20CSE03

SYSTEM MODELLING AND SIMULATION
(Professional Elective – I)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

Course Objectives: The objectives of this course are,

1. Review the cost-effectiveness and the time-effect of modeling with industry-related examples of modeling in science and engineering.
2. Estimate essential inputs of the model and respective outcomes from the simulation.
3. Analyze different models and simulations, describe the iterative development process of a model, and explain how models link the physical and virtual worlds.

Course Outcomes: On Successful completion of the course, students will be able to,

1. Create a computer simulation based on the physical characteristics of the system.
2. Solve ordinary and partial differential equations with computational methods.
3. Display insight into the uncertainties in a system and how they can be characterized.
4. Manipulate the data structures of numerical computing; matrices, and vectors, and visually represent data sets coming from computer simulations.

UNIT - I

Introduction to Modeling; Modeling Concepts and Definitions; Introduction to MATLAB; MATLAB Scripts; MATLAB Arrays.

UNIT - II

Aspects of discrete event simulation; Random number/variate generation; linear models; graphing data in MATLAB; MATLAB Array Math.

UNIT - III

Graphing in MATLAB; Nonlinear Functions and Modeling; Curve fitting; MATLAB I/O.

UNIT - IV

Stochastic models; Accuracy and precision in modeling; MATLAB conditional statements; MATLAB loops; MATLAB functions.

UNIT - V

Simulation models validation methods; Read/write simulation data from/to external files.

Text Books:

1. Steven I. Gordon, Brian Guilfoos “Introduction to Modeling and Simulation with MATLAB® and Python”. CRC Press, 2017.
2. Law and Kelton “Simulation Modeling and Analysis”, Third Edition, McGraw Hill, Boston, MA, 2000.

20CSE04

FREE AND OPEN SOURCE TECHNOLOGIES
(Professional Elective – I)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

Pre-requisites: Programming for problem solving, Object Oriented Programming.

Course Objectives: The objectives of this course are,
1. To familiarize the students with Open Source Technologies.
2. To expose students with OSS Projects, Advantages of Open Source.
3. To make the students understand the principles, methodologies, policies, licensing procedures and ethics of FOSS.

Course Outcomes: On Successful completion of this course, student will be able to,
1. Identify various FOSS tools, platforms, licensing procedures and development models, ethics
2. Describe various FOSS projects, development models and project management
3. Adapt to the usage of FOSS tools and technologies.
4. Distinguish between Proprietary and Open Source tools, development methods
5. Practice Open Source principles, ethics, and models and to evaluate various Open Source projects like Linux, Apache, GIT, etc.

UNIT - I

Introduction to Open Source: Open Source, need and principles of OSS, Open Source Standards, Requirements for Software, OSS success, Free Software, Examples, Free Vs. Proprietary Software, Public Domain software, Historyof free software, Proprietary Vs Open Source, uses and advantages of Free and Open Source Software.

UNIT - II

Principles and Open Source Methodology: Open Source Initiatives, Open Standards Principles, Methodologies, Software freedom, Open Source Software Development, Licenses, Copyright vs. Copy left, Patents, zero marginal cost, income-generation Opportunities, Internationalization.

UNIT - III

Case Studies: Apache, BSD, Linux, Mozilla Firefox, Wikipedia, GIT, GNU CC, LibreOffice.

UNIT - IV

Open Source Project: Starting and Maintaining an Open Source Project, Open Source Hardware, Open Source Design, OpenSource Teaching (OST), Open Source Media.
How to create your own Licenses, Important FOSS Licenses (Apache, BSD, GPL and LGPL).

UNIT - V

Open Source Ethics: Open Source Government, Ethics of Open Source, Social and Financial Impact of Open Source Technology, Shared Software, Shared Source, Open Source as a Business Strategy.

Text Books:
1. Kailash Vadera, Bhavyesh Gandhi "Open Source Technology", University Science Press, 1st Edition, 2009.
2. Fadi P. Deek, James A. M. McHugh, "Open Source Technology and Policy", Cambridge University Press.

Suggested Reading:
1. Wale Soyinka, "Linux Administration- A beginner's Guide", Tata McGraw Hills.
2. Andrew M. St. Laurent, "Understanding Open Source and Free Software Licensing", O'Reilly Media.
3. Dan Woods, Gautam Guliani, "Open Source for the Enterprise", O'Reilly Media.
4. Bernard Golden, "Succeeding with Open Source", Addison-Wesley Professional.

5. Clay Shirky, Michael Cusumano, “Perspectives on Free and Open Source Software”, MIT press.

Online Resources:

1. https://fossee.in/
2. https://opensource.com
3. https://www.gnu.org/

20CSE05

OPTIMIZATION TECHNIQUES
(Professional Elective - I)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

Pre-requisites: Mathematical Foundation for Data Science and Security.

Course Objectives: The objectives of this course are,

1. To identify and develop optimization techniques from the verbal description of real system.
2. To learn different techniques to get optimum solution LPP.
3. To understand the Mathematical representations that are needed to solve optimization problem.
4. To analyze the results of the different real-world problems.
5. To construct network and find critical path using network scheduling technique

Course Outcomes: On Successful completion of this course, student will be able to,

1. Calculate the optimum values for given objective function by LPP.
2. Solve the solution for maximize the profit with minimum cost by Transportation problem.
3. Determine the optimum feasible solution for assignment and travelling salesman problems and computing the optimal solution for Job sequencing models.
4. Compute the optimum values for given objective function by IPP and optimal strategy for games.
5. Identify critical path using network scheduling.

UNIT - I

Introduction to Operations Research: Basics definitions, objectives, models, application and limitations. Linear Programming (LP) - Mathematical Formulation of LP problem, Graphical Method, Some Exceptional Cases, Simplex Method - Introduction, computational procedure, artificial variables technique - big-M method and 2-phase method.

UNIT - II

Introduction, Mathematical Formulation of transportation Problem, Balanced / Unbalanced, Minimization / Maximization, Determination of the initial basic feasible solution using (i) North-West Corner Rule (ii) Least cost method & (iii) Vogel's approximation method for balanced & unbalanced transportation problems. Optimality Test & obtaining of optimal solution (Considering per unit transportation cost) using MODI method and steppingstone method.

UNIT - III

Introduction, Mathematical Formulation of Assignment Problem, Hungarian method for optimal solution, Solving unbalanced problem, Traveling salesman problem, Sequencing models, Solution of Sequencing Problem – Processing n Jobs through 2 Machines – Processing n Jobs through 3 Machines – Processing 2 Jobs through m machines – Processing n Jobs through m Machines.

UNIT - IV

Integer Programming Problem: Introduction, Types of Integer Programming Problems, Gomory's All-IPP Method, All IPP Algorithm, Branch and Bound Technique Game and strategies: Introduction, Game with maximin-minimax principle (Pure Strategies), Game with Mixed Strategies, Dominance Property, Graphical Method for 2 X n or m x 2 Games, Linear Programming Approach for Game Theory.

UNIT - V

Construction of Network – Rules & Precautions, C.P.M. & P.E.R.T. Networks, Obtaining of Critical Path, Time estimates for activities, Probability of completion of project, Determination of floats (total, free, independent)

Text Books:

1. Kanti Swarup, P. K. Gupta, Man Mohan, "Operations Research", Sultan Chand Publications, 2010.
2. R. Pannerselvam, "Operations Research", PHI, 2nd Edition, 2016.

Suggested Reading:

1. Deb K. “Optimization for Engineering Design Algorithms and Examples”, PHI, 2000.
2. Arora J. “Introduction to Optimization Design”, Elsevier Academic Press, New Delhi, 2004.
3. Saravanan R. “Manufacturing Optimization through Intelligent Techniques”, Taylor & Francis (CRC Press), 2006.
4. Hardley G. “Linear Programming”, Narosa Book Distributors Private Ltd., 2002.

Online Resources:

1. https://nptel.ac.in/courses/111105039
2. https://nptel.ac.in/courses/105108127

20ECO10

FUNDAMENTALS OF WIRELESS COMMUNICATION
(Open Elective – I)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

Prerequisite: A course on basics of electronics is required.

Course Objectives: The objectives of this course are,

1. To familiarize the concepts related to cellular communication and its capacity.
2. To teach students the fundamentals of propagation models and multipath fading.
3. To describe diversity schemes applied in wireless communication and understand the latest Wireless technologies

Course Outcomes: On Successful completion of this course, student will be able to,

1. Understand the overview of Wireless Communication.
2. Relate the cellular concepts like frequency reuse, hand off, coverage and capacity.
3. Analyse the mobile radio propagation with large scale and small scale fading.
4. Select the suitable diversity technique to combat the multipath fading effects.
5. Compare the multiple access techniques and apply to wireless standards.

UNIT - I

An overview of wireless communications: Roadmap of cellular communications. First-Generation systems. Second-Generation systems. Third-Generation systems, Fourth-Generation systems and Fifth-Generation Systems.

UNIT - II

The Cellular Concept-System Design Fundamentals: Introduction, Frequency Reuse, Channel Assignment Strategies. Handoff Strategies. Interference and System Capacity. Power Control for Reducing Interference.

UNIT - III

Mobile Radio Propagation: Large-Scale Path Loss, Introduction to Radio Wave Propagation, Free Space Propagation Model, the Three Basic Propagation Mechanisms, **Small-Scale Fading and Multipath:** Small-Scale Multipath Propagation, Factors Influencing Small-Scale Fading, Doppler Shift, Types of Small-Scale Fading.

UNIT - IV

Diversity Techniques: Practical Space Diversity Considerations- Selection Diversity, Feedback or Scanning, Maximal Ratio Combining Diversity Equal Gain Combining. **Orthogonal frequency division multiplexing:** Introduction, Principle of OFDM. OFDM transceivers Cyclic prefix, Spectrum of OFDM, Fading mitigation in OFDM. Intercarrier interference.

UNIT - V

Multiple access techniques: Duplexing: FDD versus TDD. FDMA. TDMA. CDMA. OFDMA. SDMA
Wireless Standards: Global System for Mobile (GSM). GSM Services and Features, GSM System Architecture, GSM Radio Subsystem. GPRS and EDGE- features.

Text Books:

1. Theodore S. Rappaport - Wireless Communications Principles and Practice, 2nd Edition, Pearson Education, 2003.
2. Andrea Goldsmith, “Wireless Communications”, Cambridge University Press, First Edition, 2005.
3. Ke-Lin Du, Concordia University, Montréal,M. N. S. Swamy- Wireless Communication Systems.From RF Subsystems to 4G Enabling Technologies. April 2010.

Suggested Reading:

1. Sanjay Kumar, “Wireless Communication the Fundamental and Advanced Concepts” River Publishers, Denmark, 2015
2. Andreas F.Molisch - Wireless Communications John Wiley, 2nd Edition, 2006.
3. Wireless Communications and Networking, Vijay Garg, Elsevier Publications, 2007.

20EEO05

WASTE MANAGEMENT
(Open Elective – I)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

Course Objectives: The objectives of this course are,

1. To imbibe the concept of effective utilization of any scrap.
2. To become familiar with the processes of all disciplines of engineering.
3. To learn the technique of connectivity from waste to utility.

Course Outcomes: On Successful completion of this course, student will be able to,

1. Categorize the waste based on the physical and chemical properties.
2. Explain the Hazardous Waste Management and Treatment process.
3. Illustrate the Environmental Risk Assessment, methods, mitigation and control.
4. Interpret the Biological Treatment of Solid and Hazardous Waste.
5. Identify the waste disposal options, describe the design and construction, Operation, Monitoring, Closure of Landfills.

UNIT - I

Introduction to waste management and Municipal Solid Waste Management: Classification of waste: Agro based, Forest residue, Industrial waste, e-Waste, Municipal Solid Waste Management: Fundamentals Sources, composition, generation rates, collection of waste, separation, transfer and transport of waste, treatment and disposal options.

UNIT - II

Hazardous Waste Management and Treatment: Hazardous Waste Identification and Classification, Hazardous Waste Management: Generation, Storage and collection, Transfer and transport, Processing, Disposal, Hazardous Waste Treatment: Physical and Chemical treatment, Thermal treatment, Biological treatment, Pollution Prevention and Waste Minimization, Hazardous Wastes Management in India.

UNIT - III

Environmental Risk Assessment: Defining risk and environmental risk, Parameters for toxicity quantification, Types of exposure, Biomagnifications, Effects of exposure to toxic chemicals, risk analysis and risk matrix, methods of risk assessment, mitigation and control of the risk, case studies.

UNIT - IV

Biological Treatment: Solid and Hazardous Waste Composting; bioreactors; anaerobic decomposition of solid waste; principles of biodegradation of toxic waste; inhibition; co-metabolism; oxidative and reductive processes; slurry phase bioreactor; in-situ remediation.

UNIT - V

Waste Disposal: Key Issues in Waste Disposal, Disposal Options and Selection Criteria: Disposal options, Selection criteria, Sanitary Landfill: Principle, Landfill processes, Landfill Gas Emission: Composition and properties, Hazards, Migration, Control, Leach ate Formation: Composition and properties. Leach ate migration, Control, Treatment, Environmental Effects of Landfill, Landfill Operation Issues, Design and construction, Operation, Monitoring, Closure of Landfills - Landfill Remediation, national and International Waste management programs.

Text Books:

1. John Pichtel “Waste Management Practices”, CRC Press, Taylor and Francis Group 2005.
2. LaGrega, M.D.Buckingham,P.L. and Evans, J.C. Hazardous “Waste Management”, McGraw Hill International Editions, New York, 1994.
3. Richard J. Watts, Hazardous “Wastes - Sources, Pathways, Receptors”, John Wiley and Sons, New York, 1997.

