GEETHANJALI INSTITUTE OF SCIENCE & TECHNOLOGY: NELLORE

(AUTONOMOUS)

NELLORE–524317 (A.P) INDIA

B.TECH IN COMPUTER SCIENCE & ENGINEERING (DATA SCIENCE)

COURSE STRUCTURE AND SYLLABI UNDER RG 22 REGULATIONS

Vision & Mission

VISION

- To emerge as a premier department of Computer Science and Engineering in the domain of Data Science striving to produce competent young data scientists to serve the society with professional commitment and ethical values.

MISSION

- **M1**: Transforming learners into technically proficient engineers through innovative teaching learning methodologies enabling them to fulfil industrial requirements.
- **M2**: Inculcating discipline, ethical and professional values among the aspirants to become socially responsible engineers.
- **M3**: Exploring the potential of learners through integrity and professionalism to serve the needs of the society.
- **M4**: Engaging students in acquisition of core capabilities through learner-centric activities to offer sustainable solutions to real-time problems .

B. Tech CSE (DS) - PROGRAM OUTCOMES (PO's)	
A graduate of the Computer Science and Engineering (Data Science) Program will demonstrate:	
PO1:	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2:	**Problem analysis**: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3:	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4:	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5:	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
PO6:	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7:	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8:	**Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9:	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10:	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11:	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12:	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

B. Tech CSE (DS) - PROGRAM EDUCATIONAL OBJECTIVES (PEO's)	
A graduate of Computer Science and Engineering (Data Science) will be able to:	
PEO 1	Contribute to the economic growth of the Country through a purposeful and productive interaction with their peers .
PEO 2	Successfully pursue higher studies in engineering or management courses .
PEO 3	Emerge as visionary leaders and entrepreneurs possessing leadership qualities and team building skills..
PEO 4	Exhibit core technical competencies to analyse and design viable solutions for problems with social responsibility and ethical standards..

B. Tech CSE (DS) - PROGRAM EDUCATIONAL OBJECTIVES (PSO's)	
A graduate of Computer Science and Engineering (Data Science) will be able to:	
PSO1	Apply the principles of Data Science, Data Management, Data Security and Visualization for Data Analysis and prediction.
PSO2	Utilize the knowledge of analytics, statistics and Machine Learning concepts to solve real time problems related to Data Analysis.

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Ph. No. 08622-212769, E-Mail: geethanjali@gist.edu.in, Website: www.gist.edu.in

Semester-5(Theory-5, Lab-2, SC-1, MC-1)							
Sl. No.	**Category**	**Course Code**	**Course Title**	**Hours per week**			**Credits**
				L	**T**	**P**	**C**
1	PCC	22A3303T	Automata and Compiler Design	3	0	0	3
2	PCC	22A0508T	Software Engineering	3	0	0	3
3	PCC	22A0528T	Machine Learning	3	0	0	3
4	PEC	22A0535b 22A3308T 22A0520T	**Professional Elective-I:** 1. Software Testing 2. Information Retrieval System 3. Computer Networks	3	0	0	3
5	OEC	22A0430T 22A0214Ta 22A0149T 22A0321Ta	**Open Elective-I:** 1. Principles of Communication Systems 2. Power Electronics 3. Building Materials 4. Automobile Engineering	3	0	0	3
6	PCC(Lab)	22A0510P	Software Engineering Lab	0	0	3	1.5
7	PCC(Lab)	22A0532P	Machine Learning Lab	0	0	3	1.5
8	SC	22A0518	**Skill Advanced Course:** Linux Programming	1	0	2	2
9	MC	22A0526	**Mandatory Course:** Design Thinking and Innovation	2	0	0	0
Community Service Project 2Months (Mandatory)after second year (to be evaluated during V semester)				0	0	0	1.5
				Total credits			**21.5**

Category	**Credits**
Professional Core Courses (PCC)	12
Professional Elective Courses (PEC)	3
Open Elective Courses (OEC)	3
Skill Advanced Course (SC)	2
Summer Internship	1.5
Total	21.5

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AUTOMATA AND COMPILER DESIGN					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A3303T	**3: 0:0:0**	**3**	**CIE:30SEE:70**	**3Hours**	**PCC**

Course Objectives:

This course will enable students :

- Understand formal definitions of machine models
- To illustrate finite state machines to solve problems in computing
- Understanding of formal grammars
- To explain the hierarchy of problems arising in the computer sciences.
- Understanding of undecidable problems

Course Outcomes (CO):

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

- Understand the fundamental concepts of Formal Languages and Automata
- Apply the knowledge of Automata Theory, Grammars & Regular Expressions for solving various problems.
- Design of Context Free Grammar for formal language
- Construct push down automaton for the given language
- Make use of Turing machine concept to solve the simple problems
- Explain decidability or undecidability of various problems

Syllabus		**Total Hours:48**
MODULE-I	**Finite Automata**	**10Hrs**

Why Study Automata Theory? The Central Concepts of Automata Theory, Automation, Finite Automation, Transition Systems, Acceptance of a String by a Finite Automaton, DFA, Design of DFAs, NFA, Design of NFA, Equivalence of DFA and NFA, Conversion of NFA into DFA, Finite Automata with Є-Transition, Minimization of Finite Automata, Mealy and Moore Machines, Applications and Limitation of Finite Automata.

MODULE -II	**Regular Expressions**	**9Hrs**

Regular Expressions, Equivalence of two Regular Expressions, Finite Automata and Regular Expressions, Inter Conversion, Equivalence between Finite Automata and Regular Expressions, Pumping Lemma, Closers Properties, Applications of Regular Expressions, Grammars, Classification of Grammars-Chomsky Hierarchy, Finite Automata and Regular Grammars, Regular Expressions and Regular Grammars.

MODULE -III	**Context Free Grammars**	**10Hrs**

Context Free Grammar, Leftmost and Rightmost Derivations, Parse Trees, Ambiguous Grammars, Simplification of Context Free Grammars-Elimination of Useless Symbols, E-Productions and Unit Productions, Normal Forms for Context Free Grammars-Chomsky Normal Form and Greibach Normal Form, Pumping Lemma, Closure Properties, Applications of Context Free Grammars.

MODULE -IV	**Introduction To Compiling**	**9Hrs**

Introduction To Compiling: Overview of Compilers, Phases of a Compiler.

Lexical Analysis: The Role of Lexical Analyzer, Input Buffering, Specification of Tokens, Recognition of Tokens, The lexical analyzer generator Lex, Design of a Lexical Analyzer generator

MODULE -V	**Syntax Analysis**	**10Hrs**

Syntax Analysis: The role of the Parser, First and Follow, Predictive Parsing, LR Parsers-SLR, Canonical LR, LALR, Parser Generator(YACC).

Syntax-Directed Definition, S-Attributed SDD, L-Attributed SDD, Translation Schemes, three address code,

Principle Sources Of Code Optimizations, Issues Code generation

Text Books:

1. Introduction to Automata Theory, Languages and Computation, J.E.Hopcroft, R.Motwani and J.D.Ullman, 3rd Edition, Pearson, 2008.

Reference Books:

1. Theory of Computer Science-Automata, Languages and Computation, K.L.P.Mishra and N.Chandrasekaran, 3rd Edition, PHI, 2007.
2. Introduction to Automata Theory, Formal Languages and Computation, ShyamalenduKandar, Pearson, 2013.

Web Reference:

https://www.iare.ac.in/sites/default/files/PPT/ACD%20PPTS_0.pdf

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SOFTWARE ENGINEERING
(Common to **CSE, AI&ML, DS, CS**)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0508T	3:0:0:0	3	CIE:30 SEE:70	3 Hours	PCC

Course Objectives:

This course will enable students to:

- To learn the basic concepts of software engineering and life cycle models.
- To understand the requirements engineering and agile models.
- To interpret the basic concepts of software design
- To understand the basic concepts of black box and white box software testing and enable to design test cases for unit, integration, and system testing
- To understand the basic concepts in risk management and reengineering.

Course Outcomes (CO):

On completion of this course, student will be able to

- Use software life cycle activities for process models (L3).
- Use software requirements specifications for given problems (L3).
- Apply design concepts, component Level and user interface design for a given problems(l3)
- Apply various test cases for a given problems (L3).
- Apply quality management concepts at the application level. (L3)
- Determine risk management plans and implementation(l3)

Syllabus		Total Hours:48
Module-I	**Software, Software Engineering and Software Process**	**10 Hrs**

Basic concepts: abstraction versus decomposition, evolution of software engineering techniques, Software development life cycle (SDLC) models: Iterative waterfall model, Prototype model, Evolutionary model, Spiral model, RAD model, Agile models, software project management: project planning, project estimation, COCOMO, project scheduling, Organization and team structure, risk management.

Module-II	Requirements Engineering and Agile Models	9 Hrs

The Nature of software, The unique nature of web apps, The software myths

Requirements Engineering: Functional and non-functional requirements, the software requirements document, Requirements specification, Requirements engineering processes, Requirements elicitation and analysis, Requirements validation, Requirements management

Agile development model: What is agility, what is an agile process, XP, Agile process models, CMMI

Module-III	Design Concepts, Component Level and User Interface Design	9 Hrs

Design Concepts: Good Software Design, Cohesion and coupling, The design Process, Design concepts, design models

Component Level Design: Introduction to components, designing class-based components

User Interface Design: Golden rules, User Interface analysis and design

Module-IV	Software Testing Strategies, Project Metrics and Quality Management	10 Hrs

Software Testing Strategies: coding standards and guidelines, code review, testing, types of testing.

Process and project metrics: software measurement, A framework for product metrics.

Quality Management: Quality, Software quality**,** metrics for software quality, software quality assurance.

Module-V	Risk Management and Reengineering	10 Hrs

Risk Management: Risk identification, Risk projection, risk refinement, RMMM

Maintenance and reengineering: Software maintenance, reengineering, reverse engineering and forward engineering

Case Study: Implementation of safe home system using software engineering principles.

Text Books:

1. Pressman R, "Software Engineering- Practioner Approach", McGraw Hill.
2. Somerville, "Software Engineering", Pearson 2.

Reference Books:

1. Rajib Mall, "Fundamentals of Software Engineering", 5th Edition, PHI, 2018.
2. Richard Fairley, "Software Engineering Concepts", Tata McGraw Hill.
3. Jalote Pankaj, "An integrated approach to Software Engineering", Narosa.

Web Reference:

https://nptel.ac.in/courses/106/105/106105182/

http://peterindia.net/SoftwareDevelopment.html

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MACHINELEARNING
(Common to **CSE, AI&ML, DS, CS**)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0528T	3:0:0:0	3	CIE:30 SEE:70	3 Hours	PCC

Course Objectives:

This course will enable students to:

- Understand basic concepts of Machine Learning
- Study different learning algorithms
- Illustrate evaluation of learning algorithms

Course Outcomes (CO):

On completion of this course, student will be able to

- Interpret the basic concepts of Human Learning, Machine Learning, Building and Evaluating a Model, Classification, Regression and Clustering
- Building, training and evaluating a Model
- Apply different Classification algorithms to real world problems
- Apply different Regression techniques to real world problems
- Apply Partitioning Methods of Clustering to real world problems
- Apply Density-based methods of Clustering to real world Scenarios

Syllabus		Total Hours:48
Module-I	**Introduction – Human Learning & Machine Learning**	**10Hrs**

Human Learning, Types of Human Learning, Machine Learning, Types of Machine Learning, Applications of Machine Learning, Issues in Machine Learning.

Basic types of Data in Machine Learning, Data Preprocessing : Data Cleaning, Data transformation and Data Reduction

Module-II	Modeling and Evaluation	9Hrs

Introduction, selecting a Model, training a Model, Model Representation and Interpretability, Evaluating Performance of a Model, Improving Performance of a Model

Module-III	Supervised Learning :Classification	10Hrs

Classification – Methods of Classification : Classification model, Classification Learning Steps, Classification by Decision tree Induction, Classification by Back propagation, K-Nearest Neighbor Classification, Random Forest Algorithm, Naïve Baye's Classification

Module-IV	Supervised Learning : Regression	10Hrs

Regression – Assumptions in Regression Analysis, Types of Regression: Simple Linear Regression, Multiple Linear Regression, Polynomial Regression, Logistic Regression, Curve Fitting- Method of Least Squares.

Module-V	Unsupervised Learning : Clustering	9Hrs

Clustering- Different types of clustering techniques, Partitioning Methods: K-Means Algorithm, K-Medoid's algorithm, Hierarchical Clustering Methods, Density based Clustering Methods- DBSCAN, DENCLUE, OPTICS

Text Books:

1. Machine Learning, SaikatDutt, Subramanian Chandramouli, Amit Kumar Das, Pearson, 2019..

Reference Books:

1. EthernAlpaydin, "Introduction to Machine Learning", MIT Press, 2004.
2. Stephen Marsland, "Machine Learning -An Algorithmic Perspective", Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series,2014.
3. Andreas C. Müller and Sarah Guido "Introduction to Machine Learning with Python: A Guide for Data Scientists", Oreilly.

Web References:

1. Andrew Ng, "Machine Learning Yearning"
2. https://www.deeplearning.ai/machine-learning-
3. https://www.cse.huji.ac.il/~shais/UnderstandingMachineLearning/index.html

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SOFTWARE TESTING
(Common to **CSE, AI&ML, DS, CS**)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0535b	3:0:0:0	3	CIE:30 SEE:70	3 Hours	PCC

Course Objectives:

This course is designed to:

- Acquire knowledge on distinct types of testing methodologies.
- Describe the principles and procedures for designing test cases.
- Understand the stages of testing from Development to acceptance testing

Course Outcomes (CO):

- Interpret the need of testing.
- Outline the strategies of dataflow testing.
- Apply testing in various domains.
- Design testing for checking the logic
- Choose Test cases that are geared to discover the program defects.
- Design test cases before writing code and run these tests automatically.

Syllabus		Total Hours:48
Module-I	**Introduction, Flow graphs and Path testing**	**10Hrs**

- Purpose of Testing, Dichotomies, Model for Testing, Consequences of Bugs,Taxonomy of Bugs
- Basics Concepts of Path Testing, Predicates, Path Predicatesand Achievable Paths, Path Sensitizing, Path Instrumentation, Application of Path Testing.

Module-II	Transaction &Data Flow &Flow Testing	9Hrs

- Transaction Flows, Transaction Flow Testing Techniques.
- Basics of Dataflow Testing, Strategies in Dataflow Testing, Application of Dataflow Testing.

Module-III	Domain Testing	10Hrs

Domains and Paths, Nice & Ugly Domains, Domain testing, Domainsand Interfaces Testing, Domain and Interface Testing, Domains and Testability.

Module-IV	Paths, Path products and Regular expressions	10Hrs

- Path Products & Path Expression, Reduction Procedure, Applications, Regular Expressions & Flow Anomaly Detection.
- Overview, Decision Tables, Path Expressions, KV Charts, Specifications.

Module-V	State, State Graphs and Transition Testing	9Hrs

- State Graphs, Good & Bad StateGraphs, State Testing, Testability Tips.
- Motivational Overview, Matrix of Graph, Relations,Power of a Matrix, Node Reduction Algorithm, Building Tools.

Text Books:

1. Boris Beizer, "Software testing techniques", Dreamtech, second edition, 2002.

Reference Books :

1. Brian Marick, "The craft of software testing", Pearson Education.
2. Yogesh Singh, "Software Testing", Camebridge
3. P.C. Jorgensen, "Software Testing" 3rd edition, Aurbach Publications (Dist.bySPD).
4. N.Chauhan, "Software Testing", Oxford University Press.
5. P.Ammann&J.Offutt, "Introduction to Software Testing" , Cambridge Univ.Press.
6. Perry, "Effective methods of Software Testing", John Wiley, 2nd Edition, 1999.

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Information Retrieval Systems

(Common to CSE, AI&ML, DS, CS)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A3308T	3:0:0:0	3	CIE:30 SEE:70	3 Hours	PEC

Course Objectives:

This course will enable students to:

- Teach how to retrieve information
- Discuss indexing and how to use it
- Demonstrate how to automate indexing

Course Outcomes (CO):

After the completion of the course students will able to

- Recognize the Boolean Model, Vector Space Model, and Probabilistic Model.
- Understand retrieval utilities.
- Understand different formatting tags
- Understand cross-language information retrieval
- Understand the clustering techniques
- Determine the efficiency.

Syllabus		Total Hours:48
Module-I	**Introduction**	**10Hrs**

Introduction to Information Retrieval Systems: Definition of Information Retrieval System, Objectives of Information Retrieval Systems, Functional Overview, Relationship to Database Management Systems, Digital Libraries and Data Warehouses.

Information Retrieval System Capabilities: Search Capabilities, Browse Capabilities, Miscellaneous Capabilities

Module-II	**Cataloguing and Indexing, Data structure**	**9Hrs**

Cataloguing and Indexing: History and objectives of Indexing, Indexing Process, Automatic Indexing, Information extraction.

Data structure: Introduction to Data Structure, Stemming Algorithms, Inverted File Structure, N-Gram Data Structures, PAT Data Structure, Signature File Structure, Hypertext and XML Data Structures, Hidden Markov Models.

Module-III	**Automatic Indexing, Document and Term Clustering**	**10Hrs**

Automatic Indexing: Classes of Automatic Indexing, Statistical Indexing, Natural Language, Concept Indexing, Hypertext Linkages.
Document and Term Clustering: Introduction to Clustering, Thesaurus Generation, Manual Clustering Automatic Term Clustering, Complete Term Relation Method, Clustering Using Existing Clusters, One Pass Assignments, Item Clustering, hierarchy of Clusters.

Module-IV	**Automatic Indexing, Information visualization**	**9Hrs**

Automatic Indexing: Search Statements and Binding, Similarity Measures and Ranking, Relevance

Feedback, Selective Dissemination of Information Search, Weighted Searches of Boolean Systems, Searching the INTERNET and Hypertext.

Information visualization: Introduction to Information visualization, Cognition and perception, Information Visualization Technologies.

Module-V	**Text Search Algorithms, Multimedia Information Retrieval, Information System Evaluation**	**10Hrs**

Text Search Algorithms: Introduction to Text Search techniques, software Text Search algorithms, Hardware Text Search Systems.

Multimedia Information Retrieval: Spoken Language Audio Retrieval, Non-Speech Audio Retrieval, Graph retrieval, Imagery Retrieval, Video Retrieval.

Information System Evaluation: Introduction to Information System Evaluation, Measures Used in System Evaluation, Measurement Example- TREC results.

Text Books:

1. Information Storage and Retrieval Systems: Theory and Implementation by Gerald J. Kowalski, Mark T. Maybury, Springer, 2013.

Reference Books:

1. Frakes, W.B., Ricardo Baeza-Yates: Information Retrieval Data Structures and Algorithms, Prentice Hall, 1992.
2. Modern Information Retrieval by Yates Pearson Education.
3. Information Storage & Retrieval by Robert Korfhage – John Wiley & Sons.

Web References:

https://www.tutorialandexample.com/information-retrieval

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COMPUTER NETWORKS
(Common **to CSE, AI&ML, CS, DS**)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0520T	3: 0:0:0	3	CIE:30 SEE:70	3 Hours	PCC

Course Objectives:

This course will enable students:

- Determine the basic concepts of Computer Networks.
- Determine the layered approach for design of computer networks
- Distinguish OSI and TCP/IP reference models
- Predict the network path used in Internet environment
- Use the format of headers of IP, TCP and UDP
- Illustrate the concepts of application layer, network security fundamentals.