Suggested Reading:

1. Basics of Solid and Hazardous Waste Mgmt. Tech. by KantiL.Shah 1999, Prentice Hall.
2. Solid and Hazardous Waste Management 2007 by S.C.Bhatia Atlantic Publishers & Dist.

20MEO09

ORGANIZATIONAL BEHAVIOUR
(Open Elective – I)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

Course Objectives: The objectives of this course are,

1. Define basic organizational behavior principles and analyze how these influence behavior in the work place.
2. Analyze the influence of perceptions and personality on individual human behavior in the work place.
3. Discuss the theories of Motivation and Leadership.
4. Provide knowledge on different organizational structures; and concepts of culture, climate and organizational development and make the students familiarize with individual behavior.
5. Describe the interpersonal and their intrapersonal reactions within the context of the group and also demonstrate effective communication and decision making skills in small group settings.

Course Outcomes: On successful completion of the course, students will be able to

1. Understand Organizational Behavioral principles and practices.
2. Compare various organizational designs and cultures enabling organizational development.
3. Apply motivational theories and leadership styles in resolving employee‘s problems and decision makingprocesses.
4. Understand the group dynamics, communication network, skills needed to resolve organizational conflicts.
5. Analyze the behavior, perception and personality of individuals and groups in organizations in terms of the key factors that influence organizational behavior.

UNIT – I

Introduction: Organizational behaviour, nature and levels of organizational behavior, individuals in organization, individual differences , personality and ability, the big 5 model of personality , organizationally relevant personality traits, the nature of perception , characteristics of the perceiver, target and situation, perceptual problems.

UNIT – II

Organization structure: Organizational designs and structures, traditional and contemporary organizational designs, organizational culture and ethical behavior , factors shaping organizational culture, creating an ethical culture, concepts, organizational climate, organization conflict, and organization development.

UNIT – III

Motivation and leadership: Motivation, early and contemporary theories of motivation, leadership, early and contemporary approaches to leadership.

UNIT – IV

Group dynamics: Groups and group development, turning groups into effective teams, managing change , process, types and challenges, communicating effectively in organizations, communication process, barriers to communication, overcoming barriers to communication, persuasive communication, communication in crisis situations.

UNIT – V

Power, Politics, Conflict and Negotiations: Power, politics, conflict and negotiations, sources of individual, functional and divisional power, organizational politics conflict, causes and consequences, Pondy‘s model of organizational conflict, conflict resolution strategies.

Text Books:

1. Jennifer George and Gareth Jones, “Understanding and Managing Organizational Behavior”, Pearson Education Inc., 2012.
2. Jon L Pierce and Donald G. Gardner, “Management and Organizational behavior”, Cengage Learning

India (P) Limited, 2001.
3. Richard Pettinger, "Organizational Behaviour", Routledge, 2010.

Suggested Reading:

1. Stephen P. Robbins, Jennifer George and Gareth Jones, "Management and Organizational Behaviour", Pearson Education Inc., 2009.
2. John Schermerhorn, Jr., James G. Hunt and Richard N. Osborn, "Organizational Behaviour", 10th edition, Wiley India Edition, 2009.

20MTO03

QUANTUM COMPUTING
(Open Elective – I)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

Course Objectives: The objectives of this course are,

1. To learn Quantum bits and compute mathematical foundation
2. To understand the evaluation of the quantum bits.
3. To learn Quantum operations by building blocks of Quantum programming
4. To know the basics of Quantum logic gates and circuits
5. To learn Quantum Algorithms by various Techniques.

Course Outcomes: On successful completion of the course, students will be able to

1. Compute basic mathematical operations on Quantum bits.
2. Execute Quantum operations of Quantum computing
3. Built quantum programs
4. Develop quantum Logical gates and circuits.
5. Develop the quantum algorithm

UNIT - I

Math Foundation for Quantum Computing: Introduction of Vector Space, Subspaces, Basis and Finite Dimensions. Vectors and orthogonality, inner product and Outer product and Hilbert Spaces. Formation of Matrices by Linear Transformation. Linear Independent and dependent Vectors. Unitary operators and projectors, Eigen values and Eigen Vectors.

UNIT – II

Introduction to Quantum Computing: Quantum Mechanics (Huygens wave theory ,Photo electric effect De-Broglie hypothesis and Heisenberg's uncertainty Principle), Origin of Quantum Computing, Overview of major concepts in Quantum Commuting ,Qubits and multi-qubits states, Bra-ket notation, Quantum Superposition Motivation for Studying Quantum Computing, Major players in the industry (IBM, Microsoft, Rigetti, D-Wave

UNIT – III

Building Blocks for Quantum Program: Block sphere representations, Multi-qubits, Inner and outer product of Multiple of qubits, Tensor product, Quantum Entanglement, Quantum Teleporation (EPR Model) and Bell State.

UNIT – IV

Quantum Logical gates and Circuits: Pauli, Hadamard, Phase shift, controlled gates, AND, OR and NAND gate, C-Not, CCNOT gate Introduction of Fourier Transform and Discrete Fourier transform.

UNIT – V

Quantum Algorithms: Z-Transform. Basic techniques exploited by quantum algorithms (Amplitude amplification, Quantum Fourier Transform, Quantum Phase estimation, Quantum walks), Major Algorithms (Shore's Algorithm, Grover's Algorithm, Deutsch's Algorithm, Deutsch-Jozsa Algorithm).

Text Books:

1. David McMahon, "Quantum Computing Explained", Wiley-IEEE Computer Society Pr., 2008.

Suggested Reading:

1. Michael A. Nielsen, "Quantum Computation and Quantum Information", Cambridge University Press, 2010.

20BTO04

BIOINFORMATICS
(Open Elective – I)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

Prerequisites: The school level basic knowledge in Fundamental science is required.

Course Objectives: The objectives of this course are,

1. To provide elementary knowledge in biology and bioinformatics and biological information available to a biologist on the web and learn how to use these resources on their own.
2. To learn the fundamentals of biological databases, Sequence analysis, data mining, sequence alignment and phylogenetics.
3. To learn methods for determining the predictinggene and protein.

Course Outcomes: On successful completion of the course, students will be able to,

1. Explain the basic concepts of biology and bioinformatics.
2. Identify various types of biological databases used for the retrieval and analysis of the information
3. Explain the sequence analysis and data mining.
4. Discuss the methods used for sequence alignment and construction of the phylogenetic tree.
5. Describe the methods used for gene and protein structure prediction.

UNIT - I

Introduction And Basic Biology: Bioinformatics- Introduction, Scope and Applications of Bioinformatics; Basics of DNA, RNA, Gene and its structure, Protein and metabolic pathway; Central dogma of molecular biology; Genome sequencing, Human Genome Project.

UNIT - II

Biological Databases: Introduction to Genomic Data and Data Organization, types of databases, biological databases and their classification, Biological Databases - NCBI, SWISS PROT/Uniport, Protein Data Bank, Sequence formats; Information retrieval from biological databases; Data mining of biological databases

UNIT - III

Sequence Analysis and Data Mining: Scoring matrices, Amino acid substitution matrices- PAM and BLOSUM; Gap, Gap penalty; Database similarity searching - BLAST, FASTA algorithms to analyze sequence data, FASTA and BLAST algorithms comparison; Data Mining- Selection and Sampling, Pre-processing and Cleaning, Transformation and Reduction, Data Mining Methods, Evaluation, Visualization, Designing new queries, Pattern Recognition and Discovery, Text Mining Tools

UNIT - IV

Sequence Alignment And Phylogentics: Sequence Alignment – Local and Global alignment; Pairwise sequence alignment – Dynamic Programming method for sequence alignment - Needleman and Wunsch algorithm and Smith Waterman algorithm. Multiple sequence alignment - Methods of multiple sequence alignment, evaluating multiple alignments, applications of multiple sequence alignment. Concept of tree, terminology, Methods of phylogenetic analysis, tree evaluation – bootstrapping, jackknifing

UNIT - V.

Macromolecular Structure Prediction:

Gene prediction, - neural networks method, pattern discrimination methods, conserved domain analysis; Protein structure basics, protein structure visualization, Secondary Structure predictions; prediction algorithms; Chou-Fasman and GOR method, Neural Network models, nearest neighbor methods, Hidden-Markov model, Tertiary Structure predictions; prediction algorithms; homology modeling, threading and fold recognition, ab initio prediction.

Text Books:

1. David Mount, “Bioinformatics Sequence and Genome Analysis”, 2nd edition, CBS Publishers and

Distributors Pvt. Ltd., 2005
2. Rastogi SC, Mendiratta N and Rastogi P, "Bioinformatics: Methods and Applications Genomics, Proteomics and Drug discovery", 3rd edition, PHI Learning Private Limited, New Delhi, 2010

Suggested Reading:

1. Baxebanis AD and Francis Ouellette BF, "Bioinformatics a practical guide the analysis of genes and proteins", 2nd edition, John Wiley and Sons, Inc., Publication, 2001
2. Vittal R Srinivas, "Bioinformatics: A modern approach. PHI Learning Private Limited", New Delhi, 2009
3. JiXiong, "Essential Bioinfomatics", Cambridge University Press, 2006.

20CSC23

OPERATING SYSTEMS LAB

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	50 Marks
Credits	1.5

Pre-requisites: Operating systems, Programming for problem solving.

Course Objectives: The objectives of this course are,

1. To explore Unix/Linux operating system.
2. To analyze various system calls available in Linux/Unix.

Course Outcomes: On Successful completion of this course, student will be able to,

1. Understand Linux/Unix environment.
2. Identify and interpret various system programs.
3. Understand and implement shell programming.
4. Simulate memory management and file allocation techniques.
5. Analyze process and file management system calls by creating and/or modifying concurrent programs.
6. Build network-oriented applications using system calls.

List of Experiments:

1. Shell programming.
2. Implementation of memory management techniques like paging and segmentation.
3. Implementation of Linked, Indexed and Contiguous file allocation methods.
4. Demonstration of Linux/Unix file related system calls: mkdir, link, unlink, mount, unmount, users+, chown, chmod, open, close, read, write, lseek, stat, sync.
5. Demonstration of Linux/Unix process related system calls: fork, wait, exec, exit, getpid, getuid, setuid brk, nice, sleep.
6. Development of applications using Linux/Unix system calls: signal, socket, accept, snd, recv, connect.

Text Books:

1. Galvin, Silberschatz, “Operating System Concepts”, 10th Edition, John Wiley & Sons, 2018.
2. Dhananjay Dhamdhare, “Operating Systems-A Concept Based Approach”, 3rd Edition, McGraw Hill Education, 2017.

Suggested Reading:

1. Ekta Walia, “Operating System Concepts”, Khanna Book Publishing, 2020.
2. William Stallings, “Operating Systems Internals and Design Principles”, Pearson Ed., 2012.
3. Charles Crowley, “Operating Systems –A Design Oriented Approach”, McGraw Hill Education, 2017.
4. Andrew S. Tanenbaum, Albert S Woodhull, “Operating systems Design and Implementation”, Pearson Ed., 2009.

20CSC24

DATA COMMUNICATION AND COMPUTER NETWORKS LAB

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	50 Marks
Credits	1.5

Pre-requisites: Operating Systems, Data Communication and Computer Networks.

Course Objectives: The objectives of this course are,

1. To familiarize students with the communication media, devices, and protocols.
2. To expose students to gain practical knowledge of computer networks and its configuration.
3. To create simple network topologies using simulation tools.

Course Outcomes: On successful completion of the course, students will be able to,

1. Identify the different types of wiring equipment's used in the networks lab.
2. Understand the various network devices like repeater, hub, switch, and routers.
3. Practice the basic network configuration commands like ifconfig, ping, traceroute, nslookup, dig, arp, netstat, nmap.
4. Design and demonstrate network topologies using GNS3.
5. Examine the packet transfer using tcpdump.
6. Analyze the network performance using Wireshark or any tool.

List of Experiments:

1. Study of Network media, cables, and devices and Cable Construction.
2. Demonstration of basic network commands/utilities (both in Windows and Linux).
3. PC Network Configuration.
4. Building a switch-based network / Configuration of Cisco Switch CBS250-24T-4G 24-Port.
5. Configuration of Cisco Router ISR-4331.
6. Configuration of VLAN in Cisco switch.
7. Develop different local area networks using GNS3. Connect two or more Local area networks. Explore various sub-netting options.
8. Configure Static routing using GNS3 tool.
9. Basic OSPF configuration using GNS3 tool.
10. Basic EIGRP Configuration using GNS3 tool.
11. Analysis of network traces using tcpdump.
12. Analysis of network traces using Whireshark.

Text Books:

1. S. Tanenbaum, "Computer Networks", Pearson Education, Fifth Edition, 2013.

Online Resources:

1. https://learningnetwork.cisco.com/s/question/0D53i00000Kt7EkCAJ/tools-for-ccnp-network-simulator-lab-tasks
2. https://www.packettracernetwork.com/
3. https://www.ghacks.net/2019/11/13/gns3-is-an-open-source-graphical-network-simulator-for-windows-linux-and- macos/
4. https://www.imedita.com/blog/top-10-list-of-network-simulation-tools/
5. https://www.gns3.com/

20CSC25

CASE STUDIES USING UML LAB

Instruction	2 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	50 Marks
Credits	1

Prerequisites: Object Oriented Programming, Software Engineering.

Course Objectives: The objectives of this course are,

1. To identify Project Scope, Objectives and infrastructure.
2. To understand Software Engineering methodologies for project development
3. To gain knowledge about Computer Aided Software Engineering (CASE) tools.
4. To use effective communication and technical skills for building quality software.

Course Outcomes: On successful completion of the course, students will be able to,

1. Identify the problem scope and constraints in the problem.
2. Prepare software requirements specifications (SRS) for the system according to standards.
3. Apply the design notations of structured approach to develop ER and Data Flow Diagrams.
4. Apply/Use the design notations of OO approach to develop UML diagrams using rational tools.
5. Implement, analyze and prepare the documentation for the proposed system.

Select one large Information System/Approach and device the following using UML tool:

1. Structured Diagrams (Data Flow Diagrams, Entity-Relationship Diagrams etc.)
2. Preparation of Software Requirement Specification Document for a given Case Study.

UML Diagrams

1. Use Case Diagrams
2. Class Diagrams
3. Sequence Diagrams
4. Activity Diagrams
5. State Chart Diagrams
6. Component Diagrams
7. Deployment Diagrams

Text Books:

1. Grady Booch, James Rumbaugh, Ivar Jacobson: “The Unified Modeling Language User Guide”, Pearson Education, 2007.
2. Roger S. Pressman, “Software Engineering - A Practitioners Approach”, 7th Edition, Pearson Education, India, 2010.

20CSI02

INTERNSHIP – II

(Industrial / Rural Internship)

Instruction	3 to 4 weeks / 90 Hours
Duration of End Examination	-
Semester End Examination	-
Continuous Internal Evaluation	50 Marks
Credits	2

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY(A)

SCHEME OF INSTRUCTIONS AND EXAMINATION

Model Curriculum(R-20)

B.E. (Computer Science and Engineering)

SEMESTER - VI

S. No	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per Week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
THEORY									
1.	20CSC26	Compiler Design	3	-	-	3	40	60	3
2.	20CSC27	Artificial Intelligence	3	-	-	3	40	60	3
3.	20CSEXX	Professional Elective – II	3	-	-	3	40	60	3
4.	20CSEXX	Professional Elective – III	3	-	-	3	40	60	3
5.	20XXXXX	Open Elective-II	3	-	-	3	40	60	3
6.	20EGM03	Universal Human Values 2.0	3	-	-	3	40	60	3
PRACTICAL									
7.	20CSC28	Compiler Design Lab	-	-	3	3	50	50	1.5
8.	20CSC29	Artificial Intelligence Lab	-	-	3	3	50	50	1.5
9.	20CSEXX	Professional Elective – II Lab	-	-	2	3	50	50	1
10.	20EGC03	Employability Skills	-	-	2	3	50	50	1
		TOTAL	**18**	**-**	**10**	**-**	**440**	**560**	**23**

L: Lecture T: Tutorial D: Drawing P: Practical

CIE - Continuous Internal Evaluation SEE - Semester End Examination

Professional Elective - II	
20CSE06	Soft Computing
20CSE07	Internet of Things
20CSE08	Enterprise Application Development
20CSE09	Machine Learning
20CSE10	DevOps

Professional Elective - II Lab	
20CSE15	Soft Computing Lab
20CSE16	Internet of Things Lab
20CSE17	Enterprise Application Development Lab
20CSE18	Machine Learning Lab
20CSE19	DevOps Lab

Professional Elective - III	
20CSE11	Natural Language Processing
20CSE12	Embedded Systems
20CAE04	Algorithmic Game Theory
20CSE13	Adhoc Sensor Networks
20CSE14	Software Quality Testing

Open Elective - II	
20ECO01	Remote Sensing and GIS
20MTO01	Financial Mathematics
20EEO02	Energy Management Systems
20EGO01	Technical Writing Skills
20CEO02	Disaster Risk Reduction And Management
20CHO04	Environmental and Sustainable Development

20CSC26

COMPILER DESIGN

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

Pre-requisites: Formal Language and Automata Theory, Data Structures.

Course Objectives: The objectives of this course are,

1. To understand and list the different stages in the process of compilation.
2. To identify different methods of lexical analysis and design top-down and bottom-up parsers.
3. To implement syntax directed translation schemes and develop algorithms to generate code for a target machine and advance topics of compilers.

Course Outcomes: On successful completion of the course, students will be able to,

1. Identify the concepts related to translator, tokens, bootstrapping porting and phases of the compiler.
2. Use grammar specifications and implement lexical analyzer by the help of compiler tools.
3. Explore the techniques of Top down, Bottom up Parsers and apply parsing methods for various grammars.
4. Implement syntax directed translation schemes and relate Symbol table organization
5. Explain the algorithms to generate code for a target machine code and evaluate.
6. Recognize the errors and their recovery strategies and understanding advance topics

UNIT - I

Introduction to compilers – Analysis of the source program, Phases of a compiler, grouping of phases, compiler writing tools - bootstrapping, data structures.
Lexical Analysis: The role of Lexical Analyzer, Input Buffering, Specification of Tokens using Regular Expressions, Review of Finite Automata, Recognition of Tokens, scanner generator(lex, flex).

UNIT - II

S**yntax Analysis**: Top-Down Parsing: Recursive Descent parsing, Predictive parsing, LL (1) Grammars.
Bottom-Up Parsing: Shift Reduce parsing – Operator precedence parsing (Concepts only).
LR parsing: Constructing SLR parsing tables, Constructing Canonical LR parsing tables and Constructing LALR parsing tables. Parser generator (YACC, BISON).

UNIT - III

Syntax directed translation: Syntax directed definitions, Bottom- up evaluation of S-attributed definitions, L-attributed definitions, Top-down translation, Bottom-up evaluation of inherited attributes.
Type Checking: Type systems, Specification of a simple type checker, overview of Symbol Table

UNIT - IV

Intermediate Code Generation (ICG): Intermediate languages – Graphical representations, Three Address code, Quadruples, Triples.
Code Optimization: Principal sources of optimization, Optimization of Basic blocks.

UNIT - V

Code generation: Issues in the design of a code generator. The target machine, a simple code generator. Overview of machine-dependent and independent optimizations .Error recovery in various phases.
Advanced topics: Review of Compiler Structure, Advanced elementary topics, Structure of optimizing compilers.

Text Books:

1. Alfred V Aho, Monica S Lam, Ravi Sethi, Jeffrey D Ullman, “Compilers: Principles Techniques & Tools”, Pearson Education 2nd Edition, 2013.
2. Steven Muchnik, “Advanced Compiler Design and Implementation”, Kauffman, 1998.

Suggested Reading:

1. Kenneth C Louden, “Compiler Construction: Principles and Practice”, Cengage Learning, 2005.
2. Keith D Cooper & Linda Tarezon, “Engineering a Compiler”, Morgan Kafman, Second edition, 2004.
3. John R Levine, Tony Mason, Doug Brown “Lex &Yacc”, 3rd Edition Shroff Publisher, 2007.

Online Resources:

1. http://www.nptel.ac.in/courses/106108052
2. https://web.stanford.edu/class/archive/cs/cs143/cs143.1128/
3. http://en.wikibooks.org/wiki/Compiler_Construction
4. http://dinosaur.compilertools.net/
5. http://epaperpress.com/lexandyacc/

20CSC27

ARTIFICIAL INTELLIGENCE

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

Pre-requisites: Data structures, Discrete Mathematics.

Course Objectives: The objectives of this course are,

1. To become familiar with basic principles of AI and its fundamentals.
2. To discuss the knowledge and application of intelligent systems and their practical applications.
3. To analyze the various knowledge representation schemes, reasoning and learning techniques of AI.

Course Outcomes: On successful completion of the course, students will be able to,

1. Define the role of agents and interaction with the environment to establish goals.
2. Identify and formulate search strategies to solve problems by applying suitable search strategy.
3. Understand probabilistic reasoning and Markov decision process to solve real world problems.
4. Design applications using Reinforcement Learning.
5. Apply AI concepts to solve the real-world problems.

UNIT - I

Introduction: Concept of AI, history, current status, scope, agents, environments, Problem Formulations, Review of tree and graph structures.

Intelligent agents: Classification, Working of an agent, single agent and multi agent systems, multi agent application.

UNIT - II

Search Algorithms: State space representation, Search graph and Search tree. Random search, Search with closed and open list, Depth first and Breadth first search. Heuristic search, Best first search. A* algorithm, problem reduction, constraint satisfaction, Game Search, minmax algorithm, alpha beta pruning, constraint satisfaction problems.

UNIT - III

Knowledge & Reasoning: Knowledge-Based Agents, Logic, First-Order Logic, Syntax-Semantics in FOL, Simple usage, Inference Procedure, Inference in FOL, Reduction, Inference Rules, Forward Chaining, Backward Chaining, Resolution.

UNIT - IV

Probabilistic Reasoning: Probability, conditional probability, Bayes Rule, Bayesian Networks- representation, construction and inference, temporal model, hidden Markov model.

Markov Decision Process: MDP formulation, utility theory, utility functions, value iteration, policy iteration and partially observable MDPs.

UNIT - V

Reinforcement Learning: Passive reinforcement learning, direct utility estimation, adaptive dynamic programming, temporal difference learning, active reinforcement learning- Q learning.

Text Books:

1. Stuart Russell, Peter Norvig, “Artificial Intelligence: A Modern Approach”, 3rd Ed., Prentice Hall, 2010.
2. Elaine Rich and Kevin Knight, “Artificial Intelligence”, Tata McGraw Hill, 3rd Edition, 2018.

Suggested Reading:

1. Trivedi M.C., “A Classical Approach to Artificial Intelligence”, Khanna Publishing House, Delhi, 2018.
2. Saroj Kaushik, “Artificial Intelligence”, Cengage Learning India, 2011.

Online Resources:

1. https://nptel.ac.in/courses/106105077
2. https://nptel.ac.in/courses/106106126
3. https://aima.cs.berkeley.edu

20CSE06

SOFT COMPUTING
(Professional Elective – II)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

Pre-requisites: Linear Algebra & Calculus, Differential Equations and Transform Theory.

Course Objectives: The objectives of this course are,
1. To learn various types of soft computing techniques and their applications.
2. To acquire the knowledge of neural network architectures, learning methods and algorithms.
3. To understand Fuzzy logic, Genetic algorithms and their applications.

Course Outcomes: On Successful completion of this course, student will be able to,
1. Understand various soft computing concepts and techniques.
2. Analyze and design various learning models.
3. Apply the Neural Network Architecture for various Real time applications.
4. Examine and approximate reasoning using fuzzy logic.
5. Design Genetic algorithms in different applications.
6. Develop soft computing techniques to solve different applications.

UNIT - I
Soft computing vs. Hard computing, Various types of soft computing techniques.
Artificial Neural Networks: Fundamental concepts, Evolution of neural networks, Basic models of artificial neural network, important terminologies of ANNs. McCulloch-Pitts neuron, linear separability, Hebb network.

UNIT - II
Supervised Learning Neural Networks: Perceptron networks, Adaptive linear neuron (Adaline), Multiple Adaptive linear neuron (Madaline), Back propagation network.

UNIT - III
Unsupervised Learning Neural Networks: Kohonen Self Organizing networks, Adaptive resonance theory.
Associate Memory Networks: Bidirectional associative memory network, Hopfield networks.

UNIT - IV
Fuzzy Logic: Introduction to classical sets and Fuzzy sets, Fuzzy relations, Tolerance and equivalence relations, Membershipfunctions, Defuzzification.

UNIT - V
Genetic Algorithms: Introduction, Basic operators and terminology, Traditional algorithm vs. genetic algorithm, Simple genetic algorithm, General genetic algorithm, Classification of genetic algorithm, Genetic programming, Applications of genetic algorithm.

Text Books:
1. S.N. Sivanandam& S.N. Deepa, “Principles of soft computing”, Wiley publications, 2nd Edition, 2011.
2. Soft Computing – Ikvinderpal Singh, Khanna Book Publishing 2015.

Suggested Reading:
1. S. Rajasekaran, G.A. Vijayalakshmipai, “Neural Networks, Fuzzy logic & Genetic Algorithms, Synthesis & Applications”, PHI publication, 2008.
2. LiMin Fu, “Neural Networks in Computer Intelligence”, McGraw-Hill edition, 1994.
3. K.L.Du & M.N.S Swamy, “Neural Networks in a Soft Computing Framework”, Springer International edition, 2008.
4. Simon Haykins, “Neural Networks a Comprehensive Foundation”, PHI, second edition.
5. Goldberg, David E., “Genetic Algorithms in Search, Optimization and Machine Learning”, Addison Wesley, New Delhi, 2002.
6. Learning and Soft Computing by Kecman, Pearson Education, 2001.

7. N.P. Padhy and S.P. Simon,"Soft Computing: With Matlab Programming", Oxford University Press, 2015.
8. Neuro fuzzy and soft computing by Jang, Pearson Education, 1996.

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc18_cs13/preview.
2. https://archive.nptel.ac.in/courses/106/105/106105173/

20CSE07

INTERNET OF THINGS
(Professional Elective – II)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

Pre-requisites: Computer architecture and microprocessor, Programming for problem solving.

Course Objectives: The objectives of this course are,
1. To understand the architecture, basics and applications of IoT.
2. To impart practical knowledge on components of IoT.
3. To develop skills required for building real-time IoT based projects.

Course Outcomes: On successful completion of the course, students will be able to,
1. Understand IoT, its hardware and software components.
2. Comprehend I/O interface and programming APIs.
3. Analyze the use of communication protocols in IoT.
4. Explore Solution framework for IoT applications.
5. Illustrate unstructured data storage.
6. Develop real time IoT based projects.

UNIT - I
Introduction to IoT: Architectural Overview, Design principles and requirements of IoT, IoT Applications.
Elements of IoT: Basics of networking, sensors, actuators, computing devices, software, data management and processing environment and Security issues.

UNIT - II
IoT Hardware Components: Computing (Arduino, Raspberry Pi), Communication modules, Sensors, Actuators, I/O interfaces, Programming API's.