Course Outcomes(CO):

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

- Use the software and hardware components of a computer network (L3)
- Apply the reference model of a computer network(L3)
- Solve the error correction and detection in existing protocols(L3)
- Predict path for routing, and congestion control algorithms(L3)
- Determine the functionality of TCP and UDP(L3)
- Use the appropriate application layer applications(L3)

Syllabus		Total Hours:48
Module-I	**The Internet and the Reference Models**	**10Hrs**

Introduction: Computer Network, Network Topologies, types of networks, Reference models- The OSI Reference Model the TCP/IP Reference Model - A Comparison of the OSI and TCP/IP Reference Models.

Physical Layer –Introduction to physical layer, Guided Media- Twisted-pair cable, Coaxial cable, Fiber optic cable, Unguided media: Wireless-Radio waves, microwaves, infrared.

Module-II	The Data Link Layer	9Hrs

The Data Link Layer:Data Link Layer Design Issues, Error Detection and Correction, Elementary Data Link Protocols, Sliding Window Protocols

Module-III	The Network Layer	10Hrs

The Network Layer: Network Layer design issues, Routing algorithms, Congestion control and Internetworking, Network layer in internet.

Module-IV	Transport Layer	9Hrs

Transport Layer: Transport layer services, service primitives, Elements of transport protocols**,** The Internet Transport Protocols: TCP/IP, UDP.

Module-V	The Application Layer and Network security	10Hrs

The Application Layer: DNS, SMTP, FTP, Email and security, network security.

Text Books:

1. Andrew S.Tanenbaum, David j.wetherall, Computer Networks, 5th Edition, PEARSON.
2. James F. Kurose, Keith W. Ross, "Computer Networking: A Top-Down Approach", 6th edition, Pearson, 2019.

Reference Books:

1. Forouzan, Datacommunications and Networking, 5th Edition, McGraw Hill Publication.
2. Youlu Zheng, Shakil Akthar, "Networks for Computer Scientists and Engineers", Oxford Publishers, 2016.

Web Reference:

1. https://nptel.ac.in/courses/106105183/25
2. http://www.nptelvideos.in/2012/11/computer-networks.html
3. https://nptel.ac.in/courses/106105183/3

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PRINCIPLES OF COMMUNICATION SYSTEMS
(Common to **CSE, AI&ML,DS,CS**)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0430T	3:0:0:0	3	CIE:30 SEE:70	3 Hours	OEC

Course Objectives:

This course will enable students to:

- To understand the concept of various modulation schemes and multiplexing.
- To apply the concept of various modulation schemes to solve engineering problems.
- To analyze various modulation schemes.
- To evaluate various modulation scheme in real time applications.

Course Outcomes (CO):

On completion of this course, student will be able to

- Understand the concept of various modulation schemes.
- Understand the concept of Different multiplexing techniques.
- Apply the concept of various modulation schemes to solve engineering problems.
- Analyze various modulation schemes.
- Evaluate various modulation schemes in real time applications.
- Understand the concept of various Communication systems.

Syllabus		Total Hours:48
Module-I	**Amplitude Modulation**	**10Hrs**

Amplitude Modulation: Introduction to Noise and Fourier Transform. An overview of Electronic Communication Systems. Need for Frequency Translation
Amplitude Modulation: DSB-FC, DSB-SC, SSB-SC and VSB, Radio Transmitter and Receiver. Theta notation (Θ), Mathematical analysis of non-Recursive and recursive Algorithms with Examples.

Module-II	**Frequency Modulation**	**9Hrs**

Frequency Modulation: Introduction to Angle Modulation, Tone modulated FM Signal, Arbitrary Modulated FM Signal, FM Modulation and Demodulation. Stereophonic FM Broadcasting.

Module-III	**Pulse Modulation**	**10Hrs**

Pulse Modulation: Sampling Theorem- Low pass and Band pass Signals. Pulse Amplitude Modulation and Concept of Time Division Multiplexing and Frequency Division Multiplexing. Pulse Width Modulation. Digital Representation of Analog Signals

Module-IV	**Digital Modulation**	**9Hrs**

Digital Modulation: Binary Amplitude Shift Keying, Binary Phase Shift Keying and Quadrature Phase Shift Keying, Binary Frequency Shift Keying. Regenerative Repeater, M-aryand comparison

Module-V	**NP-Complete and NP-Hard problems**	**10Hrs**

Communication Systems: Satellite, RADAR, Optical, Micro wave communication, Mobile and Computer Communication (Block diagram approach only).

Text Books:

1. Herbert Taub, Donald L Schilling and Goutam Saha, “Principles of Communication Systems”, 3 rd Edition, Tata McGraw-Hill Publishing Company Ltd., 2008.

Reference Books:

1. B. P. Lathi, Zhi Ding and Hari M. Gupta, “Modern Digital and Analog Communication Systems”, 4th Edition, Oxford University Press, 2017.
2. K. Sam Shanmugam “Digital and Analog Communication Systems”, Wiley India Edition, 2008.

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3rd Mile, Bombay Highway, Gangavaram (V), Kovur(M), SPSR Nellore (Dt), Andhra Pradesh, India- 524137

Ph. No. 08622-212769, E-Mail: geethanjali@gist.edu.in, Website: www.gist.edu.in

POWER ELECTRONICS
(Common to **CSE,AI&ML,DS,CS)**

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0214Ta	**3:0:0:0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**OEC**

Course Objectives:

The objectives of the course are to make the students learn about:

- Get an overview of semi-conductor devices (such as PN junction diode & Transistor) and their switching characteristics.
- Understand the characteristics of AC to DC converters.
- Understand about the practical applications Electronics in industries

Course Outcomes (CO):

On completion of this course, student will be able to

- basic concepts of diode and transistor and its operation
- basic operating principles of power semiconductor switching devices.
- the operation of power electronic converters, inverters, AC voltage controllers, and cycloconverter
- How to apply the learnt principles and methods to practical applications.

Syllabus		Total Hours:48
Module-I	**POWER SEMI CONDUCTOR DEVICES -I**	**9Hrs**

Classification of Switching Devices Based on Frequency and Power Handling Capacity, Thyristors – Silicon Controlled Rectifiers (SCR's) – TRIACs, GTOs - Characteristics and Principles of Operation and other Thyristors.

Module-II	POWER SEMI CONDUCTOR DEVICES-II	10Hrs

BJT – Power Transistor - Power MOSFET – Power IGBT – Static Characteristics – Turn on and Turn Off Methods SCR- Dynamic Characteristics of SCR - Two Transistor Analogy – Triggering Circuits- Series and Parallel Connections of SCR's – Specifications and Ratings of SCR's, BJT, IGBT

Module-III	PHASE CONTROLLED CONVERTERS	9Hrs

Phase Control Technique – Single Phase Line Commutated Converters – Mid Point and Bridge Connections – Half Controlled Converters, Fully Controlled Converters with Resistive, RL Loads and RLE Load– Derivation of Average Load Voltage and Current – Effect of Source Inductance – Numerical Problems.

Module-IV	INVERTERS	10Hrs

Inverters – Single Phase Inverter – Basic Series Inverter – Basic Parallel Capacitor Inverter Bridge Inverter – Waveforms – Simple Forced Commutation Circuits for Bridge Inverters – Single Phase Half and Full Bridge Inverters-Pulse Width Modulation Control-Harmonic Reduction Techniques-Voltage Control Techniques for Inverters – Numerical Problems,

Module-V	AC VOLTAGE CONTROLLERS & CYCLO CONVERTERS	10Hrs

AC Voltage Controllers – Single Phase Two SCR's in Anti Parallel – With R and RL Loads – Modes of Operation of TRIAC – TRIAC with R– Derivation of RMS Load Voltage, Current and Power Factor Wave Forms – Firing Circuits -Numerical Problems

Cyclo Converters – Single Phase Mid-Point Cycloconverters with Resistive and Inductive Load (Principle of Operation only) – Bridge Configuration of Single Phase Cycloconverter (Principle of Operation only) – Waveforms

Text Books:

1. Power Electronics, M. D. Singh and K. B. Khanchandani, Mc Graw Hill Education (India) Pvt. Ltd., 2nd Edition, 2007, 23rd Reprint 2015.
2. Power Electronics: Circuits, Devices and Applications, Muhammad H. Rashid, Pearson, 3rdEdition, 2014, 2nd Impression 2015

Reference Books:

1. Power Electronics, K. R. Varmah, Chikku Abraham, CENGAGE Learning, 1st Edition, 2016.
2. Power Electronics, P. S. Bimbhra, Khanna Publishers, 2012.
3. Power Electronics: Devices, Circuits, and Industrial Applications, V. R. Moorthi, OXFORD University Press, 1st Edition, 2005, 12th Impression 2012

Web References:

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Ph. No. 08622-212769, E-Mail: geethanjali@gist.edu.in, Website: www.gist.edu.in

BUILDING MATERIALS

(Common to **CSE, AI&ML, DS, CS**)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0149T	**3:0:0:0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**OEC**

Course Objectives:

To identify the traditional materials that is used for building constructions.

- To explain basic concepts of building components such as stair case and masonry
- To know the causes of dampness in structures and its preventive measures
- To understand the building rules, building bye laws and acoustics of building

Course Outcomes (CO):

On completion of this course, student will be able to

- To understand the characteristics of different building materials
- Differentiate brick masonry, stone masonry construction and bonds used in construction of walls of buildings
- To know about the causes of dampness in buildings and its ill effects
- To understand the principles of planning in buildings
- Describe capable of understanding building rules and knowledge about, bye-laws and building elements.

Syllabus		Total Hours:48
Module-I	**MATERIALS**	**9Hrs**
Traditional materials: Stones- Types of stone masonry -Brick-types of brick masonry- lime Cement – Timber – Seasoning of timber - their uses in building works		
Module-II	**BUILDING COMPONENTS**	**9Hrs**
Lintels, Arches and Vaults – Staircases, Lifts – Types. Different types of flooring-Concrete, Mosaic, Terrazzo floors; Different types of roofs- Pitched, Flat and Curved Roofs. Lean-to-Roof, Coupled Roofs, Trussed roofs - King and Queen Post Trusses. Doors & Windows- Types and Specifications		
Module-III	**DAMPNESS**	**10Hrs**
Dampness and its prevention: Cause of dampness- ill effects of dampness-requirements of an ideal material for damp proofing-materials for damp proofing –methods of damp proofing.		
Module-IV	**BUILDING PLANNING**	**10Hrs**
Elements of building planning- basic requirements-orientation-planning for energyefficiency-planning based on utility-other requirements		
Module-V	**BUILDING RULES AND BYE-LAWS**	**10Hrs**
Zoning regulations; Regulations regarding layouts or subdivisions; Building regulations; Rules for special type of buildings; Calculation of plinth, floor and carpet area; Floor space index. Building Information System.		

Text Books:

1. Building Drawing by M.G. Shah, C.M. Kale and S.Y. Patki, Tata McGraw-Hill, New
2. B.C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, ‚Building Construction' - Laxmi Publications (P) Ltd., New Delhi

Reference Books:

1. Building Materials, S. K. Duggal, New Age International Publications.
2. N. Kumaraswamy, A. Kameswara Rao, building planning and drawing, 7th Ed, Charotar

Web Reference:

1. http://nptel.ac.in/courses/105104103/
2. http://www.academicpub.org/jwrhe/
3. http://www.peo.on.ca/index.php/ci_id/21843/la_id/1

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AUTOMOBILE ENGINEERING
(Common to **CSE, AI&ML, DS, CS**)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0321Ta	3:0:0:0	3	CIE:30 SEE:70	3 Hours	OEC

Course Objectives:

This course will enable students:

- Impart the knowledge of vehicle structure and its components.
- Demonstrate various components of petrol engines and diesel engines.
- Trains about the various electrical system, circuits, and testing of automobiles.
- Explain the concepts of steering, suspension and braking system in automobile.

Course Outcomes (CO):

On completion of this course, student will be able to

- Identify different parts of automobile
- Explain the working of various parts like engine and brakes
- Describe the working of steering and the suspension systems.
- Summarize the wheels and tires
- Outline the future developments in the automobile industry

Syllabus		Total Hours:48
Module-I	**Introduction to vehicle structure and engine components**	**9Hrs**

Vehicle construction - Chassis and body- Specifications - Engine - Types - Construction - Location of engine - Cylinder arrangement - Construction details - Cylinder block - Cylinder head - Cylinder liners - Piston – piston rings - Piston pin - Connecting rod - Crankshaft - Valves. Lubrication system - Types - Oil pumps - Filters. Crankcase ventilation

Module-II	Ignition and fuel supply systems	10Hrs

Ignition system - Coil and Magneto - Spark plug - Distributor – Electronic ignition system - Fuel system - Carburetor - Fuelpumps - Fuel injection systems - Mono point and Multi point – Unit Injector – Nozzle types - Electronic Fuel Injection system (EFI) – GDI, MPFI, DTSI.

Module-III	Steering and suspension system	9Hrs

Principle ofsteering - Steering Geometryand wheel alignment - Steering linkages – Steering gearboxes - Power steering - front axle - Suspension system - Independent and Solid axle – coil, leaf spring and air suspensions - torsion bar - shock absorbers.

Module-IV	Wheels, Tyres and Braking System	10Hrs

Wheels and Tyres - Construction - Type and specification - Tyre wear and causes - Brakes - Needs – Classification –Drum and Disc Mechanical - Hydraulic and pneumatic - Vacuum assist – Retarders – Anti-lock Braking System(ABS).

Module-V	Automobile electrical systems and advances in automobile engineering	10Hrs

Battery-General electrical circuits- Active Suspension System (ASS) - Electronic Brake Distribution (EBD) – Electronic Stability Program(ESP), Traction Control System (TCS) - Global Positioning System (GPS), Hybrid vehicle, Fuel Cell.

Text Books:

1. Kirpal Singh, Automobile Engineering, Vol.1&2, Standard Publications, 13/e, 2020.
2. William.Crouse, Automotive Mechanics, 10/e, McGraw-Hill, 2006.
3. David A. Corolla, Automotive Engineering: Powertrain, Chassis System and Vehicle Body, Butterworth-Heinemann Publishing Ltd, 2009.
4. Richard Stone, Jeffrey K. Ball, Automotive Engineering Fundamentals" SAE International, 2004

Reference Books:

1. Bosch, Automotive Hand Book, 6/e, SAE Publications, 2007.
2. K. Newton and W. Steeds, The motor vehicle, 13/e, Butterworth-Heinemann Publishing Ltd, 1989.

1. Joseph Heitner, Automotive Mechanics Principles and Practices, 2/e, CBS publishing 2004 .

Web References:

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https://nptel.ac.in/courses/107106088

Text Books:

1. Andrew S.Tanenbaum, David j.wetherall, Computer Networks, 5th Edition, PEARSON.
2. James F. Kurose, Keith W. Ross, "Computer Networking: A Top-Down Approach", 6th edition, Pearson, 2019.

Reference Books:

1. Forouzan, Data communications and Networking, 5th Edition, McGraw Hill Publication.
2. Youlu Zheng, Shakil Akthar, "Networks for Computer Scientists and Engineers", Oxford Publishers, 2016.

Web Reference:

1. https://nptel.ac.in/courses/106105183/25
2. http://www.nptelvideos.in/2012/11/computer-networks.html
3. https://nptel.ac.in/courses/106105183/3

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SOFTWARE ENGINEERING LAB
(Common to CSE, AI&ML, DS, CS)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0510P	0:0:3:0	1.5	CIE: 30 SEE:70	3 Hours	PCC

Course Objectives:

This course will enable students to:

- To learn and implement the fundamental concepts of Software Engineering.
- To explore functional and non-functional requirements through SRS.
- To practice the various design diagrams.
- To learn to implement various software testing strategies.

Course Outcomes (CO):

On completion of this course, student will be able to

- Familiarize with historical and modern software methodologies(L3)
- Apply the phases of software projects and practice the activities of each phase(L3)
- Determine SRS document(L3)
- Apply cohesion, coupling and metrics in project management(L3)
- Sketch UML diagrams for various applications(L3)
- Apply various test cases and determine quality attributes for a given problems (L3)

Syllabus | **Total Hours:48**

Experiment-1

Draw the Work Breakdown Structure for the system to be automated

Experiment-2

Schedule all the activities and sub-activities Using the PERT/CPM charts

Experiment-3

Define use cases and represent them in use-case document for all the stakeholders of the system to be automated

Experiment-4

Identify and analyze all the possible risks and its risk mitigation plan for the system to be Automated

Experiment-5

Diagnose any risk using Ishikawa Diagram (Can be called as Fish Bone Diagram or Cause & Effect Diagram)

Experiment-6

Define Complete Project plan for the system to be automated using Microsoft Project Tool

Experiment-7

Define the Features, Vision, Business objectives, Business rules and stakeholders in the vision document

Experiment-8

Define the functional and non-functional requirements of the system to be automated by using Use cases and document in SRS document

Experiment-9

Define the following traceability matrices :

1. Use case Vs. Features
2. Functional requirements Vs. Usecases

Experiment-10

Estimate the effort using the following methods for the system to be automated:

1. Function point metric
2. Use case point metric

Experiment-11

Develop a tool which can be used for quantification of all the non-functional requirements

Experiment-12

Write C/C++/Java/Python program for classifying the various types of coupling.

Experiment-13

Write a C/C++/Java/Python program for classifying the various types of cohesion.

Experiment-14

Write a C/C++/Java/Python program for object oriented metrics for design proposed by Chidamber and Kremer. (Popularly called CK metrics)

Experiment-15

Convert the DFD into appropriate architecture styles.

Experiment-16

Draw a complete class diagram and object diagrams using Rational tools

Experiment-17

Define the design activities along with necessary artifacts using Design Document.

Experiment-18

Reverse Engineer any object-oriented code to an appropriate class and object diagrams.

Experiment-19

Test a piece of code that executes a specific functionality in the code to be tested and asserts a certain behavior or state using Junit.

Experiment-20

Test the percentage of code to be tested by unit test using any code coverage tools

Experiment-21

Define appropriate metrics for at least 3 quality attributes for any software application of your interest.

Experiment-22

Define a complete call graph for any C/C++ code. (Note: The student may use any tool that generates call graph for source code)

Reference Books:

1. Software Engineering? A Practitioner‟ s Approach, Roger S. Pressman, 1996, MGH.
2. Software Engineering by Ian Sommerville, Pearson Edu, 5th edition, 1999
3. 3. An Integrated Approach to software engineering by Pankaj Jalote , 1991 Narosa

Web References:

1. http://vlabs.iitkgp.ac.in/se/

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Ph. No. 08622-212769, E-Mail: geethanjali@gist.edu.in, Website: www.gist.edu.in

MECHINE LEARNING LAB

(Common to **CSE, AI&ML, DS, CS**)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0532P	0:0:3:0	1.5	CIE:30 SEE:70	3 Hours	PCC

Course Objectives:

This course will enable students to:

- Make use of Data sets in implementing the machine learning algorithms
- Implement the machine learning concepts and algorithms in any suitable language of choice.

Course Outcomes (CO):

On completion of this course, student will be able to

- Understand the Mathematical and statistical prospective of machine learning algorithms through python programming
- Appreciate the importance of visualization in the data analytics solution
- Derive insights using Machine learning algorithms

Syllabus | **Total Hours:48**

List of Experiments

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

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

Experiment 3: Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.

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

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

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

Experiment 7: Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.

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

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

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

Reference Book:

1. Python Machine Learning Workbook for beginners, AI Publishing, 2020

Web Reference:

https://www.udemy.com/course/machinelearning/

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LINUX PROGRAMMING (SKILL)
(Common to **DS, CS**)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0518	1:0:2:0	2	CIE:30 SEE:70	3 Hours	SC

Course Objectives:

This course will enable students to:

- Analyze the Linux utilities and Linux environment.
- Learn the fundamentals of shell scripting/programming.
- Understand system administration processes by providing a hands-on experience.

Course Outcomes (CO):

On completion of this course, student will be able to

CO1: Understand the Basic commands and utilities in Linux Environment
CO2: Identify and use Linux utilities to create and manage simple file processing operations, organize directory structures with appropriate security.
CO3: Analyze the Linux utilities and Linux environment.
CO4: Use shell script to automate different tasks as Linux.
CO5: Illustrate file processing operations such as standard I/O and formatted I/O.
CO6: Develop various client server applications using TCP or UDP protocols.

Syllabus — **Total Hours:48**

Introduction to Linux/Unix:- Architecture of Unix, Features of Unix , Unix Commands – man, echo, printf, script, passwd, uname, who, date, stty, pwd, cd, mkdir, rmdir, ls, cp, mv, rm, cat, more, wc, lp, od, tar, gzip, : User and session management commands: useradd, groupadd, userdel, groupdel.

Linux/Unix Utilities:- Introduction to unix file system, file handling utilities, vi editor, Text processing utilities and backup utilities: commands to be covered are tail, head, sort, nl, uniq, sed, grep,egrep, fgrep, cut, paste, join, tee, pg, comm, cmp, diff, tr and awk.
Unix Session, Standard Streams, Redirection, Pipes.

Filters and Pipes, Concatenating files, Display Beginning and End of files, Cut and Paste, Sorting, Translating Characters, Files with Duplicate Lines, Count characters, Words or Lines, Comparing Files

Shell Programming:
Introduction to shells, Variables, input and output, Environment variables, Basic script concepts, Expressions, Decision making and repetition etc.

Socket programming: Client Sever Implementation Using Sockets and Shared Memory

Task 1: Study and Practice on various commands like man, echo, printf, clear, script, passwd, cal,uname, who, date, tty, stty, pwd, who,.

Task 2: Studyand Practice on various commands like cd, mkdir, rmdir cp, mv, ln, rm, unlink, du, df, mount, umount, find, unmask, ulimit, ps.

Task 3: Studyand Practice on various commands like tail, head, sort, nl, uniq, grep, egrep, fgrep, cut, paste, join, tee, pg, comm, cmp, diff, tr.

Task 4:

Session-1

a) Log into the system
b) Use vieditor to create a file called myfile.txt which contains some text.
c) Correct typing errors during creation.
d) Save the file
e) logout of the system

Session-2

a) Log into the system
b) open the file created in session 1
c) Add some text
d) Change some text
e) Delete some text
f) Save the Changes
g) Logout of the system

Task 5:

a) Login to the system
b) Use the appropriate command to determine your login shell
c) Use the /etc/passwd file to verify the result of step b.
d) Use the who command and redirect the result to a file called myfile1. Use the more command to see the contents of myfile1.
e) Use the date and who commands in sequence (in one line) such that the output of date will display on the screen and the output of who will be redirected to a file called myfile2. Use the more command to check the contents of myfile2.

Task 6:

a) Log into the system
b) Use the cat command to create a file containing the following data. Call it mytable use tabsto separate the fields.

1425	Ravi	15.65
4320	Ramu	26.27
6830	Sita	36.15
1450	Raju	21.86

c) Use the cat command to display the file, mytable.
d) Use the vicommand to correct anyerrors in the file, mytable.
e) Use the sort command to sort the file mytable according to the first field. Call the sorted file my table (same name)
f) Print the file mytable
g) Use the cut and paste commands to swap fields 2 and 3 of mytable. Call it my table (same name)
h) Print the new file, mytable
i) Logout of the system.

Task 7:

a) Write a sed command that deletes the first character in each line in a file.
b) Write a sed command that deletes the character before the last character in each line in a file.
c) Write a sed command that swaps the first and second words in each line in a file.

Task 8:

1. Write a shell script that accepts a file name, starting and ending line numbers as arguments and displays all the lines between the given line numbers.
2. Write a shell script that deletes all lines containing a specified word in one or more files supplied as arguments toit.

Task 9:

1. Write a program to generate Fibonacci series
2. Write a program to check whether given string is palindrome or not
3. Write a shell script to find factorial of a given integer.

Task 10:

1. Write a shell script that receives any number of file names as arguments checks if every argument supplied is a file or a directory and reports accordingly. Whenever the argument is a file, the number of lines on it is also reported.
2. Write a shell script to list all of the directory files in a directory

Task 11:

1. Write an awk script to count the number of lines in a file that do not contain vowels.
2. Write an awk script to find the number of characters, words and lines in a file.
3. Write an awk script to calculate average marks of each student.
4. Write an awk script to replace a string in a file.

Task 12:

Simulate the following commands
a) Simulate cat command b) Simulate cp command

Task 13:

2. Write client and server programs (using java) for interaction between server and client processes using Unix domain sockets.
3. Write client and server programs (using java) for interaction between server and client processes using Internet domain sockets.

Reference Books:

1. Sumitabha Das, "Your Unix The Ultimate Guide", Tata McGraw-Hill, New Delhi, India, 2007.
2. B. A. Forouzan and R. F. Gilberg, "Unix and Shell Programming", Cengage Learning.
3. Robert Love, "Linux System Programming", O'Reilly, SPD.
4. Stephen G. Kochan, Patrick Wood, "Unix Shell Programming", Sams publications, 3rd Edition, 2007.
5. T. Chan, "Unix System Programming using C++", Prentice Hall India, 1999.

Web Reference:

https://www.simplilearn.com/linux-programming-for-beginners-article

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Design Thinking and Innovation
(Common to All)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0526	2: 0:0:0	0	CIE:30	-	MC

Course Objectives:

The objective of this course is to familiarize students with design thinking process as a tool for breakthrough innovation. It aims to equip students with design thinking skills and ignite the minds to create innovative ideas, develop solutions for real-time problems.

Course Outcomes (CO):

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

- Define the concepts related to design thinking.
- Explain the fundamentals of Design Thinking and innovation
- Apply the design thinking techniques for solving problems in various sectors.
- Analyze to work in a multidisciplinary environment
- Evaluate the value of creativity
- Formulate specific problem statements of real time issues

Syllabus		Total Hours:48
Module-I	**Introduction to Design Thinking**	**9Hrs**

Introduction to elements and principles of Design, basics of design-dot, line, shape, form as fundamental design components. Principles of design. Introduction to design thinking, history of Design Thinking, New materials in Industry.

Module -II	Design Thinking Process	9Hrs

Design thinking process (empathize, analyze, idea & prototype), implementing the process in driving inventions, design thinking in social innovations. Tools of design thinking - person, costumer, journey map, brain storming, product development Activity: Every student presents their idea in three minutes, Every student can present design process in the form of flow diagram or flow chart etc. Every student should explain about product development.

Module -III	Innovation	10Hrs

Art of innovation, Difference between innovation and creativity, role of creativity and innovation in organizations. Creativity to Innovation. Teams for innovation, Measuring the impact and value of creativity. Activity: Debate on innovation and creativity, Flow and planning from idea to innovation, Debate on value-based innovation.

Module -IV	Product Design	10Hrs

Problem formation, introduction to product design, Product strategies, Product value, Product planning, product specifications. Innovation towards product design Case studies. Activity: Importance of modelling, how to set specifications, Explaining their own product design.

Module -V	Design Thinking in Business Processes	10Hrs

Design Thinking applied in Business & Strategic Innovation, Design Thinking principles that redefine business – Business challenges: Growth, Predictability, Change, Maintaining Relevance, Extreme

competition, Standardization. Design thinking to meet corporate needs.

Design thinking for Startups. Defining and testing Business Models and Business Cases. Developing & testing prototypes. Activity: How to market our own product, About maintenance, Reliability and plan for startup.

Text Books:

1. Change by design, Tim Brown, Harper Bollins (2009)
2. Design Thinking for Strategic Innovation, Idris Mootee, 2013, John Wiley & Sons

Reference Books:

1. Design Thinking in the Classroom by David Lee, Ulysses press
2. Design the Future, by Shrrutin N Shetty, Norton Press
3. Universal principles of design- William lidwell, kritinaholden, Jill butter.
4. The era of open innovation – chesbrough.H

Web Reference:

1. https://nptel.ac.in/courses/110/106/110106124/
2. https://nptel.ac.in/courses/109/104/109104109/
3. https://swayam.gov.in/nd1_noc19_mg60/preview

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3rd Mile, Bombay Highway, Gangavaram (V), Kovur(M), SPSR Nellore (Dt), Andhra Pradesh, India- 524137

Ph. No. 08622-212769, E-Mail: geethanjali@gist.edu.in, Website: www.gist.edu.in

Semester-6(Theory-5, Lab-3, SC-1MC-1)							
Sl. No.	**Category**	**Course Code**	**Course Title**	**Hours per week**			**Credits**
				L	**T**	**P**	**C**
1	PCC	22A0534c	Big Data Analytics	3	0	0	3
2	PCC	**22A3206T**	Data Visualization	3	0	0	3
3	PCC	22A0529T	Cloud Computing	3	0	0	3
4	PEC	22A0522c 22A3301T 22A0530a	**Professional Elective-II:** 1. Software Project Management 2. Artificial Intelligence 3. Cryptography Network Security		0	0	3
5	OEC	22A0431T 22A0213Ta 22A0150T 22A0327Tb	**Open Elective-II:** 1. Micro Controllers and Applications 2. Control Systems 3. Environmental Economics 4. Introduction to Composite Materials		0	0	3
6	PCC(Lab)	**22A3207P**	Big Data Analytics Lab	0	0	3	1.5
7	PCC(Lab)	**22A3208P**	Data Visualization Lab	0	0	3	1.5
8	PCC(Lab)	22A0533P	Cloud Computing Lab	0	0	3	1.5
9	SC	22A0029P	**Skill Oriented Course:** Soft Skills	1	0	2	2
10	MC	22A0032T	**Mandatory Course:** Research Methodology	2	0	0	0
				Total credits			**21.5**

Category	Credits
Professional Core Course (PCC)	13.5
Professional Elective Course (PEC)	3
Open Elective Course (OEC)	3
Skill Oriented Course (SC)	2
Industrial/Research Internship (Mandatory)2Months	-
Total	21.5

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BIG DATA ANALYTICS
(Common to **CSE, AI&ML, DS, CS**)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0534c	3:0:0:0	3	CIE:30 SEE:70	3 Hours	PEC

Course Objectives:

- Understand the basic concepts and importance of Big Data
- Familiarize with the installation of Hadoop and how to analyze the Big Data
- Understand the design concepts of HDFS
- Provide good insight for developing a MapReduce applications
- Understand Hadoop environment.
- Explore the concepts of Pig, Hive, Spark and HBase

Course Outcomes (CO):

After the completion of the course students will able to
CO1: Understand the concepts and tools of big data.
CO2: Analyzing the Data with Hadoop
CO3: Develop MapReduce application
CO4: Illustrate the Anatomy of MapReduce and Hadoop environment
Determine why existing technologies are inadequate to analyze the large data
CO5: Apply large-scale analytic tools to solve some of the open big data problems.
CO6: Analyze analytic tools

Syllabus		Total Hours:48
Module-I	**Introduction to Big Data**	**10Hrs**

Introduction to Big Data: Big data fundamentals, importance of big data, Structuring Big Data, Big Data Analytics, Meet Hadoop: Data, Data Storage and Analysis, History of Apache Hadoop, Hadoop Ecosystem, Installation of Hadoop, Analyzing the Data with Hadoop, Scaling Out.

Module-II	HDFS and MapReduce	9Hrs

HDFS: HDFS Concepts, HDFS Architecture, The Command-Line Interface, Data flow: Anatomy of a file read and Anatomy of a file write.

Map Reduce: Developing a MapReduce application: The Configuration API, setting up the Development Environment, Running Locally on Test Data, Running on a Cluster.

Module-III	How MapReduce Works and Hadoop Environment	10Hrs

How MapReduce Works: Anatomy of a Map Reduce Job Run, Failures, Shuffle and Sort.
Hadoop Environment: Setting up a Hadoop Cluster, Cluster specification, Cluster Setup and Installation, Hadoop Configuration.

Module-IV	Data Analyzation using Pig as a tool	9Hrs

Pig: Pig Concepts**,** Apache Pig Architecture, Installing and Running Pig, Comparison with Databases, Pig Latin, User Defined Functions, Data Processing Operators.

Module-V	Open source tools for Big Data: Hive, Spark and HBase	10Hrs

Hive: Hive concepts, Hive Architecture, Installing Hive, Comparison with traditional Databases, HiveQL, Tables, Querying Data.
Spark: Spark Concepts, Architecture of Spark, Installing Spark, Anatomy of a Spark Job Run.
HBase: Introduction to HBase, HBase Architecture, Installation.

Text Books:

1. Tom White, "Hadoop: The Definitive Guide"Fourth Edition, O'Reilly Media, 2015.
2. Big Data Black Book, DT Editorial services, Dream tech Press
3. Big Data, Big Analytics: Emerging business intelligence and analytic trends for today's businesses, Michael Minnelli, Michelle Chambers, and Amiga Dhiraj, Wiley Cio Series

Reference Books:

1. Glenn J. Myatt, Making Sense of Data, John Wiley & Sons, 2007 Pete Warden,Big Data Glossary, O'Reilly, 2011.
2. Michael Berthold, David J.Hand, Intelligent Data Analysis, Springer, 2007.
3. Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos,Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data, McGraw Hill Publishing, 2012.
4. Anand Rajaraman and Jeffrey David Ullman, Mining of Massive Datasets Cambridge University Press, 2012

Web References:

https://onlinecourses.swayam2.ac.in/arp19_ap60/preview

https://www.shiksha.com/online-courses/big-data-analytics-courses-certification-training-by-nptel-st601-tg91

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DATA VISUALIZATION
(Only to **DS**)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A3206T	3:0:0:0	3	CIE:30 SEE:70	3 Hours	PCC

Course Objectives:

This course will enable students to:
- Familiarize with data visualization concepts
- Learn the data visualization principles
- Learn the concepts of plots
- Learn the concepts of data visualization via kernel machines
- Familiarize the data visualization for applications

Course Outcomes (CO):

On completion of this course, student will be able to
- Understand the data visualization concepts (L2).
- Apply various graphs and plots for data visualization (L3).
- Apply the matrix visualization for cluster analysis (L3)
- Analyze the kernel Machine in cluster analysis (L4).
- Apply various operations for genetic algorithms (L3).
- Illustrate the data visualization techniques for applications (L2).

Syllabus		Total Hours:48
Module-I	**Data Visualization**	**9Hrs**

Data Visualization: Introduction, A Brief History of Data Visualization, Good Graphics - Scientific Design Choices in Data Visualization, Static Graphics- Complete Plots, Customization, Data Visualization Through Their Graph Representations, High-dimensional Data Visualization, Linked Data Views.

Module-II	Methodologies-I	10Hrs

Methodologies-I: Interactive Linked Micro Map Plots for the Display of Geographically Referenced Statistical Data, Manual Controls.

Regression by Parts: Fitting Visually Interpretable Models with guide, Smoothing Techniques for Visualization

Module-III	Methodologies-II	9Hrs

Methodologies-II: Visualizing Cluster Analysis and Finite Mixture Models, Mosaic Plots and Their Variants, Matrix Visualization, Visualization in Bayesian Data Analysis.

Module-IV	Data Visualization via Kernel Machine	10Hrs

Data Visualization via Kernel Machine: Introduction, Kernel Principal Component Analysis, Kernel Canonical Correlation Analysis, Kernel Cluster Analysis

Module-V	Applications	10Hrs

Applications: Visualization for Genetic Network Reconstruction, Visualization and Analysis of Medical Images, Visualizing Functional Data with an Application to eBay's Online Auctions

Text Books:

1. Handbook of Data Visualization – Chun-houh Chen ,Wolfgang Härdle ,Antony Unwin – 3

Reference Books:

1. Better data visualizations- A gude for scholars, researchers and wonks-Jonathan schwabish-Columbia university Press
2. Visualizing data-O'Relly

Web Reference:

https://elearn.nptel.ac.in/shop/iit-workshops/completed/data-visualization-with-r/

https://www.youtube.com/watch?v=UjYzNhBVIvY

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CLOUD COMPUTING

(Common to **CSE, AI&ML, DS, CS**)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0529T	3:0:0:0	3	CIE:30 SEE:70	3 Hours	PCC

Course Objectives:

This course will enable students to:

- To introduce the broad perceptive of cloud architecture and model
- To understand the concept of Virtualization and familiar with the lead players in cloud.
- To understand the features of cloud simulator and apply different cloud programming model
- To design of cloud Services and explore the trusted cloud Computing system

Course Outcomes (CO):

On completion of this course, student will be able to

CO1: To Understand the basic concepts about cloud computing vision and its developments and gain the **Knowledge** of virtualization technology.
CO2: Analyze the concepts of cloud services and the deployment models.
CO3: Choose among various cloud technologies for implementing applications (GAE, Open stack, etc.)
CO4: Construct the virtual machines by using VMware simulator.
CO5: Build scientific applications by using Cloud environment.
CO6: Develop Business and Consumer Applications.

Syllabus		Total Hours:48
Module-I	**Basics of Cloud Computing**	**10Hrs**

Introduction to Cloud: Introduction to Cloud, Cloud Computing Reference Model, Characteristics and Benefits, Challenges Ahead, Elasticity in Cloud, On-demand Provisioning.

Virtualization: Introduction, Characteristics of Virtualized Environment, Taxonomy of Virtualization Techniques, Virtualization, and Cloud computing.

Module-II	Cloud Architecture, Models and Security	9Hrs

Cloud Computing Architecture: Introduction, Cloud Reference Model, Architecture, Infrastructure / Hardware as a Service, Platform as a Service, Software as a Service, Types of Clouds.

Cloud Deployment Model: Public Clouds, Private Clouds, Hybrid Clouds, Community Clouds, Economics of the Cloud.

Module-III	Cloud Technologies and Advancements	10Hrs

Apache Hadoop, MapReduce, Hadoop Cluster setup, Virtual Box, Google App Engine, Programming Environment for Google App Engine – Open Stack

Module-IV	VMware Simulator	9Hrs

VMW: Basics of VMWare, Advantages of VMware virtualization, create a new virtual machine on local host, cloning virtual machines, virtualize a physical machine, starting and

stopping a virtual machine.

Module-V	Cloud Applications	10Hrs

Cloud Applications: Scientific Applications – Health Care, Geoscience.

Business And Consumer Applications - CRM and ERP, Social Networking, Media Applications, and Multiplayer Online Gaming.

Text Books:

1. Mastering Cloud Computing by RajkumarBuyya, Christian Vecchiola, S.Thamarai Selvi from TMH 2013.
2. George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud" O'Reilly
3. Cloud computing a practical approach - Anthony T.Velte , Toby J. Velte Robert Elsenpeter, TATA McGraw- Hill , New Delhi – 2010.

Reference Books:

1. Cloud computing for dummies- Judith Hurwitz , Robin Bloor , Marcia Kaufman ,Fern Halper, Wiley Publishing, Inc, 2010
2. Cloud Computing (Principles and Paradigms), Edited by Rajkumar Buyya, James Broberg, Andrzej Goscinski, John Wiley & Sons, Inc. 2011
3. Enterprise Cloud Computing, Gautam Shroff, Cambridge University Press, 2010.
4. Cloud Application Architectures: Building Applications and Infrastructure in the Cloud, George Reese, O 'Reilly, SPD, rp2011.
5. Essentials of Cloud Computing by K. Chandrasekaran. CRC Press. Cloud computing A Hands-On Approach by ArshdeepBahga and Vijay Madisetti.