UNIT - III
IoT Data Protocols: MQTT, CoAP, AMQP, DDS, HTTP, WebSocket
Network Protocols for IoT: 6LowPAN, RPL, IPV6, WiFi, Bluetooth, ZigBee, Z-Wave, LoRaWan, MQTT, XMPP

UNIT - IV
IoT Application Development: Solution framework for IoT applications- Implementation of Device integration, Data acquisition and integration, Device data storage- Unstructured data storage on cloud/local server, Authentication, authorization of devices.

UNIT - V
IoT Case Studies: IoT case studies based on Industrial automation, Transportation, Agriculture, Healthcare, Home Automation.

Text Books:
1. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, StamatisKarnouskos, David Boyle,"From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence",1st Edition, Academic Press, 2014.
2. Jeeva Jose, "Internet of Things", Khanna Publishing House, Delhi, 2018.
3. Arshdeep Bahga and Vijay Madisetti, "Internet of Things: A Hands-on Approach", Universities Press, 2014.

Suggested Reading:
1. Dr. SRN Reddy, Rachit Tirnkral and Manasi Mishra, "Introduction to Internet of Things: A practical Approach", ETI Labs, 2018.
2. Adrian McEwen, "Designing the Internet of Things", Wiley, 2013.
3. Raj Kamal, "Internet of Things: Architecture and Design", McGraw Hill, 2017.

4. Cuno Pfister, "Getting Started with the Internet of Things", 0' Reilly Media, 2011.

Online Resources / Weblinks / NPTEL Courses:

1. Li Da Xu, Wu He, and Shancang Li, "Internet of Things in Industries: A Survey ", IEEE Transactions on Industrial Informatics, Vol. 10, No. 4, Nov. 2014.
2. T. Winter, P. Thubert, A. Brandt, J. Hui, R. Kelsey, P. Levis, K. Pister, R. Struik , JP. Vasseur, R. Alexander, "RPL: IPv6 Routing Protocol for Low-Power and Lossy Networks", IETF, Standards Track, Mar. 2012.
3. Z. Shelby, K. Hartke, C. Bormann, "The Constrained Application Protocol (CoAP)", Internet Engineering Task Force (IETF), Standards Track, 2014.
4. L.Fenzel, "What's The Difference Between IEEE 802.15.4 And ZigBee Wireless?",Electronic Design (Online), Mar. 2013.
5. S. N. Das and S. Misra, "Information theoretic self-management of Wireless Sensor Networks", Proceedings of NCC 2013.
6. F. Luo *et al*., "A Distributed Gateway Selection Algorithm for UAV Networks," in IEEE Transactions on Emerging Topics in Computing, vol. 3, no. 1, pp. 22-33, March 2015.
7. https://onlinecourses.nptel.ac.in/noc19_cs31/
8. https://www.nabto.com/guide-iot-protocols-standards/

20CSE08

ENTERPRISE APPLICATION DEVELOPMENT
(Professional Elective – II)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

Pre-requisites: Internet and web technologies, OOPs, Database management systems.

Course Objectives: The objectives of this course are,

1. To provide good understanding of latest web technologies on client side components like ReactJS and Angular2
2. To acquire knowledge on web frameworks, develop server side web applications like Node.js and Express
3. To develop innovative web applications using various technologies.

Course Outcomes: On successful completion of the course, students will be able to,

1. Understand the database connectivity and application servers.
2. Explore the type of forms with validations using ReactJS.
3. Utilize Express framework to develop responsive web applications.
4. Demonstrate the architecture and file system of NodeJs.
5. Identify the significance of component intercommunication with Angular2.
6. Adapt MEAN or MERN stack to implement a real-time web application.

UNIT - I

Introduction to Full stack development and NoSQL

MongoDB: Basics, Configuring Server and Client, MongoDB Compass, Creating Database, MongoDB Commands, MongoDB CRUD Operations.

REST: Introduction to REST and API, REST Constraints, Representations, Resource Identifier, REST Actions, Status Codes.

UNIT - II

NodeJs: Introduction, NodeJS Features and Drawbacks, setup Environment for NodeJs, NodeJS Program architecture, NodeJS Web Server, NodeJS Global Objects, NodeJS OS Objects, NodeJS Error Handling, Node JS Event Loop, NodeJS File System, Async and Sync, Connecting with Database, Handling CRUD Operations.

UNIT - III

Building an Express web application: Introduction to Express, Installation of Express, Create first Express application, the application request and response objects, configuring an Express application, rendering views, Authentication, Authorization.

UNIT - IV

Introduction to ReactJS: React Components, React State and Props

Component intercommunication: Component Composition, pass data from parent to child, pass data from child to parent, Fetching data API using axioms, Types of forms, Form Validations, Posting Data, React Router, Building & Deploying React App.

UNIT - V

Introduction to Angular2: Angular2 Architecture (Component-Based Architecture), Consuming API, State Management, Validation, Routing. Passing data from parent to child and Passing data between siblings.

Angular2 Specific: Directives, Modules, Components, Observables, Binding, Pipes, Dependency Injection.

Text Books:

1. Amos Q. Haviv, MEAN Web Development, Second Edition, Packt Publications, November 2016.
2. Vasan Subramanian, “Pro MERN Stack, Full Stack Web App Development with Mongo, Express, React, and Node”, 2nd Edition, APress.
3. Fernando Doglio, “REST API Development with Node.js”, 2nd Edition, APress.

Suggested Reading:

1. Shelly Powers, “Learning Node: Moving to the Server-Side”, 2nd Edition, O’REILLY, 2016.
2. Simon D. Holmes and Clive Harber, “Getting MEAN with Mongo, Express, Angular, and Node”, Second Edition, Manning Publications, 2019
3. Brad Dayley, “Node.js, MongoDB and Angular Web Development”, 2nd Edition, Addison-Wesley Professional, 2017.

Online Resources:

1. https://www.mongodbtutorial.org/mongodb-crud/
2. https://reactjs.org/tutorial/tutorial.html
3. https://www.javatpoint.com/expressjs-tutorial
4. https://www.javatpoint.com/nodejs-tutorial
5. https://angular-training-guide.rangle.io/

20CSE09

MACHINE LEARNING
(Professional Elective – II)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

Pre-requisites: Linear Algebra and Calculus, Artificial Intelligence.

Course Objectives: The objectives of this course are,

1. To understand the need and elements of Machine Learning
2. To study various machine learning techniques.
3. To design solutions for real world problems using machine learning techniques.

Course Outcomes: On successful of the course student will be able to,

1. Define the basic concepts related to Machine Learning.
2. Recognize the underlying mathematical relationships across ML algorithms and their paradigms.
3. Determine the various applications of Machine Learning.
4. Model, design and develop solutions to real world problems using Machine Learning Algorithms.
5. Evaluate and interpret the results of the various machine learning tools.

UNIT - I

Introduction to Machine Learning: Introduction, Classic and Adaptive machines, learning Types-Supervised, Unsupervised, deep learning, bio-inspired adaptive systems, Machine Learning, and big data.

Elements of Machine Learning: Data formats, Learnability, Statistical learning concepts, Class balancing, Elements of Information theory.

UNIT - II

Feature Selection and Feature Engineering: Data sets, creating training and test sets, managing categorical data, missing features, data scaling and normalization, whitening, Feature selection and filtering, PCA, Visualization of high-dimensional datasets.

Regression Algorithms: Linear regression, Regression types: Ridge, Lasso, ElasticNet, Robust, Polynomial and Isotonic.

UNIT - III

Classification Algorithms: KNN, Linear classification, logistic regression, grid search, classification metrics, ROC curve.

Naïve Bayes and Discriminant Analysis: Bayes theorem, Naïve Bayes classifiers, Discriminant analysis.

Decision Trees and Ensemble Learning: Binary Decision trees, Introduction, to Ensemble Learning-Random Forests, AdaBoost, Gradient Tree Boosting, Voting classifier.

UNIT - IV

Support Vector Machines: Linear SVM, Kernel based Classification.

Clustering Fundamentals: Basics, K-means, Evaluation methods, DBSCAN, Spectral Clustering, and Hierarchical Clustering.

UNIT - V

Machine Learning Architectures: Data collection, Normalization and regularization, Dimensionality reduction, Data augmentation, Modeling/Grid Search/Cross-validation, Visualization, GPU support, introduction to distributed architectures, Scikit-learn tools for ML architectures.

Text Books:

1. Giuseppe Bonaccorso, “Machine Learning Algorithms”, 2nd Edition, Packt, 2018,
2. Tom Mitchel “Machine Learning”, Tata McGraW Hill, 2017.

Suggested Reading:

1. Abhishek Vijavargia “Machine Learning using Python”, BPB Publications, 1st Edition, 2018
2. ReemaThareja “Python Programming”, Oxford Press, 2017

3. Yuxi Liu, “Python Machine Learning by Example”, 2nd Edition, PACT, 2017

Online Resources:

1. https://www.guru99.com/machine-learning-tutorial.htm
2. https://www.tutorialspoint.com/machine_learning_with_python/index.htm

20CSE10

DEVOPS
(Professional Elective – II)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

Pre-requisites: Database management systems, Operating systems, OOPs.

Course Objectives: The objectives of this course are,

1. To describe the agile relationship between development and IT operations.
2. To understand the skill sets and high-functioning teams involved in DevOps and related methods to reach a continuous delivery capability.
3. To implement automated system update and DevOps lifecycle.

Course Outcomes: On successful completion of this course, students will be able to,

1. Identify components of Devops environment.
2. Describe Software development models and architectures of DevOps.
3. Apply different project management, integration, testing and code deployment tools.
4. Investigate different DevOps Software development models.
5. Assess various Devops practices.
6. Collaborate and adopt Devops in real-time projects.

UNIT - I

Introduction: Software development models, Introduction to DevOps, Why DevOps, DevOps process and Continuous Delivery, Delivery pipeline, Release management, Scrum, Kanban DevOps Architecture, DevOps Workflow DevOps Lifecycle for Business Agility, and Continuous Testing.

UNIT - II

Introduction to project management: The need for source code control, the history of source code management, Git **- A version control tool**, Version Control System and Types, CVCS and DVCS.
Git Essentials: Creating repository, Cloning, check-in and committing, Fetch pull and remote, Branching.

UNIT - III

Jenkins - Continuous integration: Introduction to Continuous Integration, Build & Release and relation with DevOps Why continuous integration, Nodes/Salves, Managing plugins, Managing Software Versions.
Build Tools: Overview of Maven, Virtualization, and Virtualization in DevOps Understand Containers Dockers - A containerization technology.

UNIT - IV

Testing Tools and automation: Testing Tools and automation: Various types of testing, Automation of testing Pros and cons, Selenium -Introduction, Selenium features, Testing backend integration points, Test-driven development, REPL-driven development.
Deployment Tools: Deployment systems, Virtualization stacks, code execution at the client, Puppet master and agents, Ansible, Deployment tools: Chef, SaltStack.

UNIT - V

Code monitoring and Issue Tracking: Code monitoring tools Nagios, Munin, Ganglia, Log handling.
Introduction to issue trackers, Need of issue tracker: Workflows and issues.
Trackers tools: Bugzilla, GitLab tracker, and Jira.

Text Books:

1. Joakim Verona, “Practical Devops”, Second Edition. Ingram short title; 2nd edition, 2018.
2. Deepak Gaikwad, Viral Thakkar, “DevOps Tools from Practitioner's Viewpoint”. Wiley publications, 2019.

Suggested Reading:

1. Len Bass, Ingo Weber, Liming Zhu, “DevOps: A Software Architect's Perspective”. Addison Wesley, 1st Edition, 2015.

Online Resources:

1. https://www.coursera.org/learn/intro-to-devops
2. hhttps://www.tutorialspoint.com/introduction-to-devops/index.asp

20CSE11

NATURAL LANGUAGE PROCESSING
(Professional Elective – III)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

Pre-requisites: Artificial Intelligence, Compiler Design.

Course Objectives: The objectives of this course are,

1. To learn the fundamentals of natural language processing.
2. To understand the various text processing techniques in NLP.
3. To understand the role Text Classification Deep Learning for Text Classification techniques of NLP
4. To use Topic Modelling, Case Studies and apply the NLP techniques to IR applications.

Course Outcomes: On successful completion of the course, students will be able to,

1. Understand the basic concepts of Natural language processing pipeline and applications of NLP.
2. Illustrate various text representation techniques in NLP.
3. Analyse text classification techniques and deep learning basics to process natural language text.
4. Explore text summarization methods and example systems.
5. Demonstrate levels of NLP for several case studies.
6. Apply NLP Pipe lines to solve real world applications.

UNIT - I

NLP: A Primer, NLP in the Real World, NLP Tasks, NLP Levels, What Is Language? Building Blocks of Language, Why Is NLP Challenging? Machine Learning and Overview Approaches to NLP, Heuristics-Based, Machine Learning, Deep Learning for NLP.

NLP Pipeline: Data Acquisition, Pre-Processing Preliminaries Frequent Steps, Advanced Processing Feature Engineering Classical NLP/ML Pipeline DL Pipeline Modeling, Evaluation of Models, Post-Modeling Phases.

UNIT - II

Text Representation Vector Space Models Basic Vectorization Approaches, One-Hot Encoding Bag of Words, Bag of N-Grams, TF-IDF, Distributed Representations, Word Embedding, Going Beyond Words, Distributed Representations.

UNIT - III

Text Classification Applications One Pipeline, Many Classifiers, Using Neural Embeddings in Text Classification Deep Learning for Text Classification Interpreting Text Classification Models.

Deep Learning for Text Classification CNNs for Text Classification, LSTMs for Text Classification

UNIT - IV

Topic Modelling Text Summarization, Use Cases Setting Up a Summarizer: An Example Recommender Systems for Textual Data Machine Translation Question-Answering Systems, Social Media, E-Commerce and Retail, Healthcare, Finance, and Law.

UNIT - V

Case Study on NLP Pipeline, Text Classification: Ticketing, Ecommerce, Social media, health care, Recommender systems and other applications of NLP

Text Books:

1. Sowmya Vajjala, Bodhisattwa Majumder, Anuj Gupta & Harshit Surana "Practical Natural Language Processing: A Comprehensive Guide to Building Real world NLP Systems", O'Reilly Media, Inc., 1st Edition, 2020.
2. James Allen, "Natural Language Understanding", Bejamin Cummings, 2nd edition, 1995.

Suggested Reading:

1. Tanveer Siddiqui, U.S. Tiwary, "Natural Language Processing and Information Retrieval", Oxford University Press, 2008.

Online Resources:

1. https://nptel.ac.in/courses/106101007/
2. http://www.cs.colorado.edu/~martin/sp2.html
3. https://web.standford.edu/~jurafsky/sp3/

20CSE12

EMBEDDED SYSTEMS
(Professional Elective – III)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

Pre-requisites: Computer architecture and microprocessor, Digital logic design, Programming for problem solving.

Course Objectives: The objectives of this course are,

1. To be aware of general computing system, embedded system and classification of embedded system.
2. To analyze the core concepts of embedded system and its architecture.
3. To analyze the RTOS for embedded systems.
4. To learn embedded system development environment.
5. To learn to use tools in embedded software development process.

Course Outcomes: On successful of the course student will be able to,

1. Understand the basics of embedded systems.
2. Analyze the core concepts of Embedded System and Embedded System Architecture.
3. Design and develop Embedded System hardware and software using Embedded C.
4. Analyze the operating system for embedded systems.
5. Analyze the embedded system development environment and tools used in embedded software development process.

UNIT - I

Introduction to Embedded Systems: Embedded Systems, Processor embedded into a system, Embedded hardware units and devices in a system, Embedded software in a system, Examples of embedded systems, Design process in Embedded system, Formalization of system design, Design process and design examples(smart card, digital camera, mobile phone), Classification of Embedded Systems, Skills required for embedded system designer.

UNIT - II

Inter process communication and synchronization of processes, Threads and Tasks. Multiple processes in an application, Multiple threads in an application, Tasks, Task states, Task and data, Clear cut distinction between functions, ISRs and tasks and their characteristics. Concept of semaphores, Shared data, Inter process communication, Signal function, Semaphore functions, Message queue functions, Mailbox functions, Pipe functions, Socket functions, RPC functions.

UNIT - III

Real time operating systems: OS services, Process management, Timer functions, Event functions, Memory management, Device , File, IO subsystems management, Interrupt routine in RTOS environment and handling of Interrupt source calls, RTOS, RTOS task scheduling models, Interrupt latency, Response of tasks as performance metrics, OS security issues.

UNIT - IV

8051 interfacing with displays (LED, 7 segment display, LCD), Switch, Relay, Buzzer, D/A and A/D converters, Stepper motor.

Networked Embedded systems, Serial communication protocols, I2C bus, CAN bus, RS232, Introduction to advanced architectures: ARM and SHARC.

UNIT - V

Embedded software Development process tools: Introduction to embedded software development process and tools, Host and Target machines, linking and locating software, Getting embedded software into target system, Issues in hardware - software design and Co-design.

Testing, simulation and debugging techniques and tools: Testing on host machine, Simulators, Laboratory tools.

Text Books:

1. Raj Kamal, "Microcontrollers: Architecture, Programming, Interfacing and System Design", Pearson Education India, 2009.

Suggested Reading:

1. David E. Simon, "An Embedded Software Primer", Pearson Education, 1999.
2. Wayne Wolf, "Computers as Components: Principles of Embedded Computing System Design", Elsevier, 2008.

20CAE04

ALGORITHMIC GAME THEORY
(Professional Elective – III)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

Pre-requisites: Linear Algebra and Calculus, Design and analysis of algorithms.

Course Objectives: The objectives of this course are,

1. To understand how to design systems with strategic participants that has good performance guarantees.
2. To understand the study of games from the perspective of algorithms and theoretical computer science.
3. To study the complexity-theoretic hardness of computing equilibria, focusing on Nash equilibria.
4. To study the categories of topics at a basic level: combinatorial games, zero-sum games, non-zero sum games and cooperative games.
5. To obtain familiarity how to Model and analyze conflicting situations using game theory.

Course Outcomes: On successful of this course student will be able to,

1. Acquire knowledge about the real world problems and formulate mathematical models of these problems.
2. Identifying the algorithmic Models for finding the optimal solutions for real world examples.
3. Analyze the major limitations and capabilities of game theory problems.
4. Design and analyze problems using game theory approaches.
5. Explore the real world scenarios of economic and algorithmic interactions using game theory solutions.

UNIT - I

Introduction to Stable Matchings, Men-Optimality of the Men-Proposing Gale-Shapley Algorithm, GS: Cheating, Strategies for Men, GS: Cheating Strategies for Women, Problem, Popular, Strategic Behavior in Popular Matchings, Stable Roommates: Matchings in the Non-bipartite Setting.

UNIT - II

An Introduction to Voting, The Game of Trust - Nicky Case's Interactive Essay, Arrow's Theorem, Gibbard-Satterethwaite Theorem, Domain Restrictions and Multi-winner Elections, Incentive Design in Crowd sourcing Applications, Adversarial Approaches in Deep Learning.

UNIT - III

Algorithmic for computing Market Equilibrium, Tournament fixing and superkings, Tournament Fixing Parameterized by FAS, Tournament Fixing with Bribery, An Introduction to Cake-Cutting, Envy-Freenes and Approximate EF, Sperner's Lemma and Applications, Cake Cutting with a Secret Agent, Fairness Notions for Indivisible Goods.

UNIT - IV

Combinatorial Games: Introduction and examples: N and P positions, Zermelo's Theorem, The game of Hex, Nim games, Sprague-Grundy Theorem, The Sylver Coinage Game, **Zero-Sum Games:** Introduction and examples, Saddle Point Equilibria & the Minimax Theorem, Zero, Mixed Strategies, Properties of Saddle Point Equilibria.

UNIT - V

Iterated elimination of strictly dominated strategies, Lemke-Howson Algorithm, , Evolutionary Stable Strategies, Fictitious Play, Brown-Von Neumann-Nash Dynamics, The Nash Bargaining Problem, Transferable Utility Games, The Core, Characterization of Games with non-empty Core, Shapley Value, The Nucleolus.

Text Books:

1. Noam Nisan, Tim Roughgarden, Eva Tardos, Vijay V. Vazirani (eds), “Algorithmic Game Theory”, Cambridge University, 2007.
2. Michael Maschler, Eilon Solan, and Shmuel Zamir “Game Theory”, Cambridge University Press, 2013.
3. Y. Narahari “Game Theory and Mechanism Design”, World Scientific, 2015.
4. Martin Osborne, “An Introduction to Game Theory”, Oxford University Press, 2003.

5. T. Ferguson, “Game Theory”, Web Notes.
6. Karlin and Peres, “Game Theory”, Alive, AMS.
7. DeVos and Kent, “Game Theory: A Playful Introduction”, AMS

Suggested Reading:

1. Robert Duncan Luce “Games and Decisions: Introduction and Critical Survey” (Dover Books on Mathematics), Howard Raiffa, 1989.
2. William Spaniel “Game Theory 101: The Complete Textbook”, 2011.
3. John von Neumann, Oskar Morgenstern, “Theory of Games and Economic Behavior”, Princeton Univ. Press. 2007.

Online Resources:

1. https://nptel.ac.in/courses/128106007
2. https://nptel.ac.in/courses/110101133
3. https://arxiv.org/list/cs.GT/1703
4. https://dl.acm.org/doi/book/10.1145/3241304#secAuthors

20CSE13

ADHOC SENSOR NETWORKS
(Professional Elective – III)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

Pre-requisites: Data Communication and Computer Networks, IoT.

Course Objectives: The objectives of this course are,
1. To understand the design issues in ad hoc and sensor networks.
2. To learn the different types of MAC protocols.
3. To be familiar with different types of adhoc routing protocols.
4. To get exposure to the TCP issues in adhoc networks.
5. To learn the architecture and protocols of wireless sensor networks.

Course Outcomes: On successful of the course student will be able to,
1. Explain the concepts, network architectures and applications of ad hoc and WSN.
2. Identify different issues in wireless adhoc and sensor networks.
3. Analyze the protocol design issues of adhoc and sensor networks
4. Design routing protocols for adhoc and WSN with respect to protocol design issues.
5. Evaluate the QoS related performance measurements of adhoc and sensor networks.

UNIT - I

Introduction: Fundamentals of Wireless Communication Technology – The Electromagnetic Spectrum – Radio propagation Mechanisms – Characteristics of the Wireless Channel -mobile ad hoc networks (MANETs) and wireless sensor networks (WSNs): concepts and architectures. Applications of Ad Hoc and Sensor networks. Design Challenges in Ad hoc and Sensor Networks.

UNIT - II

MAC Protocols for AdHoc Wireless Networks: Issues in designing a MAC Protocol- Classification of MAC Protocols- Contention based protocols-Contention based protocols with Reservation Mechanisms- Contention based protocols with Scheduling Mechanisms – Multi channel MAC-IEEE 802.11.

UNIT - III

Routing Protocols and Transport Layer In AdHoc Wireless Networks : Issues in designing a routing and Transport Layer protocol for Ad hoc networks- proactive routing, reactive routing on-demand), hybrid routing-Classification of Transport Layer solutions-TCP over Ad hoc wireless Networks.

UNIT - IV

Wireless Sensor Networks (WSN) and MAC Protocols: Single node architecture: hardware and software components of a sensor node – WSN Network architecture: typical network architectures-data relaying and aggregation strategies -MAC layer protocols: self-organizing, Hybrid TDMA/FDMA and CSMA based MAC-IEEE 802.15.4.

UNIT - V

WSN Routing, Localization & QoS: Issues in WSN routing – OLSR- Localization – Indoor and Sensor Network Localization-absolute and relative localization, triangulation-QOS in WSN-Energy Efficient Design-Synchronization-Transport Layer issues.

Text Books:

1. C. Siva Ram Murthy, and B. S. Manoj, “Ad Hoc Wireless Networks: Architectures and Protocols “, Prentice Hall Professional Technical Reference, 2008.

Suggested Reading:

1. Carlos De Morais Cordeiro, Dharma Prakash Agrawal “Ad Hoc & Sensor Networks: Theory and Applications”, World Scientific Publishing Company, 2006.
2. Feng Zhao and Leonides Guibas, “Wireless Sensor Networks”, Elsevier Publication, 2002.

3. Holger Karl and Andreas Willig “Protocols and Architectures for Wireless Sensor Networks”, Wiley, 2005.
4. Kazem Sohraby, Daniel Minoli, & Taieb Znati, “Wireless Sensor Networks-Technology, Protocols, and Applications”, John Wiley, 2007.
5. Anna Hac, “Wireless Sensor Network Designs”, John Wiley, 2003.

20CSE14

SOFTWARE QUALITY TESTING
(Professional Elective – III)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

Pre-requisites: Software engineering.

Course Objectives: The objectives of this course are,

1. To understand the basics of testing, test planning &design and test team organization.
2. To study the various types of tests in the life cycle of the software product.
3. To build design concepts for system testing and execution.
4. To learn the software quality assurance, metrics and defect prevention techniques.

Course Outcomes: On successful completion of the course, students will be able to,

1. Perform white-box and black-box tests in the life cycle of the software product.
2. Understand system testing and significance of software reliability.
3. Identify defect prevention techniques and SQA metrics.
4. Apply various techniques and standards of SQA.
5. Reduce potential risks to an acceptable level before they occur.

UNIT - I

Software Testing - Concepts, Issues, and Techniques

Quality Revolution, Verification and Validation, Failure, Error, Fault, and Defect, Objectives of Testing, Testing Activities, Test Case Selection White-Box and Black ,test Planning and design, Test Tools and Automation, Power of Test. Test Team Organization and Management-Test Groups, Software Quality Assurance Group, System Test Team Hierarchy, Team Building**.**

UNIT - II

System Testing

System Testing - System Integration Techniques-Incremental, Top Down Bottom Up Sandwich and Big Bang, Software and Hardware Integration, Hardware Design Verification Tests, Hardware and Software Compatibility Matrix Test Plan for System Integration. Built- in Testing. Functional testing - Testing a Function in Context. Boundary Value Analysis, Decision Tables. acceptance testing - Selection of Acceptance Criteria, Acceptance Test Plan, Test Execution Test. software reliability - Fault and Failure, Factors Influencing Software, Reliability Models

UNIT - III

System Test Categories

System test categories Taxonomy of System Tests, Interface Tests Functionality Tests. GUI Tests, Security Tests Feature Tests, Robustness Tests, Boundary Value Tests Power Cycling Tests Interoperability Tests, Scalability Tests, Stress Tests, Load and Stability Tests, Reliability Tests, Regression Tests, Regulatory Tests.
Test Generation from FSM models- State-Oriented Model. Finite-State Machine Transition Tour Method, Testing with State Verification. Test Architectures-Local, distributed, Coordinated, Remote. System test design-Test Design Factors Requirement Identification, modeling a Test Design Process Test Design Preparedness, Metrics, Test Case Design Effectiveness. System test execution- Modeling Defects, Metrics for Monitoring Test Execution .Defect Reports, Defect Causal Analysis, Beta testing, measuring Test Effectiveness.