Web Reference:

1. https://nptel.ac.in/courses
2. https://freevideolectures.com/university/iitm

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SOFTWARE PROJECT MANAGEMENT					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0522c	**3: 0:0:0**	**3**	**CIE: 30SEE:70**	**3Hours**	

Course Objectives:

1. To develop awareness regarding the theoretical and methodological issues related to software project management.
2. To develop software projects based on current technologies.

Course Outcomes (CO):

On completion of this course, student will be able to

- Identify the theoretical and methodological issues involved in modern software engineering project management
- Develop the transferable skills in logical analysis, communication and Project management necessary for working within a team.
- Translate a specification to a design, and identify the components to build the architecture for a given problem, using an appropriate software Engineering methodology.
- Select and use project management frameworks that ensure successful outcomes.
- Illustrate the risk management of software configurations.
- Develop software projects based on current technologies, by managing resources economically and keeping ethical values

Syllabus		**Total Hours:45**
Module-I	**Introduction to software engineering**	**9Hrs**

Introduction to software engineering- scope of software engineering, historical aspects, economic aspects, maintenance aspects, specification and design aspects, team Programming aspects. Layered technology, processes, methods and tools. Phases in Software development

Process models- prescriptive process models- waterfall model, incremental models, Evolutionary models and concurrent models

Module-II	**Agile development**	**9Hrs**

Agile development- agility, agile process. Extreme programming- XP Values, The XP Process, Industrial XP, The XP Debate**.** Agile development models- Adaptive Software Development (ASD), Scrum, Dynamic Systems Development Method (DSDM), Crystal, Feature Driven Development (FDD), Lean Software Development (LSD), Agile Modeling (AM) , Agile Unified Process (AUP).

Project management concepts- the management spectrum, people, product, process, and project

Module-III	**Process and project metrics**	**9Hrs**

Process and project metrics- software measurement- size oriented, function oriented, LOC and function point, metrics for software quality- measuring quality, defect removal efficiency, integrating metrics within the software process

Estimation for software projects- project planning, software scope, resources. Software project estimation, decomposition techniques- Software Sizing, Problem-Based Estimation, Process- Based Estimation

Module-IV	**Empirical estimation models**	**9Hrs**

Empirical estimation models- structure of estimation models, COCOMO II model. Estimation for agile development. Make/buy decision.

Project scheduling- relationship between people and effort, effort distribution. Task set, defining a task network. Scheduling- timeline chart, tracking the schedule. Earned value analysis

Module-V	Risk management	9Hrs

Risk management- risk strategies, software risks, risk identification, risk projection, risk refinement, Risk Mitigation, Monitoring, and Management. The RMMM Plan.

Software Configuration Management - An SCM Scenario, Elements of a Configuration Management System, Baselines, Software Configuration Items. The SCM Repository - The Role of the repository, General Features and Content, SCM Features. The SCM Process- Identification of Objects in the Software Configuration, Version Control, Change Control, and Configuration Audit, Status Reporting.

Text Books:

1. Roger S. Pressman, Software Engineering, 8/e, McGraw Hill, 2014

Reference Books:

1. Pressman R S, Software Engineering-A Practitioner's Approach, 7th edition, McGrawHill
2. Ian Sommervile, Software Engineering, 7/e, University of Lancastor, Pearson Education, 2004.
3. Bob Huges, Mike Cotterell, Rajib Mall, Software Project Management, 8/e, McGraw Hill,2015.
4. Walker Royce, Software Project Management : A Unified Frame Work, Pearson Education.

Web References:

1. https://www.tutorialspoint.com/software_engineering/software_project_management.htm
2. https://www.javatpoint.com/software-project-management

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ARTIFICIAL INTELLIGENCE					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A3301T	**3: 0:0:0**	**3**	**CIE: 30SEE:70**	**3Hours**	**ESC**

Course Objectives:

This course will enable students to:

- To understand the importance of the task environment in determining the appropriate agent design.
- To teach the concepts of state space representation, heuristic search together with the time and Space complexities.
- To describe the various types of learning methods and natural language processing.
- To provide basic knowledge on natural language for communication and perception.
- To understand the basic knowledge on robotics and philosophical foundations of AI.

Course Outcomes (CO):

On completion of this course, student will be able to

1. Understand the role of agents, environments and relationship among them. (BL-2)
2. Examine various problem-solving approaches in searching and learning. (BL-2)
3. Demonstrate the use of Reinforcement learning and natural language processing.(BL-3)
4. Understand the natural language for communication and object perception. (BL-2)
5. Demonstrate the role of Robot in various applications and list out philosophical issues in AI.(BL-2)

Syllabus		**Total Hours:45**
Module-I	**Introduction to Artificial Intelligence**	**9Hrs**

Introduction: AI Definition, Foundations of Artificial Intelligence, History of Artificial Intelligence. Intelligent Agents: Agents and Environments, Good Behavior Concept of Rationality, Nature of Environments, The Structure of Agents. Problem-Solving Agents, Searching for Solutions, Uninformed Search Strategies: Breadth-first search, Uniform-cost search, DFS: Informed (Heuristic) Search strategies: Greedy BFS, A* search.

Module-II	**Problem Solving beyond classical search and Learning**	**9Hrs**

Local search algorithms and optimization problems**:** Hill-climbing, simulated annealing; Local Search in Continuous Spaces, Searching with Non-Deterministic Actions, Searching with partial observations, Online Search Agents and Unknown Environment.

Module-III	**Reinforcement Learning and Natural Language Processing**	**9Hrs**

Introduction, Passive Reinforcement Learning, Active reinforcement Learning, Generalization in Reinforcement Learning, Policy Search, applications of Reinforcement Learning**,** Language Models, Text Classification, Information Retrieval, Information Extraction.

Module-IV	**Natural Language for communication and Perception**	**9Hrs**

Phrase structure grammars, Syntactic analysis, Augmented grammars and semantic Interpretation, Machine translation, Speech Recognition. Image formation, Early Image Processing Operations, Object recognition by appearance, Reconstructing the 3D World, Object recognition from structural information, Using Vision**.**

Module-V	**Robotics and Philosophical foundations**	**9Hrs**

Introduction, Robotic Hardware, Robotic Perception, Planning to move, Planning uncertain movements, Moving, Robotic software architectures, and application domains.
Week AI, Strong AI, Ethics and Risks of AI, Agent Components and Agent architectures, Are we going in the right direction, What if AI does succeed.

Text Books:

- Stuart Russell and Peter Norvig, Artificial Intelligence A Modern Approach, 3rdEdition, Pearson Education.
- Elaine Rich, Kevin Knight & Shivashankar B Nair, "Artificial Intelligence", 3rd - Edition, McGraw Hill Education.

Reference Books:

- Patrick Henny Winston, Artificial Intelligence, 3rdEdition, Pearson Education.
- Patterson, Introduction to Artificial Intelligence and Expert Systems, 1st Edition Pearson India.
- George F Lugar, Artificial intelligence, structures and Strategies for Complex problem solving,6thed, PEA, 2008 .
- Poole, D. and Mackworth, Artificial Intelligence: Foundations of Computational Agents, Cambridge University Press. 2010
- Padhy, N.P , Artificial Intelligence and Intelligent Systems,. 2009, Oxford University Press.

Web References:

https://www.tutorialspoint.com/artificial_intelligence/index.htm
https://www.javatpoint.com/artificial-intelligence-ai
https://www.youtube.com/watch?v=JMUxmLyrhSk

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CRYPTOGRAPHY AND NETWORK SECURITY
(Common to CSE, AIML, CS, DS)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0530a	3:0:0:0	3	CIE:30 SEE:70	3 Hours	PEC

Course Objectives:

This course will enable students to:

- Introduce the basic categories of threats to computers and networks
- Illustrate various crypto graphical algorithms.
- Demonstrate public-key cryptosystem.
- Discuss the fundamental ideas of public-key cryptography.
- Explore Web security threats and protection mechanisms.

Course Outcomes (CO):

On completion of this course, student will be able to

3. Understand and apply the cryptographic algorithms to safe guard from intruders
4. Compare and contrast symmetric and asymmetric encryption systems and their vulnerability to attack
5. Implement the various key distribution, management and message authentication Schemes to send the messages with security
6. Identify information system requirements for Transport level, wireless network, E-Mail and IP
7. Design a network security system by implementing all the concepts of encryption and decryption algorithms
8. Design a web security system by implementing all the concepts

Syllabus		Total Hours:48
Module-I	**Attacks on Computers and Computer Security**	**10Hrs**

Introduction, The need for security, Principles of security, Types of Security attacks, Security services, Security Mechanisms, A model for Network Security Cryptography, plain text and cipher text, encryption and decryption, substitution techniques, transposition techniques, symmetric and asymmetric key cryptography, Steganography

Module-II	Symmetric key Ciphers & Asymmetric key Ciphers	9Hrs

Symmetric key Ciphers: Block Cipher principles, Block cipher modes of operation, Stream ciphers, DES, AES, Blowfish, Key distribution.

Asymmetric key Ciphers: Principles of public key cryptosystems, RSA, DiffieHellman Key Exchange, and Elliptic Curve Cryptography, Key Distribution.

Module-III	Message Authentication and Hash Functions	10Hrs

Authentication requirements, Functions, Message authentication codes, Hash Functions, Secure hash algorithm, Whirlpool, HMAC, CMAC, Digital signatures.

Module-IV	E-Mail Security	9Hrs

Pretty Good Privacy, S/MIME, IP Security: IP Security overview, IPSecurity architecture, Authentication Header, Encapsulating Security Payload (ESP), Security Associations, Key-Management.

Module-V	Web Security	10Hrs

Web security considerations, Secure Socket Layer and Transport Layer Security, Secure electronic transaction Intruders, Virus and Firewalls: Intruders, Intrusion detection, password management, Virus and related threats, Firewall design principles, Types of firewalls.

Case Studies on Cryptography and security: Secure Inter-branch Payment Transactions, Virtual Elections.

Text Books:

2. William Stallings, "Cryptography and Network Security", 5th Edition, Pearson Education, 2011.
3. Bernard Menezes "Network Security and Cryptography",1st Edition, CENGAGE Learning, 2010.

Reference Books:

6. C K Shyamala, N Harini, Dr T R Padmanabhan,WileyIndia,"Cryptography and Network Security",1st Edition, Wiley India Pvt Ltd,2011.
7. Forouzan Mukhopadhyay "Cryptography and Network Security", 2nd Edition, McGrawHill, 2010.
8. Mark Stamp, Wiley India, "Information Security, Principles and Practice", 2 ndEdition,Wiley, 2011.

Web References:

- https://www.tutorialspoint.com/cryptography/index.htm
- https://www.gatevidyalay.com/tag/cryptography-and-network-security-tutorial/
- https://www.youtube.com/watch?v=C7vmouDOJYM

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MICRO CONTROLLERS ANDAPPLICATIONS

(Common to **CSE, AI&ML, DS, CS**)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0431T	**3:0:0:0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**OEC**

Course Objectives:

This course will enable students to:

- Describe the Architecture of 8051 Microcontroller and Interfacing of 8051 to external memory.
- Write 8051 Assembly level programs using 8051 instructions set.
- Describe the Interrupt system, operation of Timers/Counters and Serial port of 8051.
- Interface simple switches, simple LEDs, ADC 0804, LCD and Stepper Motor to 8051

Course Outcomes (CO):

On completion of this course, student will be able to

- Understand the importance of Microcontroller
- Acquire the knowledge of Architecture of 8051 Microcontroller.
- Apply and Interface simple switches, simple LEDs, ADC 0804, LCD and Stepper Motor to using 8051 I/O ports.
- Develop the 8051 Assembly level programs using 8051 instructions set.
- Design the Interrupt system
- Understand the operation of Timers/Counters and Serial port of 8051.

Syllabus		Total Hours:48
Module-I	**8051 Microcontroller**	**10Hrs**

8051 Microcontroller: Microprocessor Vs Microcontroller, Embedded Systems, Embedded Microcontrollers, 8051 Architecture- Registers, Pin diagram, I/O ports functions, Internal Memory organization. External Memory (ROM & RAM) interfacing.

Module-II	Addressing Modes	9Hrs

Addressing Modes, Data Transfer instructions, Arithmetic instructions, Logical instructions, Branch instructions, Bit manipulation instructions. Simple Assembly language program examples to use these instructions.

Module-III	8051 Stack, Stack and Subroutine instructions	9Hrs

8051 Stack, Stack and Subroutine instructions: Simple Assembly language program examples to use subroutine instructions.8051 Timers and Counters – Operation and Assembly language programming to generate a pulse using Mode-1 and a square wave using Mode- 2 on a port pin.

Module-IV	8051 Serial Communication	10Hrs

8051 Serial Communication- Basics of Serial Data Communication, RS- 232 standard, 9 pin RS232 signals, Simple Serial Port programming in Assembly and C to transmit a message and to receive data serially.8051 Interrupts. 8051 Assembly language programming to generate an external interrupt using a switch.

Module-V		10Hrs
8051 C programming to generate a square waveform on a port pin using a Timer interrupt. Interfacing 8051 to ADC-0804, DAC, LCD and Interfacing with relays and Opto isolators, Stepper Motor Interfacing, DC motor interfacing, PWM generation using 8051.		

Text Books:

1. Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D. McKinlay; "The 8051 Microcontroller and Embedded Systems – using assembly and C", PHI, 2006 / Pearson, 2006.
2. Kenneth J. Ayala, "The 8051 Microcontroller", 3rd Edition, Thomson/Cengage Learning

Reference Books:

1. Manish K Patel, "The 8051 Microcontroller Based Embedded Systems", McGraw Hill, 2014, ISBN: 978-93-329-0125-4.
2. Raj Kamal, "Microcontrollers: Architecture, Programming, Interfacing and System Design", Pearson Education, 2005. Wayne Wolf, FPGA based system design, Prentice hall, 2004.

Web References:

https://nptel.ac.in/courses/117104072

https://onlinecourses.nptel.ac.in/noc22_ee12/preview

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3rd Mile, Bombay Highway, Gangavaram (V), Kovur(M), SPSR Nellore (Dt), Andhra Pradesh, India- 524137

Ph. No. 08622-212769, E-Mail: geethanjali@gist.edu.in, Website: www.gist.edu.in

CONTROL SYSTEMS

(Common to **CSE, AI&ML, DS, CS**)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0213Ta	3:0:0:0	3	CIE:30 SEE:70	3 Hours	OEC

Course Objectives:

This course will enable students to:

- Merits and demerits of open loop and closed loop systems; the effects of feedback
- The use of block diagram algebra and Mason's gain formula
- Transient and steady state responses, time domain specifications
- Frequency domain specifications, Bode diagrams and Nyquist plots
- The fundamental aspects of modern control

Course Outcomes (CO):

On completion of this course, student will be able to

- Evaluate the effective transfer function of a system from (i) block diagram reduction techniques (ii) Mason's gain formula
- Compute the steady state errors and transient response characteristics
- Determine the absolute stability and relative stability of a system
- Design a compensator to accomplish desired performance
- Derive state space model of a given physical system and solve the state equation

Syllabus		Total Hours:48
Module-I	**INTRODUCTION**	**10Hrs**

Open Loop and closed loop control systems and their differences- Examples of control systems- Classification of control systems, Feedback Characteristics, Effects of positive and negative feedback. Mathematical models – Differential equations of Translational and Rotational mechanical systems, and Electrical Systems, Block diagram reduction methods – Signal flow graph - Reduction using Mason's gain formula. Transfer Function of DC Servo motor - AC Servo motor - Synchro transmitter and Receiver.

Module-II	**TIME RESPONSE ANALYSIS**	**9Hrs**

Step Response - Impulse Response - Time response of first order systems – Characteristic Equation of Feedback control systems, Transient response of second order systems - Time domain specifications – Steady state response - Steady state errors and error constants

Module-III	**STABILITY**	**9Hrs**

The concept of stability – Routh's stability criterion – Stability and conditional stability – limitations of Routh's stability. The root locus concept - construction of root loci effects of adding poles and zeros to G(s)H(s) on the root loci.

Module-IV	**FREQUENCY RESPONSE ANALYSIS**	**10Hrs**

Introduction, Frequency domain specifications-Bode Diagrams-Determination of Frequency domain specifications and transfer function from the Bode Diagram Stability Analysis from Bode Plots. Polar Plots- Phase margin and Gain Margin-Stability Analysis.

Module-V	STATE SPACE ANALYSIS	10Hrs

Concepts of state, state variables and state model, derivation of state models from differential equations. Transfer function models. Block diagrams. Diagonalization. Solving the Time invariant state Equations- State Transition Matrix and its Properties. System response through State Space models. The concepts of controllability and observability

Text Books:

1. Modern Control Engineering, Katsuhiko Ogata, PEARSON, 1st Impression 2015.
2. Control Systems Engineering, I. J. Nagrath and M. Gopal, New Age International Publishers, 5th edition, 2007, Reprint 2012.

Reference Books:

1. Automatic Control Systems, Farid Golnaraghi and Benjamin. C. Kuo, WILEY, 9th Edition, 2010.
2. Control Systems, Dhanesh N. Manik, CENGAGE Learning, 2012.
3. John J D'Azzo and C. H. Houpis , "Linear Control System Analysis and Design: Conventional and Modern", McGraw - Hill Book Company, 1988.

Web References:

https://archive.nptel.ac.in/courses/107/106/107106081/

https://onlinecourses.nptel.ac.in/noc20_ee90/preview

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ENVIRONMENTAL ECONOMICS
(Common to CSE, AI&ML, DS, CS)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0150T	3:0:0:0	3	CIE:30 SEE:70	3 Hours	OEC

Course Objectives:

This course will enable students to:

- To impart knowledge on sustainable development and economics of energy
- To teach regarding environmental degradation and economic analysis of degradation
- To inculcate the knowledge of economics of pollution and their management
- To demonstrate the understanding of cost benefit analysis of environmental resources
- To make the students to understand principles of economics of biodiversity

Course Outcomes (CO):

On completion of this course, student will be able to

- The information on sustainable development and economics of energy
- The information regarding environmental degradation and economic analysis of degradation
- The identification of economics of pollution and their management
- The cost benefit analysis of environmental resources
- The principles of economics of biodiversity

Syllabus		Total Hours:48
Module-I	**SUSTAINABLE DEVELOPMENT**	**9Hrs**

Introduction to sustainable development - Economy-Environment interlinkages - Meaning of sustainable development - Limits to growth and the environmental Kuznets curve – The sustainability debate - Issues of energy and the economics of energy.

Module-II	ENVIRONMENTAL DEGRADATION	9Hrs

Economic significance and causes of environmental degradation - The concepts of policy failure, externality and market failure - Economic analysis of environmental degradation – Equi –marginal principle.

Module-III	ECONOMICS OF POLLUTION	10Hrs

Economics of optimal pollution, regulation, monitoring and enforcement - Managing pollution using existing markets: Bargaining solutions – Managing pollution through market intervention: Taxes, subsidies and permits.

Module-IV	COST – BENEFIT ANALYSIS	10Hrs

Cost – Benefit Analysis: Economic value of environmental resources and environmental damage - Concept of Total Economic Value - Alternative approaches to valuation – Cost-benefit analysis and discounting.