UNIT - IV

Software Quality

Software quality - People‘s Quality Expectations, Frameworks and ISO-9126, McCall‘s Quality Factors and Criteria – Relationship. Quality Metrics. Quality Characteristics ISO 9000:2000 Software Quality Standard. Maturity models- Test Process Improvement, Testing Maturity Model.

UNIT - V

Software Quality Assurance

Quality Assurance - Root Cause Analysis, modeling, technologies, standards and methodologies for defect prevention. Fault Tolerance and Failure Containment - Safety Assurance and Damage Control, Hazard analysis using fault-trees and event-trees. Comparing Quality Assurance Techniques and Activities. QA Monitoring and Measurement, Risk Identification for Quantifiable Quality Improvement. Case Study: FSM-Based Testing of Web-Based Applications.

Text Books:

1. Kshirasagar Nak Priyadarshi Tripathy, "Software Testing and Quality Assurance-Theory and Practice", John Wiley & Sons Inc, 2008.
2. Jeff Tian, "Software Quality Engineering: Testing, Quality Assurance, and Quantifiable Improvement", John Wiley & Sons, Inc., Hoboken, New Jersey. 2005.

Suggested Reading:

1. Daniel Galin "Software Quality Assurance - From Theory to Implementation", Pearson Education Ltd. UK, 2004.
2. Milind Limaye "Software Quality Assurance", TMH, New Delhi, 2011.

20ECO01

REMOTE SENSING AND GIS
(Open Elective - II)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

Prerequisite: Basic knowledge of Geography is required

Course Objectives:
1. Explain the fundamental concepts of remote sensing and digital imaging techniques.
2. Make the students to understand the principles of thermal and microwave remote sensing.
3. Make the students understand the significance of GIS and the process of GIS.

Course Outcomes:
1. Demonstrate the understanding of basic concepts of remote sensing and interpret energy interactions.
2. Choose an appropriate technique for a given scenario by appreciating the types of remote sensing.
3. Distinguish the principle behind the working of microwave and LiDAR sensing.
4. Apply Microwave remote sensing techniques
5. Explain the procedure for encoding data and geospatial data analysis.

UNIT - I
Concept of Remote Sensing: Remote sensing definition, data, process, EM bands used in remote sensing, Interactions and recording of energy: interaction with atmosphere, interaction with earth surface features (soil, water, vegetation), recording of energy by sensors, Transmission, reception and processing, Image interpretation and analysis, Applications, Advantages and limitations of Remote sensing, Orbits of Remote sensing satellites, Indian remote sensing satellites.

UNIT - II
Digital Imaging: Types of Remote sensing, Sensor resolutions, Digital Image, Sensor components, Principle of a long-track and across-track scanning, Hyperspectral Imaging, Thermal Remote Sensing.

UNIT - III
Microwave Remote Sensing: Active and Passive Microwave Remote Sensing, Radar Imaging: Key components of imaging radar, viewing geometry, spatial resolution, principle of RAR, SAR and their range resolution, Satellite Radar Imaging, LIDAR.

UNIT - IV
Concept of Geographic Information Systems: Key components of GIS, joining spatial and attribute data, functions, advantages and applications of GIS, Spatial data model, Raster data model, Vector data model.

UNIT - V
Process of GIS and Geospatial analysis: Data sources, encoding raster data, encoding vector data, encoding attribute data, linking spatial and attribute data, Geospatial data analysis methods database query, geospatial measurement, overlay operations, network analysis and surface analysis. Integration of GIS and remote sensing.

Text Books:
1. Basudeb Bhatta, "Remote Sensing and GIS", 2/e, Oxford University Press, 2012.
2. Lillesand T.M., and Kiefer R.W. "Remote Sensing and Image Interpretation", 6/e, John Wiley &Sons, 2000.

Suggested Reading:
1. James B. Campbell and Randolph H. Wynne, "Introduction to Remote Sensing", the Guilford Press, 2011.
2. Michael N DeMers, "Fundamentals of GIS", 2/e, John Wiley, 2008.

20MTO01

FINANCIAL MATHEMATICS
(Open Elective - II)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

Course Objectives: The objectives of this course are,

1. To explain the terms of financial market and its derivatives including options and futures.
2. To explain the modern portfolio theory.
3. To discuss the pricing theory in discrete time.
4. To explain the stochastic calculus.
5. To discuss the pricing theory in continuous theory.

Course Outcomes: On successful completion of the course, students will be able to

1. Calculate the internal rate of return, annuity and amortization.
2. Apply the portfolio theory.
3. Examine the binomial model of pricing.
4. Analyze the stochastic differential equations.
5. Solve the BSM partial differential equations.

UNIT - I

Introduction to financial markets: Introduction to financial markets, financial instruments, bonds, stocks, futures & forwards, swaps and options. Time value of money, simple and compound interest rate, net present value, annuities, Amortization, Bond yield, internal rate of return and annuities. Markowitz portfolio theory, risk and return, two and multi-asset portfolio theory, minimum variance portfolio, efficient frontier.

UNIT - II

Modern portfolio theory: Capital Asset Pricing Model and portfolio performance analysis. No arbitrage principle, pricing of forwards and futures, properties of options. Derivative pricing by replication in single and multi-period binomial model.

UNIT - III

Risk neutral pricing in discrete time: Discrete probability spaces, filtration, conditional expectation. Discrete time martingales, Markov chain, risk-neutral pricing in binomial model for European and American derivatives.

UNIT - IV

Stochastic Calculus: General probability spaces, conditional expectation, Brownian motion and its properties. Ito integral, Ito formula, Girsanov's theorem, martingale representation theorem, stochastic differential equation.

UNIT - V

Risk neutral pricing in continuous time:-Black Scholes-Merton (BSM) model, pricing of European derivatives in BSM framework. Valuation of European options in BSM model, BSM formula, BSM partial differential equation, hedging, model completeness, and fundamental theorems of asset pricing.

Text Books:

1. Ales Cerny "Mathematical Techniques in Finance: Tools for Incomplete Markets". Princeton University Press, 2009.
2. Luenberger, David G. "Investment Science", Oxford University Press. Delhi, 1998.

Suggested Reading:

1. Hull, J. C., &Basu, S. "Options, Futures and Other Derivatives" 7th Edition Pearson Education. New Delhi, 2010.
2. S. R. Pliska "Introduction to Mathematical Finance: Discrete Time Models". Blackwell Publishers Inc., 2002.
3. Ross, Sheldon M. "An elementary Introduction to Mathematical Finance" 3rd Edition, Cambridge University Press. USA, 2011.

20EEO02

ENERGY MANAGEMENT SYSTEMS
(Open Elective - II)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

Prerequisites: Students should have prior knowledge on different energy generation systems, basic idea about audit instruments.

Course Objectives: The objectives of this course are,

1. To know the concept of Energy Management.
2. To understand the formulation of efficiency for various Engineering Systems.
3. To enable the students to develop managerial skills to assess feasibility of alternative approachesand drive strategies regarding Energy Management.

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

1. Know the current Energy Scenario and importance of Energy Conservation.
2. Understand the concepts of Energy Management, Energy Auditing.
3. Interpret the Energy Management methodology, Energy security and Energy Strategy.
4. Identify the importance of Energy Efficiency for Engineers and explore the methods of improving Energy Efficiency in mechanical systems, Electrical Engineering systems.
5. Illustrate the Energy Efficient Technologies in Civil and Chemical engineering systems.

UNIT - I

Various form of Energy and its features: Electricity generation methods using different energy sources such as solar energy, wind energy, Bio-mass energy, and Chemical energy such as fuel cells. Energy Scenario in India, Impact of Energy on economy, development, and environment sectors of national and international perspective.

UNIT - II

Energy Management-I: Defining Energy Management, need for Energy Management, Energy management techniques, importance of Energy Management, managing the Energy consumption, Energy Audit and Types, Energy Audit Instruments.

UNIT - III

Energy Management-II: understanding Energy costs, bench marking, Energy performance, matching energy use to requirement, optimizing the input, fuel & Energy substitution, material and Energy balance diagrams, Energy pricing, Energy and Environment, Energy Security.

UNIT - IV

Energy Efficient Technologies-I: Importance of Energy Efficiency for Engineers, Energy Efficient Technology in Mechanical engineering: Compressed Air System, Heating, ventilation and air- conditioning, Fans and blowers, Pumps and Pumping Systems,

Energy Efficient Technology in Electrical engineering: Automatic Power Factor Controllers, Energy Efficient Motors, soft starters with energy saver, variable speed drives, energy efficient transformers, electronic ballast, occupancy sensors, energy efficient lighting controls, space cooling, energy efficiency of lifts and escalator, energy saving potential of each technology.

UNIT - V

Energy Efficient Technologies-II: Energy Efficient Technology in Civil Engineering: Intelligent Buildings, And Various Energy Efficiency Rating Systems for Buildings, Green Buildings Energy Efficiency: management of green buildings, importance of embodied energy in selection of sustainable materials, green building design, waste reduction/recycling, rainwater harvesting, maintenance of the green buildings, green building certification, Renewable energy applications.

Energy Efficient Technology in Chemical Engineering: Green chemistry, Low carbon cements, recycling paper.

Text Books:

1. Umesh Rathore, 'Energy Management', Kataria publications, 2nd ediiton, 2014.
2. G Hariharaiyer, “Green Building Fundamentals”, Notion press.com.
3. K V Shama, P Venkataseshaiah, "Energy management and conservation", I. K. International Publishing agency pvt. ltd., 2011.

Suggested Reading:

1. Guide books for National Certification Examination for Energy Manager / Energy Auditors Book-1, General Aspects.
2. Hargroves, K., Gockowiak, K., Wilson, K., Lawry, N., and Desha, C. (2014) An Overview of Energy Efficiency Opportunities in Mechanical/civil/electrical/chemical Engineering, The University of Adelaide and Queensland University of Technology.
3. Success stories of Energy Conservation by BEE, New Delhi (www.bee-india.org).

20EGO01

TECHNICAL WRITING SKILLS
(Open Elective - II)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

Course Objectives: The objectives of this course are,

1. Process of communication and channels of communication in general writing and technical writing in particular.
2. Learn Technical Writing including sentence structure and be able to understand and use technology specific words.
3. Write business letters and technical articles.
4. Write technical reports and technical proposals.
5. Learn to write agenda, record minutes of a meeting, draft memos. Understand how to make technical presentations.

Course Outcomes: On successful completion of the course, students will be able to

1. Communicate effectively, without barriers and understand aspects of technical communication.
2. Differentiate between general writing and technical writing and write error free sentences using technology specific words
3. Apply techniques of writing in business correspondence and in writing articles.
4. Draft technical reports and technical proposals.
5. Prepare agenda and minutes of a meeting and demonstrate effective technical presentation skills.

UNIT - I

Communication – Nature and process.
Channels of Communication – Downward, upward and horizontal communication. Barriers to communication.
Technical Communication – Definition, oral and written communication. Importance and need for Technical communication. Nature of Technical Communication. Aspects and forms of Technical communication. Technical communication Skills – Listening, Speaking, Reading & Writing.

UNIT - II

Technical Writing – Techniques of writing. Selection of words and phrases in technical writing. Differences between technical writing and general writing. Abstract and specific words. Sentence structure and requisites of sentence construction. Paragraph length and structure.

UNIT - III

Business correspondence – Sales letters, letters of Quotation, Claim and Adjustment letters.
Technical Articles: Nature and significance, types. Journal articles and Conference papers, elements of technical articles.

UNIT - IV

Technical Reports: Types, significance, structure, style and writing of reports. Routine reports, Project reports.
Technical Proposals: Definition, types, characteristics, structure and significance.

UNIT - V

Mechanics of Meetings: Preparation of agenda, participation, chairing and writing minutes of a meeting. Memorandum. Seminars, workshops and conferences.
Technical Presentations : Defining purpose, audience and locale, organizing content, preparing an outline, use of Audio Visual Aids, nuances of delivery, importance of body language and voice dynamics.

Text Books:

1. Meenakshi Raman & Sangeeta Sharma, “Technical Communications-Principles and Practice”, Oxford University Press, Second Edition, 2012.
2. M Ashraf Rizvi, “Effective Technical Communication”, Tata McGraw Hill Education Pvt Ltd, 2012.

Suggested Reading:

1. Kavita Tyagi, Padma Misra, "Basic Technical Communication", PHI Learning Pvt Ltd, 2012.
2. R.C Sharma, Krishna Mohan, "Business Correspondence and Report Writing", Tata McGraw Hill, 2003

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc18_mg13/preview
2. https://www.technical-writing-training-and-certification.com/
3. https://academy.whatfix.com/technical-writing-skills

20CEO02

DISASTER RISK REDUCTION AND MANAGEMENT
(Open Elective - II)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

Course Outcomes: On successful completion of the course, students will be able to

1. Identify and understand the concepts of hazards, causes and impacts of disasters.
2. Develop a critical capacity to evaluate the principles and practices of disaster risk reduction and management.
3. Develop a deep awareness of disaster resilience, risk mitigation, and recovery policies as they arise from natural hazards around the globe.
4. Apply knowledge about existing global frameworks and existing agreements and role of community in successful Disaster Risk Reduction.
5. Evaluate DM study including data search, analysis and presentation as a case study.

UNIT - I

- Hazard and disaster-concepts, vulnerability and risk.
- Hazard and disaster type – Natural, Water- related, pandemic and human induced hazards disasters.
- Causes and Impacts of disasters – Impacts on natural eco systems: physical, psychological and social impact.
- Disaster and financial resilience.
- GIS and remote sensing.
- Disaster vulnerability profile of India –Specific to geographical regions and states (as per regional significance).

UNIT - II

- Disaster Management Cycle –Rescue, Relief, Rehabilitation, Prevention, Mitigation and Preparedness.
- Disaster risk reduction (DRR) –Community based DRR, institutions concerned with safety, disaster mitigation and construction techniques as per Indian standards.
- Early warning systems.