Module-V	ECONOMICS OF BIODIVERSITY	10Hrs

Economics of biodiversity: Economics of biodiversity conservation - Valuing individual species and diversity of species -Policy responses at national and international levels. Economics of Climate Change – stern Report

Text Books:

1. An Introduction to Environmental Economics by N. Hanley, J. Shogren and B. White Oxford University Press.(2001)
2. Blueprint for a Green Economy by D.W. Pearce, A. Markandya and E.B. Barbier Earthscan, London.(1989)

Reference Books:

1. Environmental Economics: An Elementary Introduction by R.K. Turner, D.W. Pearce and I. Bateman Harvester Wheatsheaft, London. (1994),
2. Economics of Natural Resources and the Environment by D.W. Pearce and R.K. Turner Harvester Wheat sheaf, London. (1990),

Web Reference:

1. https://nptel.ac.in/courses/109107171

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INTRODUCTION TO COMPOSITE MATERIALS

(Common to CSE, AI&ML, DS, CS)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0327Tb	3:0:0:0	3	CIE:30 SEE:70	3 Hours	OEC

Course Objectives:

This course will enable students to:

- To be familiar with classification and characteristics of composite material and their applications.
- To gain the knowledge about manufacturing methods of composites.
- To know the testing methods related to composite materials.

Course Outcomes (CO):

To provide knowledge on characteristics of composites

- To get knowledge on manufacturing and testing methods and mechanical behaviour of composites.
- To get the exposure of different materials.

Syllabus		Total Hours:48
Module-I	**Introduction**	**10Hrs**

Definitions, Composites, Reinforcements and matrices, Types of reinforcements, Types of matrices, Types of composites, Carbon Fibre composites, Properties of composites in comparison with standard materials, Applications of metal, ceramic and polymer matrix composites.

Module-II	**Manufacturing Methods**	**9Hrs**

Hand and spray lay - up, injection molding, resin injection,filament winding, pultrusion, centrifugal casting and prepregs. Fibre/Matrix Interface, mechanical. Measurement of interface strength.

Module-III	**Mechanical Properties**	**9Hrs**

Stiffness and Strength: Geometrical aspects – volume and weight fraction. Unidirectional continuous fibre, discontinuous fibers, Short fiber systems, woven reinforcements –Mechanical Testing: Determination of stiffness and strengths of unidirectional composites; tension, compression, flexure and shear.

Module-IV	**Laminates**	**10Hrs**

Plate Stiffness and Compliance, Assumptions, Strains, Stress Resultants, Plate Stiffness and Compliance, Computation of Stresses, Types of Laminates -, Symmetric Laminates, Anti-symmetric Laminate, Balanced Laminate, Quasi-isotropic Laminates, Crossply Laminate, Angle-ply Laminate. Orthotropic Laminate, Laminate Moduli, Hygrothermal Stresses.

Module-V	**Joining Methods and Failure Theories**	**10Hrs**

Joining –Advantages and disadvantages of adhesive and mechanically fastened joints. Typical bond strengths and test procedures.

Text Books:

1. K.K. Chawla, (1998), Composite Materials, Springer-Verlag, New York 2. B.T. Astrom, (1997),
2. Manufacturing of Polymer Composites, Chapman & Hall
3. Composite materials by J.N.Reddy

Reference Books:

1. Stuart M Lee, J. Ian Gray, Miltz, (1989), Reference Book for Composites Technology,CRC press
2. Frank L Matthews and R D Rawlings, (2006), Composite Materials: Engineering and Science, Taylor and Francis.

Web Reference:

https://en.wikipedia.org/wiki/Composite_material

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BIG DATA ANALYTICS LAB
Department of Computer Science and Engineering (Data Science)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A3207P	0:0:3:0	1.5	CIE:30 SEE:70	3 Hours	PCC

Course Objectives:

This course will enable students to:

- Get familiar with Hadoop distributions, configuring Hadoop and performing File management tasks
- Experiment MapReduce in Hadoop frameworks
- Implement MapReduce programs in variety applications
- Explore MapReduce support for debugging
- Understand different approaches for building Hadoop MapReduce programs for real time application

Course Outcomes (CO):

On completion of this course, student will be able to

CO1.Use Hadoop and perform File Management Tasks
CO2.Apply MapReduce programs to real time issues like word count, weather dataset and sales of a company
CO3. analyze huge data set using Hadoop distributed file systems and MapReduce
CO4. Apply data processing tool Pig
CO5. Apply data processing tool Hive
CO6. Apply data processing tool Spark

Syllabus | **Total Hours:48**

1. Install Apache Hadoop
2. Develop a MapReduce program to calculate the frequency of a given word in agiven file.
3. Develop a MapReduce program to find the maximum temperature in each year.
4. Develop a MapReduce program to find the grades of students.
5. Develop a MapReduce to find the maximum electrical consumption in each year given electrical consumption for each month in each year.
6. Develop a MapReduce to analyze weather data set and print whether the day is shinny or cool day.
7. Develop a MapReduce program to find the number of products sold in each country by considering sales data containing fields like

Tranctio n_Date	Pro duct	Pri ce	Payment _Type	Na me	Ci ty	St ate	Cou ntry	Account_ Created	Last_ Login	Latit ude	Longi tude

8. XYZ.com is an online music website where users listen to various tracks, the data gets collected which is given below. The data is coming in log files and looks like as shown below

UserId	TrackId	Shared	Radio	Skip
111115	222	0	1	0
111113	225	1	0	0
111117	223	0	1	1
111115	225	1	0	0

Write a MapReduce program to get the following

- Number of unique listeners
- Number of times the track was shared with others
- Number of times the track was listened to onthe radio
- Number of times the track was listened to in total
- Number oftimes the track was skipped on the radio

9. Develop a Map Reduce programto analyze Titanic ship data and to find the average age ofthe people (both male and female) who died in the tragedy. How many persons are survived in each class.

The titanic data will be..

Column 1 :PassengerI d	Column 2 : Survived (survived=0 &died=1)
Column 3 :Pclass	Column 4 : Name
Column 5 : Sex	Column 6 : Age
Column 7 :SibSp	Column 8 :Parch
Column 9 : Ticket	Column 10 : Fare
Column 11 :Cabin	Column 12 : Embarked

10. Develop a program to calculate the maximum recorded temperature by yearwise for the weather dataset in Pig Latin

11. Write queries to sort and aggregate the data in a table using HiveQL.

12. Develop a Java application to find the maximum temperature using Spark

Text Book(s):

1. Tom White, "Hadoop: The Definitive Guide" Fourth Edition, O'reilly Media, 2015.

Reference Book(s):

1. Glenn J. Myatt, Making Sense of Data , John Wiley & Sons, 2007 Pete Warden, Big Data Glossary, O'Reilly, 2011.
2. Michael Berthold, David J.Hand, Intelligent Data Analysis, Spingers, 2007.
3. Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos, Uderstanding Big Data : Analytics for Enterprise Class Hadoop and Streaming Data, McGrawHill Publishing, 2012.
4. Anand Rajaraman and Jeffrey David UIIman, Mining of Massive Datasets Cambridge University Press, 2012.

Web Reference:

https://www.ibm.com/analytics/big-data-analytics#:~:text=Big%20data%20analytics%20is%20the,sizes%20from%20terabytes%20to%20

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DATA VISUALIZATIONLAB
(Common to CSE, AI&ML, DS, CS)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A3208P	0:0:3:0	1.5	CIE:30 SEE:70	3 Hours	PCC

Course Objectives:

This course will enable students to:
- Familiarize with data visualization concepts
- Learn the data visualization principles
- Learn the concepts of plots
- Learn the concepts of data visualization via kernel machines
- Familiarize the data visualization for applications

Course Outcomes (CO):

On completion of this course, student will be able to
- Understand the data visualization concepts (L2).
- Apply various graphs and plots for data visualization (L3).
- Apply the matrix visualization for cluster analysis (L3)
- Analyze the kernel Machine in cluster analysis (L4).
- Apply various operations for genetic algorithms (L3).
- Illustrate the data visualization techniques for applications (L2).

Syllabus	Total Hours:48

1: Introduction to R
- a. Overview of R and Rstudio
- b. R syntax and Basic Operations
- c. Managing and navigating the R Environment

2: Data structures in R
- Vectors: a. Creation
  - b. Indexing
  - c. Basic arithmetic operations

3: Data Frames in R
- a. Creating
- b.Subsetting
- c. Manipulating

4: Data Manipulation in R
- a. Data import and Export in R
- b. Cleaning and Preprocessing data
- c. Manipulating data using functions from package like dplyr

5: Basic statistical operations
- a. Descriptive statistics (Mean, Median, Variance)
- b. Probability distributions in R
- c. Hypothesis testing (t-testing, chi-square tests)

6: Data Visualization in R

a. Introduction to basic plotting functions in R(plot, hist, boxplot)
b. Customizing plots (adding title, lables, legends)
c. Visualization methods-(categorical and continuous variables

7: Write a R programto display first 10 Fibonacci numbers
8: Write a R programto print the numbers from 1-100 and print "gist" for multiple of 3 print "GIST" for multiple of 5 and print "gist GIST" for multiple of both
9: Write a R program to create a data frame which contains details of 10 employees and display and summary of data

Reference Books:

1. Better data visualizations- A gude for scholars, researchers and wonks-Jonathan schwabish-Columbia university Press

Visualizing data-O' Relly

Web Reference:

https://www.tableau.com/learn/articles/data-visualization

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Ph. No. 08622-212769, E-Mail: geethanjali@gist.edu.in, Website: www.gist.edu.in

CLOUD COMPUTING LAB

(Common to CSE, AI&ML, DS, CS)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0533P	0:0:3:0	1.5	CIE:30 SEE:70	3 Hours	PCC

Course Objectives:

This course will enable students to:

- To develop web applications in cloud
- To learn the design and development process involved in creating a cloud based application
- Understand transfer of file form one virtual machine to another
- To learn to implement and use parallel programming using Hadoop

Course Outcomes (CO):

On completion of this course, student will be able to

CO1: Configure various virtualization tools such as Virtual Box, VMware workstation.

CO2: Design and deploy a web application in a PaaS environment.

CO3: Learn how to simulate a cloud environment to implement new schedulers.

CO4: Install and use a generic cloud environment that can be used as a private cloud.

CO5: Manipulate large data sets in a parallel environment.

Syllabus — **Total Hours:48**

List of Experiments

1. Install Virtual Box/VMware Workstation with different flavors of Linux or windows OS on top of windows operating systems.
2. Install a C compiler in the virtual machine created using virtual box and execute Simple Programs
3. Install Google App Engine. Create hello world app and other simple web applications using python/java.
4. Use GAE launcher to launch the web applications.
5. Simulate a cloud scenario using Cloud Sim and run a scheduling algorithm that is not present in Cloud Sim.
6. Find a procedure to transfer the files from one virtual machine to another virtual machine.
7. Find a procedure to launch virtual machine using try stack (Online Open stack Demo Version)
8. Install Hadoop single node cluster and run simple applications like word count

Reference:

Google Cloud Computing Foundations Course - Course (nptel.ac.in)

Web References:

1. https://www.vmware.com/products/workstation-pro/workstation-pro-evaluation.html
2. http://code.google.com/appengine/downloads.html
3. http://code.google.com/appengine/downloads.html

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SOFT SKILLS
(Common to CSE, AI&ML, DS, CS)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0029P	1:0:2:0	2	CIE:30 SEE:70	3 Hours	SC

Course Objectives:

This course will enable students to:

- To encourage allround development of the students by focusing on soft skills.
- To make the students aware of critical thinking and problem-solving skills.
- To develop leadership skills and organizational skills through group activities.
- To function effectively with heterogeneous teams.

Course Outcomes (CO):

On completion of this course, student will be able to

- Memorize various elements of effective communicative skills.
- Interpret people at the emotional level through emotional intelligence.
- Apply critical thinking skills in problem solving.
- Analyze the needs of an organization for team building.
- Judge the situation and take necessary decisions as a leader.
- Develop social and work-life skills as well as personal and emotional well-being.

Syllabus		Total Hours:48
Module-I	**Soft Skills & Communication Skills**	**10Hrs**

Introduction, meaning, significance of soft skills –Vital Components of communication skills - Inter-personal skills - Verbal and Non-verbal Communication.

Activities: Narration about self- strengths and weaknesses- clarity of thought - Interpersonal Skills- Group Discussion – Debate – Mutual Understanding - Book and film Reviews by groups - Group leader presenting views (non- controversial and secular) on contemporary issues or on a given topic. Verbal Communication- Oral Presentations- Extempore- brief addresses and speeches- Negotiation skills – Role Play- Non-verbal communication – Public speaking – Mock interviews – Anchoring Skills.

Module-II	**Critical Thinking**	**9Hrs**

Active Listening – Observation – Curiosity – Introspection – Analytical Thinking – Open-mindedness Creative Thinking.

Activities: Gathering information and statistics on a topic - sequencing – assorting – reasoning – critiquing issues – placing the problem – finding the root cause - seeking viable solution – judging with rationale – evaluating the views of others - Case Study, Story Analysis.

Module-III	**Problem Solving & Decision Making**	**10Hrs**

Meaning & features of Problem Solving – Managing Conflict – Conflict resolution – Methods of decision making – Effective decision making in teams – Methods & Styles.

Activities: Placing a problem which involves conflict of interests, choice and views – formulating the problem – exploring solutions byproper reasoning – Discussion on important professional, career and

Organizational decisions and initiate debate on the appropriateness of the decision. Case Study & Group Discussion.

Module-IV	Emotional Intelligence & Stress Management	9Hrs

Managing Emotions – Thinking before Reacting – Empathy for Others – Self-awareness – Self-Regulation – Stress factors – Controlling Stress – Tips.

Activities: Providing situations for the participants to express emotions such as happiness, enthusiasm, gratitude, and sympathy, and confidence, compassion in the form of written or oral presentations. Providing opportunities for the participants to narrate certain crisis and stress –ridden situations caused by failure, anger, jealousy, resentment and frustration in the form of written and oral presentation, Organizing Debates.

Module-V	Leadership Skills	10Hrs

Team-Building – Decision-Making – Accountability – Planning – Public Speaking – Motivation – Risk Taking - Team Building - Time Management.

Activities: Forming group with a consensus among the participants- choosing a leader- encouraging the group members to express views on leadership- democratic attitude- sense of sacrifice – sense of adjustment – vision – accommodating nature- eliciting views on successes and failures of leadership using the past knowledge and experience of the participants, Public Speaking, Activities on Time Management, Motivation, Decision Making, Group discussion etc.

Text Books:

1. Personality Development and Soft Skills (English, Paperback, Mitra Barun K.Publisher: Oxford University Press; Pap/Cdr edition (July 22, 2012)
2. Personality Development and Soft Skills: Preparing for Tomorrow, Dr Shikha Kapoor Publisher : I K International Publishing House; 0 edition (February 28, 2018)

Reference Books:

1. Soft skills: personality development for life success by Prashant Sharma, BPB publications 2018.
2. Soft Skills By Alex K. Published by S.Chand
3. Soft Skills: An Integrated Approach to Maximize Personality Gajendra Singh Chauhan,Sangeetha Sharma Published by Wiley.
4. Communication Skills and Soft Skills (Hardcover, A. Sharma) Publisher: Yking books
5. SOFT SKILLS for a BIG IMPACT (English, Paperback, Renu Shorey) Publisher: Notion Press .
6. Life Skills Paperback English Dr. Rajiv Kumar Jain, Dr. Usha Jain Publisher: Vayu Education of India

Web Reference:

1. https://youtu.be/DUlsNJtg2L8?list=PLLy_2iUCG87CQhELCytvXh0E_y-bOO1_q
2. https://youtu.be/xBaLgJZ0t6A?list=PLzf4HHlsQFwJZel_j2PUy0pwjVUgj7KlJ
3. https://youtu.be/-Y-R9hDl7lU
4. https://youtu.be/gkLsn4ddmTs
5. https://youtu.be/2bf9K2rRWwo
6. https://youtu.be/FchfE3c2jzc

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RESEARCH METHODOLOGY

(Common **to CSE, AI&ML, CS, DS, ECE, EEE, ME**)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0032T	2:0:0:0	0	CIE:30	-	MC

Course Objectives:

This course will enable students to:

- To understand the basic concepts of research and research problem
- To make the students learn about various types of data collection and sampling
- Design to enable them to know the method of statistical evaluation
- To make the students understand various testing tools in research
- To make the student learn how to write a research report
- • To create awareness on ethical issues n research

Course Outcomes (CO):

On completion of this course, student will be able to

- Understand basic concepts and its methodologies
- Understand the concept of sampling and sampling design
- Design survey questionnaires for different kinds of research
- Read. comprehend and explain research articles in their academic discipline
- Analyze various types of testing tools used in research
- Design a research paper without any ethical issues

Syllabus		Total Hours:48
Module-I	**INTRODUCTION TORESEARCHMETHODOLOGY**	**10Hrs**

Meaning of Research – Objectives of Research – Types of Research – Research Approaches – Guidelines for Selecting and Defining a Research Problem – Research Design – Concepts related to Research Design – Basic Principles of Experimental Design.

Learning Outcomes: After completion of this unit student will

- Understand the concept of research and its process
- Explain various types of research
- Know the steps involved in research design

Understand the different research approaches

Module-II	**SAMPLING AND DATA COLLECTION METHODS**	**9Hrs**

Sampling Design – steps in Sampling Design –Characteristics of a Good Sample Design – Random Sampling Design. Measurement and Scaling Techniques-Errors in Measurement – Tests of Sound Measurement – Scaling and Scale Construction Techniques – Time Series Analysis – Interpolation and Extrapolation. Data Collection Methods – Primary Data – Secondary data – Questionnaire Survey and Interviews.

Learning Outcomes: After completion of this unit student will

- Understand the concept of sampling and sampling design
- Explain various techniques in measurement and scaling
- Learn various methods of data collection
- Design survey questionnaires for different kinds of research
- Analyze the questionnaires

Module-III	CORRELATION	10Hrs

Correlation and Regression Analysis – Method of Least Squares – Regression vs Correlation – Correlation vs Determination – Types of Correlations and Their Applications

Learning Outcomes: After completion of this unit student will

- Know the association of two variables
- Understand the importance of correlation and regression
- Compare and contrast correlation and regression
- Learn various types of correlation
- Apply the knowledge of Correlation & Regression Analysis to get the results

Module-IV	STATISTICAL INFERENCE	9Hrs

Statistical Inference: Tests of Hypothesis – Parametric vs Non-parametric Tests – Hypothesis Testing Procedure – Sampling Theory – Sampling Distribution – Chi-square Test – Analysis of variance and Co-variance – Multivariate Analysis

Learning Outcomes: After completion of this unit student will

- Know the statistical inference
- Understand the hypothesis testing procedure
- Compare and contrast Parametric and Non-parametric Tests
- Understand the use of chi-square test in investigating the distribution of categorical
- Variables Analyze the significance of variance and covariance

Module-V	REPORT WRITING	10Hrs

Report Writing and Professional Ethics: Interpretation of Data – Report Writing – Layout of a Research Paper – Techniques of Interpretation- Making Scientific Presentations in Conferences and Seminars – Professional Ethics in Research

Learning Outcomes: After completion of this unit student will

- Learn about report writing
- Understand how to write research paper
- Explain various techniques of interpretation
- Understand the importance of professional ethics in research
- Design a scientific paper to present in the conferences/seminars

Text Books:

1. C.R.Kothari, "Research Methodology: Methods and Techniques",2nd edition, New Age International Publishers.
2. A Step by Step Guide for Beginners, "Research Methodology": Ranjit Kumar, Sage Publications

Reference Books:

1. P.Narayana Reddy and G.V.R.K.Acharyulu, "Research Methodology and Statistical Tools", 1st Edition, Excel Books, New Delhi.
2. Donald R. "Business Research Methods", Cooper & Pamela S Schindler, 9th edition.
3. 3. S C Gupta, "Fundamentals of Statistics", 7th edition Himalaya Publications

Web Reference:

https://onlinecourses.swayam2.ac.in/cec20_hs17/preview

https://onlinecourses.nptel.ac.in/noc22_ge08/preview

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Semester-7(Theory-6, SC-1)							
Sl. No.	**Category**	**Course Code**	**Course Title**	**Hours per week**			**Credits**
				L	**T**	**P**	**C**
1	HSC	22A0023T 22A0024T 22A0025T	**Humanity Science Elective – I:** 1. Management Science 2. Entrepreneurship and Innovation 3. Business Environment	3	0	0	3
2	PEC	22A0534a 22A0535c 22A0530c	**Professional Elective -III** 1. Software reuse &Re engineering 2. Deep Learning 3. Internet of Things	3	0	0	3
3	PEC	22A0535a 22A0535b 22A0535c	**Professional Elective-IV:** 1. Agile methodologies 2. Time series analytics 3. Adhoc and wireless sensor networks	3	0	0	3
4	PEC	22A0530c 22A0536b 22A0535a	Professional Elective-V: 1. Design patterns 2. Business Intelligence 3. Block chain technology	3	0	0	3
5	OEC	22A0241Ta 22A0432T 22A0151T 22A0327Tc	**Open Elective-III:** 1. Smart Grid 2. Basic VLSI Design 3. Disaster management 4. Measurements and Mechatronics	3	0	0	3
6	OEC	22A0232Ta 22A0433T 22A0152T 22A0331Tc	**Open Elective-IV:** 1. Electric Vehicles 2. Industrial Electronics 3. Construction Management 4. Introduction to Robotics	3	0	0	3
7	SC	22A0537	**Skill Advanced Course:** Mobile Application Development	1	0	2	2
Industrial / Research Internship 2 Months (Mandatory) after Third year (to be evaluated during VII semester)				0	0	0	3
				Total credits			**23**

Category	**Credits**
Professional Elective Courses (PEC)	9
Humanities and Social Science Course (HSC)	3
Open Elective Courses (OEC)	6
Skill Advanced Course (SC)	2

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MANAGEMENT SCIENCE					
Course Code	**L:T:P:S**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
22A0023T	**3:0:0:0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**HS**

Course Objectives:

1. To provide fundamental knowledge on Management, Administration, Organization &its concepts.
2. To make the students understand the role of management in Production
3. To impart the concept of HRM in order to have an idea on Recruitment, Selection, Training &Development, job evaluation and Meritrating concepts.
4. To create awareness on identify Strategic Management areas &the PERT/C PM for better Project Management.
5. To make the students aware of the contemporary issues in management.

Course Outcomes (CO):

On completion of this course, student will be able to

- Understand the concepts &principles of management and designs of organizationin a practical world(L2)
- Apply the knowledge of Work- study principles &Quality Control techniques inindustry(L3)
- Analyze the concepts of HRM in Recruitment , Selection and Training&Development.(L4)
- Evaluate PERT/CPM Techniques for projects of an enterprise and estimate time&cost of project &to analyze the business through SWOT.(L3)
- Create Moderntechnology in management science.(L3)

Syllabus		**Total Hours:48**
Module-I	**INTRODUCTIONTOMANAGEMENT**	**10Hrs**

Management - Concept and meaning - Nature-Functions - Management as a Science and Art and both. Schools of Management Thought - Taylor's Scientific Theory-Henry Fayol's principles -Eltan Mayo's Human relations - Systems Theory - Organizational Designs - Line organization -Line &Staff Organization-Functional Organization-MatrixOrganization-ProjectOrganization-CommitteeformofOrganization-Social responsibilities of Management.

Module-II	**OPERATIONSMANAGEMENT**	**10Hrs**

Principles and Types of Plant Layout - Methods of Production (Job, batch and Mass Production),Work Study-Statistical Quality Control-Deming 's contribution to Quality .Material Management - Objectives - Inventory-Functions - Types, Inventory

Techniques - EOQ-ABC Analysis - Purchase Procedure and Stores Management - Marketing Management - Concept -Meaning-Nature-Functions of Marketing-MarketingMix-ChannelsofDistribution-AdvertisementandSalesPromotion-Marketing Strategies based on Product Life Cycle.

Module-III	**HUMANRESOURCESMANAGEMENT**	**10Hrs**

HRM - Definition and Meaning – Nature - Managerial and Operative functions - Evolution of HRM - Job Analysis - Human Resource Planning (HRP)- Employee Recruitment-Sources of Recruitment- Employee Selection -Process and Tests in Employee Selection -Employee Training and Development- On- the- job &Off-the-job training methods-Performance Appraisal Concept- Methods of Performance Appraisal – Placement- Employee Induction –Wage and Salary Administration.

Module-IV	**STRATEGIC&PROJECTMANAGEMENT**	**10Hrs**

Definition &Meaning-Setting of Vision -Mission -Goals -Corporate Planning Process-Environmental Scanning - Steps in Strategy Formulation and Implementation - SWOT Analysis-Project Management-Network Analysis- Program Evaluation and Review Technique(PERT) - Critical Path Method (CPM)Identifying Critical Path - Probability of Completing the project within given time-Project Cost-Analysis-Project Crashing(Simple problems).

Module-V	**CONTEMPORARYISSUESINMANAGEMENT**	**8Hrs**

The concept of Management Information System (MIS)-Materials Requirement Planning (MRP)- Customer Relations Management(CRM)-Total Quality Management(TQM)-Six Sigma Concept-Supply Chain Management (SCM)-Enterprise Resource Planning(ERP)-PerformanceManagement-BusinessProcessOutsourcing(BPO)-BusinessProcessRe-Engineering and Bench Marking-Balanced Score Card-Knowledge Management.

Course Outcomes (CO):

On completion of this course, student will be able to

- Understand the concept s& principles of management and designs of organization in a practical world(L2)
- ApplytheknowledgeofWork-studyprinciples&QualityControltechniquesinindustry(L3)
- Analyze the concepts of HR Min Recruitment, Selection and Training&Development. (L4)
- Evaluate PERT/CPM Techniques for projects of an enterprise and estimate time&cost of project &to analyze the business through SWOT. (L3)
- Create Modern technology in management science. (L3)

Textbooks:

1. A.RAryasri,"ManagementScience",TMH,2013
2. Stoner, Freeman, Gilbert, Management, Pearson Education,NewDelhi,2012.

Reference Books:

1. Koontz&Weihrich,"EssentialsofManagement",6th edition,TMH,2005.
2. ThomasN.Duening&JohnM.Ivancevich,"ManagementPrinciplesandGuidelines",Biztantra.
3. KanishkaBedi,"ProductionandOperationsManagement",OxfordUniversityPress,2004.
4. SamuelC.Certo,"ModernManagement",9th edition,PHI,2005

Web Reference:

https://pubsonline.informs.org/journal/mnsc

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ENTREPRENEURSHIP & INNOVATION
(Common to All)

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
22A0024T	3:1:0:0	3	CIE:30 SEE:70	3 Hours	HS

Course Objectives:

1. To make the student understand about Entrepreneurship
2. To enable the student in knowing various sources of generating new ideas inset ting up of New enterprise
3. To facilitate the student in knowing various sources of finance in starting up of a business
4. To impart knowledge about various government sources which provide financial assistance to entrepreneurs/ women entrepreneurs
5. To encourage the student in creating and designing business plans

Course Outcomes (CO):

On completion of this course, student will be able to

- Understand the concept of Entrepreneurship and challenges in the world of competition. (L2)
- Apply the Knowledge in generating ideas for New Ventures. (L3)
- Analyzevarioussourcesoffinanceandsubsidiestoentrepreneur/womenEntrepreneurs. (L4)
- Evaluate the role of central government and state government in promoting entrepreneurship. (L3)
- Create and design business plan structure through incubations. (L3)

Syllabus		Total Hours: 48
Module-I	**INTRODUCTION TO ENTREPRENEURSHIP**	**10Hrs**

Entrepreneurship-Concept, knowledge and skills requirement-Characteristicsofsuccessfulentrepreneurs-Entrepreneurshipprocess-Factors impacting emergence of entrepreneurship- Differences between Entrepreneur and Intrapreneur-Understanding individual entrepreneurial mindset and personality- Recent trends in Entrepreneurship.

Module-II	**STARTING UP NEW VENTURE**	**10Hrs**

Starting the New Venture - Generating business idea – Sources of new ideas & methods of generating ideas-Opportunity recognition-Feasibility study- Market feasibility ,technical/operational feasibility - Financial feasibility - Drawing business plan - Preparing project report – Presenting business plan to investors.

Module-III	**SOURCES OF FINANACE**	**9Hrs**

Sources of finance - Various sources of Finance available - long term sources - Short term sources-Institutional Finance – Commercial Banks, SFC's in India- NBFC's in India – their way of financing in India for small and medium business -Entrepreneurship development programs in India – The entrepreneurial journey- Institutions in aid of entrepreneurship development

Module-IV	**WOMEN ENTREPRENEURSHIP**	**9Hrs**

Women Entrepreneurship-Entrepreneurship Development and Government- Role of Central Government and State Government in promoting women Entrepreneurship -

Introduction to various incentives, subsidies and grants – Export- oriented Units - Fiscal and Tax concessions available –Women entrepreneurship - Role and importance - Growth of women entrepreneurship in India-Issues &Challenges-Entrepreneurial motivations.

Module-V	**INTRODUCTION TO INCUBATION & INNOVATION**	**10Hrs**

Fundamentals of Business Incubation - Principles and good practices of business incubation- Process of business incubation – Types, Advantages and Disadvantages of incubation. Innovation Meaning & Definition - Forms of innovation - Innovation, features and characteristics - Factors initiating innovations - Innovation process and its stages.

Textbooks:

DFKuratkoandTVRao,"Entrepreneurship**"**-ASouth-AsianPerspective– CengageLearning,2012.(ForPPT,CaseSolutions Facultymayvisit:login.cengage.com)
NandanH,"FundamentalsofEntrepreneurship",PHI,2013

ReferenceBooks:

1. VasantDesai, "Smal lScale Industries and Entrepreneurship", HimalayaPublishing2012.
2. RajeevRoy"Entrepreneurship",2nd Edition, Oxford, 2012.
3. B.JanakiramandM.Rizwanal"EntrepreneurshipDevelopment:Text&Cases",ExcelBooks,2011.
4. Stuart Read, Effectual "Entrepreneurship", Routledge, 2013.

Web Reference:

https://digitalleadership.com/blog/the-innovation-entrepreneurship-relationship/#

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BUSINESS ENVIRONMENT

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
22A0025T	3:1:0:0	3	CIE:30 SEE:70	3 Hours	HS

Course Objectives:

- To make the student understand about the business environment.
- To enable them in knowing the importance of fiscal and monitory policy.
- To facilitate them in understanding the export policy of the country.
- Impart knowledge about the functioning and role of WTO.
- Encourage the student in knowing the structure of stock market.

Course Outcomes (CO):

On completion of this course, student will be able to

- Understand various types of business environment. (L2)
- Evaluate fiscal and monitory policy (L3)
- Analyze India's Trade Policy(L4)
- Understand the role of WTO(L2)
- Apply the knowledge of Money markets in future investment(L3)

Syllabus		Total Hours:48
Module-I	**AN OVERVIEW OF BUSINESS ENVIRONMENT**	**10Hrs**

Overview of Business Environment – Types of Environments - Internal & External -Micro and Macro environment- Competitive structure of industries - Environmental analysis – Scope of business-Characteristicsofbusiness-Process&limitationsofenvironmentalanalysis.

Module-II	**FISCALPOLICY & MONETARY POLICY**	**10Hrs**

FISCALPOLICY-PublicRevenues-PublicExpenditure-PublicdebtDevelopmentactivities financed by public expenditure - Evaluation of recent fiscal policy of Government of India - Highlights of Budget - MONETARY POLICY - Demand and Supply of Money – RBI - Objectivesofmonetaryandcreditpolicy-Recenttrends-RoleofFinanceCommission.

Module-III	**INDIA'S TRADE POLICY & BALANCE OFPAYMENTS**	**10Hrs**

INDIA'S TRADE POLICY - Magnitude and direction of Indian International Trade – Bilateral and Multilateral Trade Agreements - EXIM policy and role of EXIM bank - BALANCE OFPAYMENTS–Structure&Majorcomponents-CausesforDisequilibriuminBalanceofPayments-Correction measures – WTO - Nature and Scope - Organization and Structure – Role and functions of WTO in promoting world trade

Module-IV	**MONEYMARKETSANDCAPITALMARKETS**	**10Hrs**

Features and components of Indian financial systems - Objectives, features and structure of money markets and capital markets -Reforms and recent development– SEBI - Stock Exchanges - Investor protection and role of SEBI.

Module-V	**INTRODUCTION TO INFLATION**	**8Hrs**

Inflation – Meaning & Definition – Causes – Effects – Types – Advantages & Disadvantages
Deflation – Meaning & Definition - Causes & Effects.

Textbooks:

1. FrancisCherunilam(2009),"InternationalBusiness":TextandCases,PrenticeHallofIndia.
2. K.Aswathappa,"EssentialsofBusinessEnvironment":TextsandCases&Exercises 13thRevisedEdition.HPH2016.

Reference Books:

1. K.V.Sivayya,V.B.MDas(2009),Indian Industrial Economy, Sultan Chand Publishers, NewDelhi,India.
2. Sundaram, Black(2009) ,International Business Environment Text and Cases, Prentice Hall of India, NewDelhi, India.
3. Chari.S.N (2009),International Business, Wiley India.
4. E.Bhattacharya(2009),InternationalBusiness,ExcelPublications,NewDelhi.

Web Reference:
https://www.toppr.com/guides/business-environment/#:~:text=Definition%20of%20Business%20Environment%20is,trends%2C%20economic%20changes%2C%20etc.

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SOFTWARE REUSE & RE- ENGINEERING

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
22A0534a	3:1:0:0	3	CIE:30 SEE:70	3 Hours	HS

Course Objectives:

- To improve the quality and maintainability of the software system while minimizing the risks and costs associated with the redevelopment of the system from scratch.
- to improve its performance and scalability. The goal of reengineering is to improve the application to meet current requirements and technologies.

Course Outcomes (CO):

On completion of this course, student will be able to

- Understand the concept of Entrepreneurship and challenges in the world of competition. (L2)
- Apply the Knowledge in generating ideas for New Ventures. (L3)
- Analyzevarioussourcesoffinanceandsubsidiestoentrepreneur/womenEntrepreneurs. (L4)
- Evaluate the role of central government and state government in promoting entrepreneurship. (L3)
- Create and design business plan structure through incubations. (L3)

Syllabus		Total Hours: 48
Module-I	**Introduction to Software reuse**	**10Hrs**

Software reuse definitions, Reuse Artefacts, Artefact Characteristics, Reuse in Software Life Cycle. Assessing the R Process and its Goals, software reuse principles software reuse scope, reuse potential. restricting factors, diversity, solt reuse methods. generative reuse methods, compositional reuse methods, reuse within object oriented method application frameworks

Module-II	**Design patterns**	**10Hrs**

Design Patterns- Introduction. Creational Patterns - Factory Pattern, Factory Method. Abstract Factory Pattern, Singh Pattern, Builder Pattern.
Structural Patterns -- Adapter Pattern, Bridge Pattern, Composite Pattern, Decorator Pattern, Façade Pattern, Flies Pattern. Proxy Pattern Behavioral Patterns - Chain of responsibility Pattern, Command Pattern, Interpreter Pattern.

Module-III	**Object Oriented Business Engineering**	**9Hrs**

Object Oriented Business Engineering -Business Process Reengineering, Software Engineering Process in reuse business Component System Engineering - building flexible components systems, requirement analysis, robustness analysis, desi implementation and testing the component system.

Module-IV	**Re-Engineering process**	**9Hrs**

Introduction Re-engineering. Restructuring and Reverse Engineering, Reverse engineering, Static analysis. Dynamic analysis. Scope of reverse engineering

. Codes, specifications. and documentations. Domain analysis. Design recovery.

Module-V	**Re- engineering existing systems**	**10Hrs**

Re- engineering existing systems, refactoring, Data Re-engineering and migration. Software Reuse and Reengineering Design for reuse. Object-orientation and reuse, reuse metrics. Reengineering Metrics. Reengineering and Maintenance in software cycle.

Textbooks:

1.Taking A.A, and Grubb, P.A (1996) Software Maintenance: Concepts and Practice. Boston International Thomson Computer Press.

2 Leac'h, R.J. (1997). Software Reuse: Methods, Models, and Costs. New York: McGrawHill.

Reference Books:

1.Ivar Jaco Martin Griss, Patrick Johnsson, "Software Reuse Architecture, Process and Business Success" Pearson Education, 2003.

2 James W Cooper, "Java Design Pattes a tutorial", Pearson Education, 2003.

3.Frank Buschmann, et al., "Pattern Oriented Software Architecture – Volume I" John Wiley & Sons; 1996.

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DEEP LEARNING
(Common to CSE,AI&ML,DS,CS)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0535c	3:0:0:0	3	CIE:30 SEE:70	3 Hours	PEC

Course Objectives:

This course will enable students to:

- Demonstrate the major technology trends driving Deep Learning
- Build, train, and apply fully connected deep neural networks
- Implement efficient neural networks
- Analyze the key parameters and hyper parameters in a neural network's architecture

Course Outcomes (CO):

On completion of this course, student will be able to

- Apply Mathematical Operations on Neural Network. (L3)
- Choose proper Hyperparameters. (L4)
- Examine architecture of Deep Neural Network. (L3)
- Apply Convolutional Neural Networks in Image Classifications. (L3)
- Use RNN and LSTMs in Real time applications. (L3)
- Analyze different types of Autoencoders. (L4).

Syllabus		Total Hours:48
Module-I	**Linear Algebra**	**10Hrs**

Scalars, Vectors, Matrices and Tensors, Matrix operations, types of matrices, Norms, Eigen decomposition, Singular Value Decomposition, Principal Components Analysis.

Information Theory. Numerical Computation: Overflow and Underflow, Gradient-Based Optimization, Constrained Optimization, Linear Least Squares.

Module-II	Fundamentals of Neural Networks and Deep Learning	9Hrs

Neural Networks, Training Neural Networks, Activation Functions, Loss Functions, Hyper parameters, Building blocks of Deep Neural Networks.

Module-III	Convolutional Networks	10Hrs

The Convolution Operation, Pooling, Convolution, Basic Convolution Functions, Structured Outputs, Data Types, Efficient Convolution Algorithms, Random or Unsupervised Features, Basis for Convolutional Networks.

Module-IV	Recurrent and Recursive Neural Networks	9Hrs

Recurrent Neural Network: Modelling Time Dimension, 3D Volumetric Input, General Recursive Neural Network Architecture, LSTM Networks, Applications.

Recursive Neural Network: Architecture, Varieties of RNN, Applications of RNN.

Module-V	Autoencoders	10Hrs

Under complete Auto encoders, Regularized Auto encoders, Representational Power, Layer Size and Depth, Stochastic Encoders and Decoders, Denoising Auto encoders.

Text Book:

1. Ian Good fellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press,2016.
2. Josh Patterson and Adam Gibson, "Deep learning: A practitioner's approach", O'Reilly Media, First Edition, 2017

Reference Books:

1. Fundamentals of Deep Learning, Designing next-generation machine intelligence algorithms, Nikhil Buduma, O'Reilly, Shroff Publishers, 2019.
2. Deep learning Cook Book, Practical recipes to get started Quickly, DouweOsinga, O'Reilly, Shroff Publishers, 2019.

Web Reference:

1. https://keras.io/datasets/
2. http://deeplearning.net/tutorial/deeplearning.pdf
3. https://arxiv.org/pdf/1404.7828v4.pdf
4. https://www.cse.iitm.ac.in/~miteshk/CS7015.html
5. https://www.deeplearningbook.org
6. https://nptel.ac.in/courses/106105215

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Internet of Things

(Common to CSE, AI&ML, DS, CS)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0530c	3:0:0:0	3	CIE:30 SEE:70	3 Hours	PEC

Course Objectives:

This course will enable students to:

- Introduce the fundamental concepts of IoT and physical computing , Expose the student to a variety of embedded boards and IoT Platform, Create a basic understanding of the communication protocols in IoT communications. Familiarize the student with application program interfaces for IoT and Enable students to create simple IoT applications.