UNIT - II

- Trauma and stress management.
- First aid and emergency procedures.
- Awareness generation strategies for the community on safe practises in disaster (as per regional significance).

UNIT - II

- Components of disaster management –preparedness of rescue and relief, mitigation, rehabilitation &reconstruction.
- Institutional frame work of disaster management in India (NDMA-SDMA, NDRF, Civic volunteers, NIDM).
- Phases of disaster/risk management and post-disaster responses.
- Compensation and insurance.
- Applications of remote sensing and GIS in disaster management.

UNIT - V

- Capacity building for disaster/damage mitigation (structural and non-structural measures).
- Disaster risk reduction strategies and national disaster management guidelines.
- Disaster management Act -2005.
- Regional issues as per regional requirement/university can take minimum two topics as per high powered committee.

Text Books:

1. Singh R. “Disaster management Guidelines for Earth quakes, Landslides, Avalanches and Tsunami”. Horizon Press publications, (2017).

2. Taimpo, “Disaster management and preparedness”. CRC Press Publications, 2016.
3. Nidhi, G.D., “Disaster management preparedness” .CBS Publications Pvt. Ltd, 2014.
4. Gupta, A.K.,Nair, S.S., Shiraz, A. and Dey, S., “Flood Disaster Risk Management-CBS Publications Pvt Ltd., 2013.
5. Singh, R., “Disaster management Guidelines for Natural Disasters” Oxford University Press Pvt. Ltd., 2016.

20CHO04

ENVIRONMENTAL AND SUSTAINABLE DEVELOPMENT
(Open Elective - II)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

Course Objectives: This course will help the students:

1. To have an increased awareness on issues in areas of sustainability.
2. To understand the role of engineering & technology within sustainable development.
3. To know the methods, tools and incentives for sustainable product service system development.
4. To establish a clear understanding of the role and impact of various aspects of engineering decisions on environmental, societal and economic problems.
5. To communicate results related to their research on sustainable engineering.

Course Outcomes: At the completion of this course students will be able:

1. To relate sustainability concepts and ethical principles towards environment.
2. To understand the different types of environmental pollution problems and their respect sustainable solutions.
3. To become aware of concepts, analytical methods/models, and resources for evaluating and comparing sustainability implications of engineering activities.
4. To critically evaluate existing and new methods.
5. To develop sustainable engineering solutions by applying methods and tools to research a specific system design.
6. To apply concepts of sustainable development to address sustainability challenges in a global context.

UNIT- I

Introduction of sustainability- Need and concept of Sustainable Engineering, Social-environmental and economic sustainability concepts, Sustainable development and challenges, Multilateral Environmental acts and protocols-Clean Development Mechanism (CDM), Environmental legislations in India- Air Act and Water Act.

UNIT- II

Economic and social factors affecting sustainability, Effects of pollution from natural sources, Solid waste-sources, impacts, 4R (Reduce, Reuse, Recycling, Recover) concept, Global environmental issues-Resource degradation, Climate change, Global warming, Ozone layer depletion, Tools used to ensure sustainability in engineering activities such as environmental management systems and environmental impact assessment studies.

UNIT- III

Global, Regional and Local environmental issues, Carbon credits and Carbon trading, Carbon foot print, Environmental management standards, ISO 14000 series, Life cycle Analysis (LCA)-scope and goal, Procedures of EIA (Environment Impact Assessment) in India-Procedures of EIA in India.

UNIT- IV

Basic concept of sustainable habitat-Sustainable cities, Sustainable transport, Sustainable sources of energy-conventional and renewable sources, Green Engineering: Green buildings, Green materials for sustainable design, Green building certification, Methods for increasing energy efficiencies of buildings.

UNIT- V

Technology and sustainable development, Sustainable urbanization, Industrialization and poverty reduction, Social and Technological change, Industrial processes-material selection, Pollution prevention, Industrial ecology, Industrial symbiosis.

Text Books:

1. Allen D. T and ShonnardD. R., Sustainability Engineering Concepts, Design and Case Studies, 1st Ed, Prentice Hall, 2011.
2. Bradley A. S, Adebayo A. O and Maria. P., Engineering Applications in Sustainable Design and Development, 1st Ed, Cengage Learning, 2016.

Suggested Reading:

1. Rag R. L., Introduction to Sustainable Engineering, 2nd Ed, PHI Learning Pvt Ltd, 2016.
2. Krishna R. Reddy, Claudio Cameselle, Jeffrey A. Adams., Sustainable Engineering, 1st Edition, Wiley, 2019.

20EGMO3

UNIVERSAL HUMAN VALUES-II: UNDERSTANDING HARMONY

(**B.E/B.Tech II/III Year** -Common to all Branches)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

Introduction

This course discusses the role of human values in one's family, in society and in nature. In the Induction Program, students would get an initial exposure to human values through Universal Human Values–I. This exposure is to be augmented by this compulsory full semester foundation course.

Course Objectives: The objectives of this course are,

1. Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
2. Understanding (or developing clarity) of the harmony in human being, family, society and nature/existence.
3. Strengthening of self-reflection.
4. Development of commitment and courage to act.

Course Outcomes: On successful completion of the course, students will be able to

1. Students are expected to become more aware of themselves, and their surroundings (family, society, nature)
2. They would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.
3. They would have better critical ability.
4. They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society).
5. It is hoped that they would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.

UNIT - I

Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

- Purpose and motivation for the course, recapitulation from Universal Human Values-I.
- Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration.
- Continuous Happiness and Prosperity- A look at basic Human Aspirations.
- Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority.
- Understanding Happiness and Prosperity correctly- A critical appraisal of the current Scenario.
- Method to fulfil the above human aspirations: understanding and living in harmony at various levels.

UNIT – II

Understanding Harmony in the Human Being - Harmony in Myself

- Understanding human being as a co-existence of the sentient 'I' and the material 'Body'.
- Understanding the needs of Self ('I') and 'Body' - happiness and physical facility.
- Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer).
- Understanding the characteristics and activities of 'I' and harmony in 'I'.
- Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail Programs to ensure Sanyam and Health.

UNIT – III

Understanding Harmony in the Family and Society- Harmony in Human- Human Relationship

- Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship.
- Understanding the meaning of Trust; Difference between intention and competence.

- Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship.
- Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co -existence as comprehensive Human Goals.
- Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.

UNIT – IV

Understanding Harmony in the Nature and Existence - Whole existence as Coexistence

- Understanding the harmony in the Nature.
- Interconnectedness and mutual fulfilment among the four orders of nature - recyclability and self-regulation in nature.
- Understanding Existence as Co-existence of mutually interacting units in all - pervasive space.
- Holistic perception of harmony at all levels of existence.

UNIT – V

Implications of the above Holistic Understanding of Harmony on Professional Ethics

- Natural acceptance of human values.
- Definitiveness of Ethical Human Conduct.
- Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order.
- Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.
- Case studies of typical holistic technologies, management models and production systems.
- Strategy for transition from the present state to Universal Human Order:
    a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers.
    b. At the level of society: as mutually enriching institutions and organizations.

Assessment:

This is a compulsory credit course. The assessment is to provide a fair state of development of the student, so participation in classroom discussions, self- assessment, peer assessment etc. will be used in evaluation.

Example:

Assessment by faculty mentor: 10 Marks
Self-assessment/Assessment by peers: 10 Marks
Socially relevant project/Group Activities/Assignments: 20 Marks
Semester end examination: 60 Marks
The overall pass percentage is 40%. In case the student fails, he/she must repeat the course.

Text Books:

1. R R Gaur, R Asthana, G P Bagaria, "A Foundation Course in Human Values and Professional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1.
2. R R Gaur, R Asthana, G P Bagaria, "Teachers' Manual for A Foundation Course in Human Values and Professional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2.

Suggested Reading:

1. A Nagaraj Jeevan Vidya: Ek Parichaya, Jeevan Vidya Prakashan, Amar kantak, 1999.
2. N. Tripathi, "Human Values", New Age Intl. Publishers, New Delhi, 2004.
3. Cecile Andrews, Slow is Beautiful
4. Gandhi - Romain Rolland (English)
5. Dharampal, "Rediscovering India"
6. E. FSchumacher. "Small is Beautiful"
7. J. C. Kumarappa "Economy of Permanence"
8. Pandit Sunderlal "Bharat Mein Angreji Raj"
9. Mohandas Karamchand Gandhi "The Story of My Experiments with Truth"
10. 10.Mohandas K. Gandhi, "Hind Swaraj or Indian Home Rule"
11. Maulana Abdul Kalam Azad, India Wins Freedom.
12. Vivekananda - Romain Rolland (English)
13. The Story of Stuff

20CSC28

COMPILER DESIGN LAB

Instruction	2 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	50 Marks
Credits	1

Pre-requisites: Data Structures, Design and analysis of algorithms, Formal language and automata theory.

Course Objectives: The objectives of this course are,

1. To define the rules for implementing lexical analyzer and to understand the concepts behind the working of compiler tools- Lex, Turbo C, Yacc.
2. To analyze and apply regular grammar for various source statements expression.
3. To implement front end of the compiler by means of generating intermediate codes, implement code optimization techniques and error handling.

Course Outcomes: On successful completion of the course, students will be able to

1. Implement the rules for the analyzing phases of a compiler.
2. Apply various Syntax techniques on grammars to build the parsers.
3. Generate various intermediate code representations for source code.
4. Explore error recovery strategies and implement code optimization, code generation phases.
5. Examine the concepts of compiler tools: Lex, FlexVision, Yacc, Turbo C.

List of Programs:

1. Tokenization – By constructing DFA of Lexical Analyzer.
2. Writing a scanner application using (Tools: Jlex / JFlex / Lex).
3. Implementing parser for small language.
4. Implementing Parser with scanner or Without Scanner.
5. Implementing parser with Scanner, without Scanner or with yacc/byson generators.
6. Program to generate predictive LL1 parsing table for the Expression grammar.
7. Implementation of the language to an intermediate form (e.g. three-address code).
8. Generation of target code (in assembly language).
9. Target Code improvement with help of optimization techniques.
10. Implement Mini Compiler with Phases.

Text Books:

1. Keith D Cooper & Linda Tarezon, “Engineering a Compiler”, Morgan Kafman, Second edition, 2004.
2. John R Levine, Tony Mason, Doug Brown “Lex &Yacc”, 3rd Edition Shroff Publisher, 2007.

Suggested Reading:

1. Kenneth C Louden, “Compiler Construction: Principles and Practice”, Cengage Learning, 2005.
2. John R Levine,”Lex&Yacc”, Oreilly Publishers, 2nd Edition, 2009.

20CSC29

ARTIFICIAL INTELLIGENCE LAB

Instruction	2 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	50 Marks
Credits	1

Pre-requisites: Artificial Intelligence.

Course Objectives: The objectives of this course are,

1. To design and analyze various computing algorithms and techniques using Python.
2. To apply different learning algorithms to solve real time problems.
3. To recognize the underlying mathematical models and logics behind various AI techniques.

Course Outcomes: On successful completion of the course, students will be able to,

1. Understand the basic components of library environment and installations.
2. Analyze the design heuristics and apply various techniques to solve real world problems.
3. Apply variety of algorithms to solve problems.
4. Identify how to use GitHub and submit back genuine contributions.
5. Implement problems using game search algorithms.

Lab Experiments:

1. Design/construct the workflow of a general AI project using draw.io
2. Implement Water Jug Problem using A* search
3. Implement an 8-puzzle solver using Heuristic search technique.
4. Implement the Constraint Satisfaction problem using backtracking.
5. Implement a program for game search.
6. Implement a Bayesian network from a given data and infer the data from that Bayesian network.
7. Implement a MDP to run value and policy iteration in any environment.
8. Understanding of GitHub and conda environments.
9. Use the GitHub packages and libraries to frame a standard project and commit back to GitHub.

Text Books:

1. Stuart Russell and Peter Norvig, “Artificial Intelligence: A Modern Approach”, 3rd Edition, Prentice Hall, 2010.
2. Elaine Rich and Kevin Knight, “Artificial Intelligence”, Tata McGraw Hill, 3rd Edition, 2017.

Suggested Reading:

1. Trivedi, M.C., “A Classical Approach to Artificial Intelligence”, Khanna Publishing House, Delhi, 2018.
2. Saroj Kaushik, “Artificial Intelligence”, Cengage Learning India, 2011.

Online Resources:

1. https://nptel.ac.in/courses/106105077
2. https://nptel.ac.in/courses/106106126
3. https://aima.cs.berkeley.edu
4. https://ai.berkeley,edu/project_overview.html

20CSE15

SOFT COMPUTING LAB
(Professional Elective – II)

Instruction	2 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	50 Marks
Credits	1

Pre-requisites: Linear Algebra & Calculus, Differential Equations and Transform Theory.

Course Objectives: The objectives of this course are,
1. To illustrate the concepts of simple neuron.
2. To learn the fundamentals of Neural Networks & Feed Forward Networks, Associative Memories & Artificial Neural Networks.
3. To understand the concepts of Fuzzy Logic and Fuzzy Systems, Genetic Algorithms and its design.

Course Outcomes: On successful completion of the course, students will be able to,
1. Implement McCulloh-Pitts model for Boolean operations.
2. Apply perceptron learning algorithm for a given problem.
3. Design and analyze various Neural Networks Architectures.
4. Apply concepts of fuzzy sets on real-time applications.
5. Implement Genetic Algorithms with its operators.
6. Apply soft computing strategies for various real time applications.