Course Outcomes (CO):

On completion of this course, student will be able to

- Understand the Basic sensors and actuators for an IoT application.
- Select protocols for a specific IoT application.
- Utilize the cloud platform and APIs for IoT applications.
- Experiment with embedded boards for creating IoT prototypes.
- Design a solution for a given IoT application.
- Able to understand the application areas of IOT.

Syllabus		Total Hours:48
Module-I	**Overview of IoT**	**10Hrs**

The Internet of Things: **An Overview, The Flavour of the Internet of Things, The "Internet" of "Things", The Technology of the Internet of Things, Enchanted Objects, Who is Making the Internet of Things?**

Design Principles for Connected Devices: Calm and Ambient Technology, Privacy, Web Thinking for Connected Devices, Affordances.

Prototyping: Sketching, Familiarity, Costs Vs Ease of Prototyping, Prototypes and Production, Open source Vs Close source, Tapping into the community

Module-II	Embedded Devices	9Hrs

Electronics, Embedded Computing Basics, Arduino, Raspberry Pi, Mobile phones and tablets, Plug Computing: Always-on Internet of Things

Module-III	Communication in the IoT	9Hrs

Internet Communications: An Overview, IP Addresses, MAC Addresses, TCP and UDP Ports,Application Layer Protocols

Prototyping Online Components:

Getting Started with an API, Writing a New API, Real-Time Reactions, Other Protocols Protocol

Module-IV	Business Models	10Hrs

Business Models**: A short history of business models, The business model canvas, Who is thebusiness model for, Models, Funding an Internet of Things startup, Lean Startups.**

Manufacturing: **What are you producing, Designing kits, Designing printed circuit boards**.

Module-V	Manufacturing Process	10Hrs

Manufacturing continued**: Manufacturing printed circuit boards, Mass-producing the case andother fixtures, Certification, Costs, Scaling up software.**

Ethics**: Characterizing the Internet of Things, Privacy, Control, Environment, Solutions**.

Text Books:

1. Adrian McEwen, Hakim Cassimally - Designing the Internet of Things, Wiley Publications, 2012

Reference Books:

1. Arshdeep Bahga, Vijay Madisetti - Internet of Things: A Hands-On Approach,Universities Press, 2014.
2. The Internet of Things, Enabling technologies and use cases – Pethuru Raj, Anupama C. Raman, CRC Press.

Web Resources:

https://www.arduino.cc/
https://www.raspberrypi.org/

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AGILE METHODOLOGIES

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0535a	3:0:0:0	3	CIE:30 SEE:70	3 Hours	PEC

Course Objectives:

This course will enable students to:

- to ensure that development teams complete projects on time and within budget.
- It also helps to improve communication between the development team and the product owner. Additionally, Agile development methodology can help reduce the risks associated with complex projects

Course Outcomes (CO):

On completion of this course, student will be able to

- include increased speed and agility in delivering products or services, improved customer satisfaction.
- reducing cycle time, improving quality, and reducing waste. and reduced costs.
- All successful Agile software development projects begin with an ideation stage.
- To tangible product or service that is produced by an agile team.
- This iterative approach allows teams to adapt to changes quickly, deliver value incrementally, and ensure that the final product meets the evolving needs of stakeholders

Syllabus		Total Hours:48
Module-I	**Fundamentals of Agile**	**10Hrs**

The Genesis of Agile - Introduction and background, Agile Manifesto and Principles Overview of Scrum, Extreme Programming, Feature Driven development, Lean Software Development, Agile project management, Design and development practices in Agile projects, Test Driven Development, Continuous Integration, Refactoring, Pair Programming, Simple Design, User Stories, Agile Testing Agile Tools.

Module-II	Agile Scrum Framework	9Hrs

Introduction to Scrum, Project phases, Agile Estimation, Planning game, Product backlog, Sprint backlog, Iteration planning, User story definition, Characteristics and content of user stories, Acceptance tests and Verifying stories, Project velocity Burn down chart, Sprint planning and retrospective, Daily scrum, Scrum roles, Product Owner Scrum Master, Scrum Team, Scrum Case Study, Tools for Agile project management.

Module-III	Agile Testing	9Hrs

The Agile lifecycle and its impact on testing, Test-Driven Development (TDD), xUnit framework and tools for TDD, Testing user stories acceptance tests and scenarios, Planning and managing testing cycle, Exploratory testing, Risk based testing, Regression tests, Test Automation-Tools to support the Agile tester

Module-IV	Agile Software Design and Development	10Hrs

Agile design practices, Role of design Principles including Single Responsibility Principle, Open Closed Principle, Liskov Substitution Principle, Interface Segregation Principles, Dependency Inversion Principle in Agile Design, Need and significance of Refactoring, Refactoring Techniques, Continuous Integration, Automated build tools, Version

Module-V	**Industry Trends**	**10Hrs**

Market Scenario and adoption of Agile, Agile ALM, Roles in an Agile project, Agile applicability, Agile in Distributed teams, Business benefits, Challenges in Agile, Risks and Mitigation, Agile projects on cloud, Balancing Agility with Discipline, Agile rapid development technologies

Text Books:

Sooner Safer Happier: Antipatterns and Patterns for Business Agility

Reference Books:

- Ken Schwaber and Jeff Sutherland

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3rd Mile, Bombay Highway, Gangavaram (V), Kovur(M), SPSR Nellore (Dt), Andhra Pradesh, India- 524137
Ph. No. 08622-212769, E-Mail: geethanjali@gist.edu.in, Website: www.gist.edu.in

TIME SERIES ANALYTICS

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0535b	3:0:0:0	3	CIE:30 SEE:70	3 Hours	PEC

Course Objectives:

This course will enable students to:

1. Present time series in an informative way, both graphically and with summary statistics,
2. Model time series to analyses the underlying structure(s) in both the time and frequency domains.

Course Outcomes (CO):

On completion of this course, student will be able to

- Forecast the trend pattern exhibited by the given data by using various methods
- Run and interpret time series models and regression models for time series.
- Use the Box-Jenkins approach to model and forecast time series data empirically.
- Analyze and estimate the cyclic components using special processes.

Syllabus		Total Hours:48
Module-I	INTRODUCTION TO TREND	**10Hrs**

Introduction to times series data, application of time series from various fields, Components of a time series, Decomposition of time series. Trend: Estimation of trend by free hand curve method, method of semi averages, fitting a various mathematical curve, and growth curves.

Module-II	TREND AND SEASONAL COMPONENT	**9Hrs**

Method of moving averages. Detrending. Effect of elimination of trend on other components of the time series. Seasonal Component: Estimation of seasonal component by Method of simple averages, Ratio to Trend, Ratio to moving average and Link relatives.

Module-III	FORECASTING	**9Hrs**

Variate component method: Stationary Time series: Weak stationary, auto correlation function and correlogram of moving average .Forecasting: Exponential smoothing methods, Short term forecasting methods: Brown's discounted regression, Box-Jenkins Method.

Module-IV	CYCLIC COMPONENT	**10Hrs**

De Seasonalization . Cyclic Component: Harmonic Analysis. Some Special Processes: Moving-average (MA) process and Autoregressive (AR) process of orders one and two, Estimation of the parameters of AR (1) and AR (2) – Yule-Walker equations.

Module-V	**Forecasting Time Series and Smoothing**	**10Hrs**

Smoothing Techniques, Introduction to Linear Time Series Models. ARIMA Modeling, Volatility Models. State – Space Representation of the time series.Time-Series forecasting and performance Evaluation

Time Series and Their Features; Basic Descriptive Techniques.Trends and Time Series Decomposition.

Text Books:

- Mukhopadhyay P. (2011): Applied Statistics, 2nd ed. Revised reprint, Books and Allied

Reference Books:

1. Kendall M.G. (1976): Time Series, Charles Griffin.
2. Chatfield C. (1980): The Analysis of Time Series –An Introduction, Chapman & Hall.

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Ph. No. 08622-212769, E-Mail: geethanjali@gist.edu.in, Website: www.gist.edu.in

ADHOC AND WIRELESS SENSOR METHODS

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0535c	3:0:0:0	3	CIE:30 SEE:70	3 Hours	PEC

Course Objectives:

This course will enable students to:

- To Appreciate the importance of Adhoc and sensor networks for applications like environment monitoring, habitat monitoring, health care and data acquisition systems.
- Understanding of data transmission technologies of the Adhoc and sensor devices with focus on channel access routing and security.
- The objective of this course is to study the fundamentals of Adhoc and Sensor Networks useful in data acquisition and IoT systems

Course Outcomes (CO):

On completion of this course, student will be able to

- Appreciate the importance of Adhoc and sensor networks for applications like environment monitoring, habitat monitoring, health care and data acquisition systems.
- Understanding of data transmission technologies of the Adhoc and sensor devices with focus on channel access routing and security.
- Appreciate the need and importance of converged networks, ubiquitous environment and ' Internet of things' in the context of Adhoc and sensor networks.
- Capable of model building ,new protocol design and strategies simulation of the systems.
- To understand the issues pertaining to sensor networks and the challenges involved in managing a sensor network.

Syllabus		Total Hours:48
Module-I	**AD HOC NETWORKS – INTRODUCTION AND ROUTING PROTOCOLS**	**10Hrs**

Elements of Ad hoc Wireless Networks, Issues in Ad hoc wireless networks, Example commercial applications of Ad hoc networking, Ad hoc wireless Internet, Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks, Classifications of Routing Protocols, Table Driven Routing Protocols – Destination Sequenced Distance Vector (DSDV), On–Demand Routing protocols –Ad hoc On–Demand Distance Vector Routing (AODV).

Module-II	**SENSOR NETWORKS – INTRODUCTION & ARCHITECTURES**	**9Hrs**

Challenges for Wireless Sensor Networks, Enabling Technologies for Wireless Sensor Networks, WSN application examples, Single-Node Architecture – Hardware Components, Energy Consumption of Sensor Nodes, Network Architecture – Sensor Network Scenarios, Transceiver Design Considerations, Optimization Goals and Figures of Merit.

Module-III	**WSN NETWORKING CONCEPTS AND PROTOCOLS**	**9Hrs**

MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols And Wakeup Concepts – S-MAC, The Mediation Device Protocol, Contention based protocols – PAMAS, Schedule based protocols – LEACH, IEEE 802.15.4 MAC protocol, Routing Protocols- Energy Efficient Routing, Challenges and Issues in Transport layer protocol.

Module-IV	**SENSOR NETWORK SECURITY**	**10Hrs**

Network Security Requirements, Issues and Challenges in Security Provisioning, Network Security Attacks, Layer wise attacks in wireless sensor networks, possible solutions for jamming, tampering, black hole attack, flooding attack. Key Distribution and Management, Secure Routing – SPINS, reliability requirements in sensor networks.

Module-V	**SENSOR NETWORK PLATFORMS AND TOOLS**	**10Hrs**

Sensor Node Hardware – Berkeley Motes, Programming Challenges, Node-level software platforms – TinyOS, nesC, CONTIKIOS, Node-level Simulators – NS2 and its extension to sensor networks, COOJA, TOSSIM, Programming beyond individual nodes – State centric programming.

Text Books:

- "Ad Hoc Wireless Networks: Architectures and Protocols" by MURTHY.

Reference Books:

- "AD HOC Wireless Networks: A Communication-Theoretic Perspective" by Ozan K Tonguz, Gianluigi Ferrari

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Ph. No. 08622-212769, E-Mail: geethanjali@gist.edu.in, Website: www.gist.edu.in

DESIGN PATTERNS
(Common to CSE, AI&ML, DS, CS)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0530c	3:0:0:0	3	CIE: 30 SEE:70	3 Hours	PEC

Course Objectives:

This course will enable students to:

- understand design patterns and their underlying object-oriented concepts.
- understand implementation of design patterns and providing solutions to real world software design problems.
- To understand patterns with each other and understanding the consequences of combining patterns on the overall quality of a system.

Course Outcomes (CO):

On completion of this course, student will be able to

- Know the underlying object oriented principles of design patterns.
- Understand the creational patterns
- Understand the structural patterns
- Understand the behavioral patterns
- Understand the context in which the pattern can be applied.
- Understand how the application of a pattern affects the system quality and its tradeoffs.

Syllabus		Total Hours:48
Module-I	**Introduction to Design Patterns**	**10Hrs**

Design Pattern Definition, Design Patterns in Small Talk MVC, Describing Design Patterns, Catalog of Design Patterns, Organizing the Catalog, Solving of Design Problems using Design Patterns, Selection of a Design Pattern, Use of Design Patterns.

Module-II	**Designing A Document Editor**	**9Hrs**

Design problems, Document structure, Formatting, Embellishing the User Interface, Supporting Multiple Look and Feel standards, Supporting Multiple Window Systems, User Operations, Spelling Checking and Hyphenation.

Creational Patterns: Abstract Factory, Builder, Factory Method, Prototype, Singleton, Discussion of Creational Patterns.

Module-III	**Structural Patterns**	**10Hrs**

Structural Patterns-1: Adapter, Bridge, Composite.

Structural Patterns-2: Decorator, Facade, Flyweight, Proxy, Discuss of Structural Patterns

Module-IV	**Behavioral Patterns**	**9Hrs**

Behavioral Patterns-1: Chain of Responsibility, Command, Interpreter, Iterator.

Behavioral Patterns-2: Mediator, Memento, Observer.

Module-V	**Behavioral Patterns**	**10Hrs**

Behavioral Patterns-2(cont'd): State, Strategy, Template Method, Visitor, Discussion of Behavioral Patterns. What to Expect from Design Patterns.

Text Books:

1. Design Patterns By Erich Gamma, Pearson Education

Reference Books:

1. Pattern's in JAVA Vol-I By Mark Grand, Wiley DreamTech.
2. Pattern's in JAVA Vol-II By Mark Grand, Wiley DreamTech.
3. JAVA Enterprise Design Patterns Vol-III By Mark Grand, Wiley DreamTech.
4. Head First Design Patterns By Eric Freeman-Oreilly-spd
5. Design Patterns Explained By Alan Shalloway,Pearson Education.
6. Pattern Oriented Software Architecture, F.Buschmann&others, John Wiley & Sons

Web References:

https://elearn.nptel.ac.in/shop/iit-workshops/completed/cloud-architecture-design-patterns-pc-oncloud/
https://www.youtube.com/watch?v=1xUz1fp23TQ

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Business Intelligence

(Common to CSE, AI&ML, DS, CS)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0536b	4: 0:0:0	4	CIE: 30 SEE:70	3 Hours	Honors

Course Objectives:

- To learn the Introduction to Data mining and R Basic Statistical Techniques.
- To learn the Data Preparation and Exploration Visualization Techniques
- To learn the Introduction to Supervised Learning Methods.
- Study the performance of Classification & Regression.
- Study the performance of Logistic Regression Artificial Neural Networks.

Course Outcomes (COS):

After completion of the course, students will be able to:

- Understand the basic concepts of Data mining and R Basic Statistical Techniques.
- Determine the Data Preparation and Exploration Visualization Techniques.
- Determine the Supervised Learning Methods.
- Analyze the Classification & Regression in Business Analytics.
- Analyze the Logistic Regression Artificial Neural Networks.
- Analyze the Wrap Up Artificial Neural Networks Discriminate Analysis

Syllabus		Total Hours:48
Module- I	**Introduction to Data mining and R Basic Statistical Techniques.**	**12Hrs**
General Overview of Data Mining and its Components Introduction and Data Mining Process Introduction to R Basic Statistical Techniques. Data Preparation and Exploration Visualization Techniques		
Module-II	**Data Preparation and Exploration Visualization Techniques**	**9Hrs**
Data Preparation and Exploration Visualization Techniques Dimension Reduction Techniques Principal Component Analysis. Performance Metrics and Assessment Performance Metrics for Prediction and Classification.		
Module-III	**Introduction to Supervised Learning Methods**	**9Hrs**
Supervised Learning Methods Multiple Linear Regression. Supervised Learning Methods Naive Bayes.		
Module-IV	**Classification & Regression**	**9Hrs**
SupervisedLearningMethodsClassification&RegressionTrees.SupervisedLearning Methods Logistic Regression**.**		
Module-V	**Logistic Regression Artificial Neural Networks**	**9Hrs**
Supervised Learning Methods Logistic Regression Artificial Neural Networks. Supervised Learning Methods and Wrap Up Artificial Neural Networks Discriminant Analysis**.**		

Textbooks:

1. Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data by EMC Education Services(2015)

Reference Books:

1.DataMiningforBusinessIntelligence:Concepts,Techniques,andApplicationsinMicrosoft Office Excel with XLMiner by Shmueli, G., Patel, N. R., & Bruce, P.C.(2010)

Web Reference:

https://archive.nptel.ac.in/courses/110/105/110105089/
https://nptel.ac.in/courses/110107092
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Block Chain Technology

(Common to CSE, AI&ML, DS, CS)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0535a	3:0:0:0	3	CIE:30 SEE:70	3 Hours	PEC

Course Objectives:

This course will enable students to:

- Illustrate the fundamental concepts of black chain.
- Determine the crypto currency primitives.
- Compare and contrast the bit coins and Crypto currency
- Illustrate the different security features

Course Outcomes (CO):

On completion of this course, student will be able to

- Describe the basic concepts and technology used for block chain.
- Describe the primitives of the distributed computing and cryptography related to block chain.
- Illustrate the concepts of Bit coin and their usage.
- Implement Ethereum block chain contract.
- Apply security features in blockchain technologies.
- Use smart contract in real world applications.

Syllabus — **Total Hours:48**

Module-I	Introduction	9Hrs

Need for Distributed Record Keeping, Modeling faults and adversaries, Byzantine Generals problem, Consensus algorithms and their scalability problems, Nakamoto's concept with Block chain based crypto currency, Technologies Borrowed in Block chain – hash pointers, consensus, byzantine fault- tolerant distributed computing, digital cash etc

Module-II	Basic Distributed Computing & Crypto primitives:	10Hrs

Atomic Broadcast, Consensus, Byzantine Models of fault tolerance, Hash functions, Puzzle friendly Hash, Collison resistant hash, digital signatures, public key crypto, verifiable random functions, Zero-knowledge systems

Module-III	Bitcoin basics	10Hrs

Bitcoin blockchain, Challenges and solutions, proof of work, Proof of stake, alternatives to Bitcoin consensus, Bitcoin scripting language and their use

Module-IV	Ethereum basics:	10Hrs

Ethereum and Smart Contracts, The Turing Completeness of Smart Contract Languages and verification challenges, Using smart contracts to enforce legal contracts, comparing Bitcoin scripting vs. Ethereum Smart Contracts, Writing smart contracts using Solidity & JavaScript

Module-V	Privacy, Security issues in Block chain:	9Hrs

Pseudo-anonymity vs. anonymity, Zcash and Zk-SNARKS for anonymity preservation, attacks on Block chains: Sybil attacks, selfish mining, 51% attacks advent of algorand; Sharding based consensus algorithms to prevent these attacks

Text Books:

1. Josh Thompson, 'Block chain: The Block chain for Beginnings, Guild to Block chain Technology and Block chain Programming', Create Space Independent Publishing Platform, 2017.
2. Narayanan, Bonneau, Felten, Miller and Gold feder, "Bitcoin and Crypto currency Technologies – A Comprehensive Introduction", Princeton University Press.