List of Experiments:
1. Implementation of Simple Neural Network (McCulloh-Pitts model) for realizing AND Operation and OR operation.
2. Implementation of Perceptron network for realizing NAND operation.
3. Implementation of ANDNOT using ADALINE network.
4. Implementation of XOR problem using MADALINE network.
5. Design and Develop the Back Propagation Algorithm.
6. Implementation of Bidirectional Associative Memory (BAM) network.
7. Implementation of Hopfield Network.
8. Implementation of Membership Functions in Fuzzy Sets.
9. Implementation of Kohonen Self-Organizing Feature Maps (KSOFM) network for Clustering.
10. Implement the Genetic Algorithm for the function $f(x) = x^2$.

Textbooks:
1. S.N. Sivanandam & S.N. Deepa, “Principles of soft computing”, Wiley publications, 2nd Edition, 2011.

Suggested Reading:
1. D.K Prathikar, “Soft Computing”, Narosa Publishing House, New Delhi, 2008.
2. S.N.Sivanandam, S.N.Deepa “Principles of Soft Computing” Second Edition, Wiley Publication 2016.
3. Satish Kumar, "Neural Networks -A classroom approach"; Second Edition, TMH, 2017.

Online Resources:
1. https://onlinecourses.nptel.ac.in/noc22_cs54/preview

20CSE16

INTERNET OF THINGS LAB
(Professional Elective – II)

Instruction	2 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	50 Marks
Credits	1

Pre-requisites: Computer architecture and microprocessor, Programming for problem solving.

Course Objectives: The objectives of this course are,

1. To understand the basics of IoT and its components.
2. To impart practical knowledge on IoT applications.
3. To develop skills required for building real-time IoT based projects.

Course Outcomes: On successful completion of the course, students will be able to,

1. Use of various hardware and software IoT components.
2. Perform experiments by Interfacing I/O devices, sensors to Raspberry Pi/Arduino.
3. Understand and analyze communication protocols in IoT.
4. Monitor data and controlling of devices.
5. Develop Real time IoT based projects.

List of Experiments:

1. Introduction to IoT equipments and perform necessary software installation.
2. Write a program to interface LED/Buzzer with Arduino and to turn ON LED for 1sec after every 2 seconds.
3. Write a program to interface Digital sensor PIR with Arduino and to turn ON LED when motion detected.
4. Write a program to interface DHT22 sensor with Arduino and display temperature and humidity readings.
5. Write a program to interface motor using relay with Raspberry Pi. Turn ON motor when the temperature is high.
6. Write a program to interface LCD with Raspberry Pi and print temperature and humidity readings on it.
7. Write a program to interface flame/smoke sensor with Arduino /Raspberry Pi and give an alert message when flame/smoke is detected.
8. Implement any case study using Arduino/Raspberry Pi.

Text Books:

1. Arshdeep Bahga and Vijay Madisetti, "Internet of Things: A Hands-on Approach", Universities Press, 2014.

Suggested Reading:

1. Dr. SRN Reddy, Rachit Tirnkral and Manasi Mishra, "Introduction to Internet of Things: A practical Approach", ETI Labs, 2018.
2. Adrian McEwen, "Designing the Internet of Things", Wiley, 2013.
3. Raj Kamal, "Internet of Things:Architecture and Design", McGraw Hill, 2017.
4. Cuno Pfister, "Getting Started with the Internet of Things", 0 Reilly Media, 2011.
5. O. Vermesan, P. Friess, "Internet of Things – Converging Technologies for Smart Environments and Integrated Ecosystems", River Publishers, Series in Communications, 2013.

Online Resources / Weblinks / NPTEL Courses:

1. Li Da Xu, Wu He, and Shancang Li, "Internet of Things in Industries: A Survey ", IEEE Transactions on Industrial Informatics, Vol. 10, No. 4, Nov. 2014.
2. T. Winter, P. Thubert, A. Brandt, J. Hui, R. Kelsey, P. Levis, K. Pister, R. Struik, JP. Vasseur, R. Alexander, "RPL: IPv6 Routing Protocol for Low-Power and Lossy Networks", IETF, Standards Track, Mar. 2012.
3. Z. Shelby, K. Hartke, C. Bormann, "The Constrained Application Protocol (CoAP)", Internet Engineering Task Force (IETF), Standards Track, 2014.

4. L.Fenzel, “What’s The Difference Between IEEE 802.15.4 And ZigBee Wireless?”,Electronic Design (Online), Mar. 2013.
5. S. N. Das and S. Misra, "Information theoretic self-management of Wireless Sensor Networks", Proceedings of NCC 2013.
6. F. Luo *et al*., "A Distributed Gateway Selection Algorithm for UAV Networks," in IEEE Transactions on Emerging Topics in Computing, vol. 3, no. 1, pp. 22-33, March 2015.

20CSE17

ENTERPRISE APPLICATION DEVELOPMENT LAB
(Professional Elective – II)

Instruction	2 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	50 Marks
Credits	1

Pre-requisites: Internet and web technologies, OOPs, Database management systems.

Course Objectives: The objectives of this course are,

1. To acquire knowledge on MongoDB, ReactJS, Express, Node.js and Angular2 to develop web applications.
2. Ability to develop dynamic web content using web frameworks.
3. To understand the design and development process of a complete web application.

Course Outcomes: On successful completion of the course, students will be able to,

1. Prepare database connections with application servers.
2. Design user interfaces using ReactJS.
3. Construct strong expertise on Express framework to develop responsive web applications.
4. Create server side applications using Node.js
5. Develop SPA using Angular 2.
6. Invent next culture-shifting web applications.

List of Programs:

1. Installation, configuration and connection establishment of MongoDB.
2. CRUD operations on MongoDB.
3. Building and Deploying React App.
4. Demonstration of component intercommunication using ReactJS
5. Create Express application,
6. Demonstration of authentication and authorization using Express.
7. Data access using Node.js
8. Create a form to edit the data using Angular2
9. A case study on a single platform for all financial data for NSE India.

Textbook:

1. Amos Q. Haviv, MEAN Web Development, Second Edition, Packt Publications, November 2016
2. Vasan Subramanian, “Pro MERN Stack, Full Stack Web App Development with Mongo, Express, React, and Node”, 2nd Edition, APress.

Suggested Reading:

1. Shelly Powers, “Learning Node: Moving to the Server-Side”, 2nd Edition, O’REILLY, 2016.
2. Simon D. Holmes and Clive Harber, “Getting MEAN with Mongo, Express, Angular, and Node”, Second Edition, Manning Publications, 2019.
3. Brad Dayley, “Node.js, MongoDB and Angular Web Development”, 2nd Edition, Addison-Wesley Professional, 2017.

Online Resources:

1. https://www.mongodbtutorial.org/mongodb-crud/
2. https://reactjs.org/tutorial/tutorial.html
3. https://www.javatpoint.com/expressjs-tutorial
4. https://www.javatpoint.com/nodejs-tutorial
5. https://angular-training-guide.rangle.io/

20CSE18

MACHINE LEARNING LAB
(Professional Elective – II)

Instruction	2 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	50 Marks
Credits	1

Pre-requisites: Artificial Intelligence, Machine learning.

Course Objectives: The main objectives of this course are,

1. To make use of Data sets in implementing the machine learning algorithms.
2. To implement the machine learning concepts and algorithms.
3. To use real world data and implement machine learning models.

Course Outcomes: On Successful completion of this course, student will be able to,

1. Identify the fundamental issues and challenges of machine learning: data, model selection, model complexity, etc.
2. Identify and utilize modern tools that are useful for data analysis.
3. Recognize and implement various ways of selecting suitable model parameters for different machine learning techniques.
4. Implement and evaluate various Machine Learning approaches on real world problems
5. Apply Keras and Tensorflow to implement ML techniques.

List of Experiments:

1. Identification and Installation of python environment towards the machine learning, installing python modules/Packages Import scikitlearn, keras and tensorflows etc.
2. Build linear regression model using gradient descent, least squares, polynomial, LASSO and RIDGE approaches also compare all the algorithms and draw a table for all the metrics.
3. Demonstration of decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
4. Demonstration of Logistic Regression for a sample training data set stored as a .CSV file. Calculate the accuracy, precision, and recall for your dataset.
5. Demonstration of Naïve Bayesian classifier for a sample training data set stored as a .CSV file. Calculate the accuracy, precision, and recall for your dataset.
6. Build the decision tree classifier compare its performance with ensemble techniques like random forest, bagging, boosting and voting Demonstrate it with different decision trees.
7. Implementation of Gradient Descent Algorithm using Tensorflow.
8. Case study on supervised learning algorithms.
9. Demonstration of clustering algorithms - k-Means, Agglomerative and DBSCAN to classify for the standard datasets.

Text Books:

1. Giuseppe Bonaccorso, “Machine Learning Algorithms”, Packt Publishing, 2017.

20CSE19

DEVOPS LAB
(Professional Elective – II)

Instruction	2 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	50 Marks
Credits	1

Pre-requisites: Database management systems, Operating systems, OOPs.

Course Objectives: The objectives of this course are,

1. To explore the fundamental concepts in Project Life Cycle.
2. To develop skills using tools of DevOps.
3. To examine the application development with different automation tools.

Course Outcomes: On successful completion of this course, students will be able to,

1. Understand the phases of the software development life cycle.
2. Examine the different version control systems.
3. Recognize the importance of the build and deployment tools and test the software application.
4. Deployment of application in production environment.
5. Summaries the software configuration management.
6. Synchronize and provisioning using Puppet and Ansible.

List of Experiments:

1. Git installation and create a repository and perform fetch, pull, branching operations.
2. Jenkins Installation and implement continues Integration and Continues deployment, build a job using Jenkins.
3. To install and configure Docker for creating containers of different Operating System (Virtualization Concept)
4. Deployment Tool (Team City /Ansible) Install Docker and execute commands in a Docker and deploy the application in to Docker file
5. Test the Application using selenium tool.
6. Configuring and establish Connection between Agent and Master using Puppet
7. Install code monitoring tools ex: Nagios..Perform operations
8. Install issue tracker and monitor the workflow of any application and track the issues JIRA tool (Agile management tool)

Text Books:

1. Joakim Verona. “Practical Devops”, Second Edition. Ingram short title; 2nd edition, 2018.
2. Deepak Gaikwad, Viral Thakkar, “DevOps Tools from Practitioner's Viewpoint”. Wiley publications, 2019.

Suggested Reading:

1. Len Bass, Ingo Weber, Liming Zhu, “DevOps: A Software Architect's Perspective”. Addison Wesley, 1st Edition, 2015.

Online Resources:

1. https://www.coursera.org/learn/intro-to-devops
2. https://www.tutorialspoint.com/introduction-to-devops/index.asp

20EGCO3

EMPLOYABILITY SKILLS

Instruction	2 Hours per week
Duration of End Examination	2 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	50 Marks
Credits	1

Course Objectives: The objectives of this course are,

1. Learn the art of communication, participate in group discussions and case studies with confidence and to make effective presentations.
2. With- resume packaging, preparing them to face interviews.
3. Build an impressive personality through effective time management, leadership qualities, self-confidence and assertiveness.
4. Understand professional etiquette and to make them learn academic ethics and value system.
5. To be competent in verbal aptitude.

Course Outcomes: On successful completion of this course, students will be able to,

1. Become effective communicators, participate in group discussions with confidence and be able to make presentations in a professional context.
2. Write resumes, prepare and face interviews confidently.
3. Be assertive and set short term and long term goals, learn to manage time effectively and deal with stress.
4. Make the transition smoothly from campus to work, use media with etiquette and understand the academic ethics.
5. Enrich their vocabulary, frame accurate sentences and comprehend passages confidently.

UNIT - I

Verbal Aptitude: Error Detection, Articles, Prepositions, Tenses, Concord and Transformation of Sentences- Jumbled Words/Sentences- Vocabulary, Synonyms, Antonyms, One Word Substitutes, Idioms and Phrases, Word/Sentence/Text Completion- Reading Comprehension.

UNIT - II

Group Discussion & Presentation Skills: Dynamics of Group Discussion-Case Studies- Intervention, Summarizing, Modulation of Voice, Body Language, Relevance, Fluency and Accuracy, Coherence. Elements of Effective Presentation – Structure of a Presentation – Presentation tools – Body language - Preparing an Effective PPT.

UNIT - III

Behavioural Skills: Personal strength analysis-Effective Time Management- Goal Setting- Stress management- **Corporate Culture** – Grooming and etiquette-Statement of Purpose (SOP).

UNIT - IV

Mini Project: Research-Hypothesis-Developing a Questionnaire-Data Collection-Analysis-General and Technical Report - Writing an Abstract –Technical Report Writing-Plagiarism-Project Seminar.

UNIT -V

Interview Skills: Cover Letter andRésumé writing – Structure and Presentation, Planning, Defining the Career Objective, Projecting ones Strengths and Skill-sets – Interviews: Concept and Process, Pre-Interview Planning, Opening Strategies, Answering Strategies, Mock Interviews.

Suggested Reading:

1. Leena Sen, “Communication Skills”, Prentice-Hall of India, 2005.
2. Dr. Shalini Verma, “Body Language - Your Success Mantra”, S Chand, 2006.
3. Edgar Thorpe and ShowickThorpe , “Objective English”, 2nd edition, Pearson Education, 2007.
4. Ramesh, Gopalswamy, and Mahadevan Ramesh, “The ACE of Soft Skills”, New Delhi: Pearson, 2010.
5. Gulati and Sarvesh, “Corporate Soft Skills”, New Delhi: Rupa and Co., 2006.
6. Van Emden, Joan, and Lucinda Becker, “Presentation Skills for Students”, New York: Palgrave Macmillan, 2004.
7. A Modern Approach to Verbal & Non-Verbal Reasoning by R S Aggarwal, 2018.
8. Covey and Stephen R, “The Habits of Highly Effective People”, New York: Free Press, 1989.