Reference Books:

1. Imran Bashir, "Mastering Block chain: Distributed ledger technology, decentralization, and smart contracts explained", Packt Publishing.
2. Merunas Grincalaitis, "Mastering Ethereum: Implement Advanced Block chain Applications Using Ethereum-supported Tools, Services, and Protocols", Packet Publishing.

Web References:

1. https://onlinecourses.nptel.ac.in/noc22_cs44/preview
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SMART GRID

(Common **to CSE, AI&ML, CS, DS, ECE, EEE, ME**)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0241Ta	3:0:0:0	3	CIE:30 SEE:70	3 Hours	OEC

Course Objectives:

Student will be able to

- Overview of the technologies required for the smart grid
- Switching techniques and different means for data communication
- Standards for information exchange and smart metering
- Methods used for information security on smart grid
- Smart metering and protocols for smart metering
- Power quality management with upgraded technologies.

Course Outcomes (CO):

On completion of this course, student will be able to

- Understand the concepts and design of Smart grid.
- Understand the various communication technologies in smart grid.
- Understand the various measurement technologies in smart grid.
- Understand the analysis and stability of smart grid.
- Learn the renewable energy resources and storages integrated with smart grid.
- familiarize the high performance computing for Smart Grid applications

Syllabus		Total Hours: 48
Module-I	**INTRODUCTION TO SMART GRID**	**10 Hrs**

Evolution of Electric Grid, Concept, Definitions and Need for Smart Grid, Smart grid drivers, functions, opportunities, challenges and benefits, Difference between conventional & Smart Grid, Concept of Resilient &Self-Healing Grid, Present development & International policies in Smart Grid, Diverse perspectives from experts and global Smart Grid initiatives

Module-II	SMART GRID TECHNOLOGIES	8 Hrs

Technology Drivers, Smart energy resources, Smart substations, Substation Automation, Feeder Automation ,Transmission systems: EMS, FACTS and HVDC, Wide area monitoring, Protection and control, Distribution systems: DMS, Volt/VAR control, Fault Detection, Isolation and service restoration, Outage management, High Efficiency Distribution Transformers, Phase Shifting Transformers, Plug in Hybrid Electric Vehicles (PHEV).

Module–III	SMART METERS	10 Hrs

Introduction to Smart Meters, Advanced Metering infrastructure (AMI) drivers and benefits, AMI protocols, standards and initiatives, AMI needs in the smart grid, Phasor Measurement Unit(PMU),

Intelligent Electronic Devices (IED) & their application for monitoring & protection.

Module-IV	POWER QUALITY MANAGEMENT IN SMART GRID	10 Hrs

Power Quality & EMC in Smart Grid, Power Quality issues of Grid connected Renewable Energy Sources, Power Quality Conditioners for Smart Grid, Web based Power Quality monitoring, Power Quality Audit.

Module–V	**HIGH PERFORMANCE COMPUTING**	**10 Hrs**

Local Area Network (LAN), House Area Network (HAN), Wide Area Network (WAN), Broad band over Power line (BPL), IP based Protocols, Basics of Web Service and CLOUD Computing to make Smart Grids smarter, Cyber Security for Smart Grid.

Textbooks:

1. Smart Grid, Janaka Ekanayake, Liyanage, Wu, Akihiko Yokoyama, Jenkins, Wiley Publications, 2012, Reprint 2015.
2. Smart Grid: Fundamentals of Design and Analysis, James Momoh, Wiley, IEEE Press., 2012, Reprint 2016.

Reference Books:

1. The Smart Grid – Enabling Energy efficiency and demand response, Clark W. Gellings, P.E., CRC Press, Taylor & Francis group, First Indian Reprint. 2015.
2. Smart Grid – Applications, Communications, and Security Edited by Lars Torsten Berger, Krzysztof Iniewski, WILEY, 2012, Reprint 2015.
3. Practical Electrical Network Automation and Communication Systems, Cobus Strauss, ELSVIER, 2003

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Ph. No. 08622-212769, E-Mail: geethanjali@gist.edu.in, Website: www.gist.edu.in

BASIC VLSI DESIGN

(Common **to CSE, AI&ML, CS, DS, ECE, EEE, ME**)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0432T	3:0:0	3	CIE:30 SEE:70	3 Hours	OEC

Course Objectives:

- To give exposure to different steps involved in fabrication Process of PMOS & NMOS transistors, CMOS & BICOM Inverters.
- To provide knowledge on electrical properties of MOS & BICMOS devices to analyze the behaviour of inverters designed with various loads.
- To provide knowledge on Basic Circuit Concepts of VLSI Design
- To apply the design Rules and draw layout of a given logic circuit and basic circuit concepts to MOS circuits.
- To Apply the design for testability methods for combinational & sequential CMOS circuits

Course Outcomes:

After the completion of the course students will able to:

- Acquire qualitative knowledge about the fabrication process of integrated circuit using MOS transistors.
- Understand the concept of Basic Electrical Properties of MOS/Bi-CMOS Devices
- Apply the basic circuit concepts to MOS circuits.
- Understand the concept of Scaling of MOS circuits and Limitations of Scaling
- Apply the design Rules to draw the Stick diagram &layout of a given logic circuit.
- Interpret the need for testability and testing methods in VLSI.

Syllabus		**Total Hours: 48**
Module–I:	**Introduction to Fabrication Process**	**10Hrs**

Introduction: Brief Introduction to IC technology, Moore's Law, Different modes MOSFET operation, Fabrication Process of PMOS, NMOS, CMOS & Bi-CMOS devices, Comparison between CMOS and Bi-polar Technologies.

Fabrication Steps: Wafer Preparation, Oxidation, Photolithography, Etching, Ion Implantations, Metallization, Testing.

Module– II	**Basic Electrical Properties of MOS/BiCMOS devices**	**10 Hrs**

Basic Electrical Properties: Ids Vs Vds relationships, MOS transistor Threshold Voltage-VT, figure of merit-ω0, Trans-conductance - gm, Output conductance-gds, Pass transistor logic, NMOS Inverter, Pull-up to Pull-down Ratio for NMOS inverter driven by another NMOS inverter, and through one or more pass transistors Various pull ups, CMOS Inverter analysis and design, Bi-CMOS Inverters.

Module– III	**Basic Circuit Concepts**	**9Hrs**

Basic Circuit Concepts: Sheet Resistance Rs and concepts to MOS, Area Capacitances calculations, Inverter Delays, Driving large Capacitive Loads, Wiring Capacitances, Fan-in and fan-out

Module– IV	VLSI Circuit Design Processes	10Hrs
VLSI Design Flow, MOS Layers, Stick Diagrams, Design Rules and Layout, Lambda(λ)-based design rules for wires, contacts and Transistors, Layout Diagrams for NMOS and CMOS Inverters Logic Gates and Various MOS Circuits. Scaling of MOS circuits, Limitations of Scaling.		
Module– V	**CMOS Testing**	**9Hrs**
CAD Tools for Design and Simulation, Aspects of Design Tools, Design for Testability, Testing Combinational Logic, Testing Sequential Logic, Practical Design for Test (OFT) Guidelines, Scan Design Techniques, Built-In-Self-Test (BIST), Future Trends.		

Text Books:

1. Kamran Eshraghian, "Essentials of VLSI Circuits and Systems", Douglas and A. Pucknell and SholehEshraghian, Prentice-Hall of India Private Limited, 2005 Edition.
2. Behzad Razavi , "Design of Analog CMOS Integrated Circuits", McGraw Hill, 2003
3. Modern VLSI Design – Wayne Wolf, 3 Ed., 1997, Pearson Education.

References Books:

1. Jan M. Rabaey, "Digital Integrated Circuits", AnanthaChandrakasan and Borivoje Nikolic, Prentice-Hall of India Pvt.Ltd, 2nd edition, 2009.
2. John P. Uyemura, "Introduction to VLSI Circuits and Systems", John Wiley & Sons, reprint 2009
3. CMOS VLSI Design-A Circuits and Systems Perspective, Neil H.E Weste, David Harris, Ayan Banerjee, 3rd Edn, Pearson, 2009.

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DISASTERMANAGEMENT

(Common **to CSE, AI&ML, CS, DS, ECE, EEE, ME**)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0151T	3:0:0:0	3	CIE:30 SEE:70	3 Hours	OEC

Course Objectives:

- Develop an understanding of why and how the modern disaster manager is involved with pre-disaster and post-disaster activities.
- Develop an awareness of the chronological phases of natural disaster response and refugee relief operations
- Describe the three planning strategies useful in mitigation
- Describe public awareness and economic incentive possibilities
- Understand the tools of post-disaster management

Course Outcomes:

On completion of this course, student will be able to

- To know about the natural hazards and its management
- To know about the fire hazards and solid waste management
- To understand about the emerging infectious diseases and aids their management
- To know about the regulations of building codes and land use planning related to risk and vulnerability.
- To impart the education related to risk reduction in schools and communities

Syllabus		Total Hours: 48
Module-I	**NATURAL HAZARDS AND DISASTER MANAGEMENT**	**9 Hrs**

Introduction of DM – Inter disciplinary -nature of the subject– Disaster Management cycle – Five priorities for action. Case study methods of the following: floods, draughts – Earthquakes – global warming, cyclones & Tsunamis – Post Tsunami hazards along the Indian coast – landslides

Module-II	MAN MADE DISASTER	9 Hrs

Fire hazards – transport hazard dynamics – solid waste management – post disaster – bio terrotirism - threat in mega cities, rail and air craft's accidents, and Emerging infectious diseases & Aids and their management.

Module–III	RISK AND VULNERABILITY	10 Hrs

Building codes and land use planning – social vulnerability – environmental vulnerability – Macroeconomic management and sustainable development, climate change risk rendition – financial management of disaster – related losses.

Module –IV	ROLE OF TECHNOLOGY IN DISASTER MANAGEMENTS	10 Hrs
Disaster management for infra structures, taxonomy of infra structure – treatment plants and process facilities-electrical substations roads and bridges- mitigation programme for earth quakes –flowchart, geospatial information in agriculture drought assessment-multimedia technology in disaster risk management and training- transformable indigenous knowledge in disaster reduction.		
Module–V	**EDUCATION AND COMMUNITY PREPAREDNESS**	**10 Hrs**
Education in disaster risk reduction-Essentials of school disaster education-Community capacity and disaster resilience-Community based disaster recovery -Community based disaster management and social capital-Designing resilience- building community capacity for action.		

Text Books:

1. Rajib shah & R R Krishnamurthy "Disaster Management" – Global Challenges and Local Solutions' Universities press. (2009),
2. Tushar Bhattacharya, "Disaster Science & Management" Tata McGraw Hill Education Pvt. Ltd., New Delhi

Reference Books:

1. Harsh. K . Gupta "Disaster Management edited", Universities press, 2003.

Web Reference:

1. https://www.youtube.com/watch?v=DExlZTfKZAM&list=PLC4PaTsQiLcbejXqJR7S59Ohk2OK1rgEG

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3rd Mile, Bombay Highway, Gangavaram (V), Kovur(M), SPSR Nellore (Dt), Andhra Pradesh, India- 524137
Ph. No. 08622-212769, E-Mail: geethanjali@gist.edu.in, Website: www.gist.edu.in

MEASUREMENTS AND MECHATRONICS
(Common **to CSE, AI&ML, CS, DS, ECE, EEE, ME**)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0327Tc	3:0:0:0	3	CIE:30 SEE:70	3 Hours	OEC

Course Objectives:

- Toinstruct the principles of interchangeable manufacture.
- To introduce basic principles of mechanical measurements.
- To impart knowledge on mechatronics systems.

Course Outcomes:

Upon successful completion of the course, the students will be able to

- design the limit gauges for interchangeable manufacture.
- apply the basic principles of mechanical measurements for engineering practice.
- illustrate the role of mechatronics systems in manufacturing.
- explain principles of mechanical, hydraulic, pneumatic and electrical actuating systems.

Syllabus		Total Hours: 48
Module-I	**Limits & Fits**	**10Hrs**

Introduction, terminology pertaining to limits and fits – unilateral and bilateral tolerance system, hole and shaft basis systems – Interchangeability, deterministic & statistical tolerance, selective assembly. International Standard system of limits and fits

Limit Gauges: Taylor's principle – Classification and design of limit gauges.

Module-II	**Linear and Angular Measurements**	**10Hrs**

Line and end standards, slip gauges and length bars. bevel protractor – angle slip gauges – spirit levels and auto collimator.

Interferometry Applied to Measurement: NPL flatness interferometer and NPL gauge interferometer.

Surface Roughness Measurement: Differences between surface roughness and surface waviness- Numerical assessment of surface finish – CLA, R.M.S, Rz values, Methods of measurement of surface finish – Profilograph, Talysurf

Module-III	**Mechanical Measurements**	**10Hrs**

Introduction to measurement: Elements of generalized measurement system
Displacement Measurement- Linear Variable Differential Transformer (LVDT), encoders, potentiometers.
Temperature Measurement - Pyrometers, Resistance Temperature Detector (RTD)
Strain Measurement-Electrical strain gauge – gauge factor – method of usage of resistance strain gauge

Module-IV	Mechatronics Systems	10 Hrs
Mechatronics systems- Elements of mechatronics system, mechatronics design process, system - measurement systems, control systems, programmable logic controllers, case studies of mechatronic systems		
Module-V	**Actuating Systems:**	**8Hrs**
Hydraulic and pneumatic actuating systems - fluid systems, hydraulic systems, and pneumatic systems, components, control valves. mechanical actuating systems and electrical actuating systems – basic principles and elements.		

Textbooks:

1. R.K. Jain, "Engineering Metrology", Khanna Publishers.
2. BeckWith, Marangoni, Linehard, "Mechanical Measurements", 6th edition,PHI / PE.
3. W. Bolton , "Mechatronics – Electronic Control Systems in Mechanical and Electrical Engg.", 4th Edition, Pearson, 2012.

Reference Books:

1. IC Guptha,"Engineering Metrology ",Danpath Rai Publications.
2. Doeblin Earnest. O. Adaptation by Manik and Dhanesh,"Measurement Systems: Application and Design", Tata Mc Graw Hill Publications.

Web Reference:

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3rd Mile, Bombay Highway, Gangavaram (V), Kovur(M), SPSR Nellore (Dt), Andhra Pradesh, India- 524137

Ph. No. 08622-212769, E-Mail: geethanjali@gist.edu.in, Website: www.gist.edu.in

ELECTRIC VEHICLES
(Common to all Except EEE)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0232Ta	3:0:0:0	3	CIE:30 SEE:70	3 Hours	OEC

Course Objectives:

- Understand to Provide good foundation on hybrid and electrical vehicles.
- Understand To address the underlying concepts and methods behind power transmission in hybrid and electrical vehicles
- Familiarize energy storage systems for electrical and hybrid transportation
- Design and develop basic schemes of electric vehicles and hybrid electric vehicles.

Course Outcomes (CO):

On completion of this course, student will be able to

- Understand the working of hybrid and electric vehicles
- Apply a suitable drive scheme for developing an hybrid and electric vehicles depending on resources
- Develop the electric propulsion unit and its control for application of electric vehicles.
- Understand the proper energy storage systems for vehicle applications
- Design and develop basic schemes of electric vehicles and hybrid electric vehicles

Syllabus		Total Hours:48
Module–I	**Electric Vehicle Propulsion and Energy Sources**	**10 Hrs**

Introduction to electric vehicles, vehicle mechanics - kinetics and dynamics, roadway fundamentals propulsion system design - force velocity characteristics, calculation of tractive power and energy required, electric vehicle power source - battery capacity, state of charge and discharge, specific energy, specific power, Ragone plot. battery modeling - run time battery model, first principle model, battery management system- soc measurement, battery cell balancing. Traction batteries - nickel metal hydride battery, Li-Ion, Lipolymer battery.

Module–II	**Electric Vehicle Power Plant and Drives**	**10Hrs**

Introduction electric vehicle power plants. Induction machines, permanent magnet machines, switch reluctance machines. Power electronic converters-DC/DC converters - buck boost converter, isolated DC/DC converter. Two quadrant chopper and switching modes. AC drives PWM, current control method. Switch reluctance machine drives - voltage control, current control.

Module–III	**Hybrid And Electric Drive Trains**	**9Hrs**

Introduction hybrid electric vehicles, history and social importance, impact of modern drive trains in energy supplies. Hybrid traction and electric traction. Hybrid and electric drive train topologies. Power flow control and energy efficiency analysis, configuration and control of DC motor drives and induction motor drives, permanent magnet motor drives, switch reluctance motor drives, drive system efficiency.

Module–IV	Electric and Hybrid Vehicles - Case Studies	9 Hrs
Parallel hybrid, series hybrid -charge sustaining, charge depleting. Hybrid vehicle case study – Toyota Prius, Honda Insight, Chevrolet Volt. 42 V system for traction applications. Lightly hybridized vehicles and low voltage systems. Electric vehicle case study - GM EV1, Nissan Leaf, Mitsubishi Miev. Hybrid electric heavy-duty vehicles, fuel cell heavy duty vehicles.		
Module–V	**Electric And Hybrid Vehicle Design**	**10Hrs**
Introduction to hybrid vehicle design. Matching the electric machine and the internal combustion engine. Sizing of propulsion motor, power electronics, drive system. Selection of energy storage technology, communications, supporting subsystem. Energy management strategies in hybrid and electric vehicles - energy management strategies- classification, comparison, implementation.		

Text Books:

1. Iqbal Hussein, "Electric and Hybrid Vehicles: Design Fundamentals", 2nd edition, CRC Press, 2003.
2. Amir Khajepour, M. Saber Fallah, Avesta Goodarzi, "Electric and Hybrid Vehicles: Technologies, Modeling and Control - A Mechatronic Approach", illustrated edition, John Wiley & Sons, 2014.
3. Mehrdad Ehsani, YimiGao, Sebastian E. Gay, Ali Emadi, "Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design", CRC Press, 2004.

Reference Books:

1. James Larminie, John Lowry, "Electric Vehicle Technology", Explained, Wiley, 2003.
2. John G. Hayes, G. Abas Goodarzi, "Electric Powertrain: Energy Systems, Power Electronics and Drives for Hybrid, Electric and Fuel Cell Vehicles", 1st edition, WileyBlackwell, 2018.

Web References:

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INDUSTRIAL ELECTRONICS
Common to (EEE, CSE, AI&ML, IT, CS, DS)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0433T	3:0:0:0	3	CIE:30 SEE:70	3 Hours	OEC

Course Objectives:

This course will enable students to:

- Describe semi-conductor devices (such as PN junction diode & Transistor) and their switching characteristics.
- Understand the characteristics of AC to DC converters.
- Understand about the practical applications Electronics in industries.
- Describe the ultrasonic and its application.

Course Outcomes (CO):

On completion of this course, student will be able to

- Understand the semi-conductor devices and their switching characteristics.
- Apply the Ultrasonic waves with different applications.
- Understand the working of Transistor and its different configurations.
- Analyze the thermal effects of ultrasonic, soldering and welding by ultrasonic, ultrasonic Drying in the industry; interpret the characteristics of AC to DC converters.
- Develop the practical applications Electronics in industries.
- Apply the process of Resistance welding, Induction heating and Dielectric heating in the industry.

Syllabus		Total Hours:48
Module-I	**Scope of industrial Electronics**	**10Hrs**

Scope of industrial Electronics, Semiconductors, Merits of semiconductors, crystalline structure, Intrinsic semiconductors, Extrinsic semiconductors, current flow in semiconductor, Open circuited p-n junction, Diode resistance, Zener diode, Photo conductors and junction photo diodes, Photo voltaic effect, Light emitting diodes(LED).

Module-II	Junction Transistor	9Hrs

Introduction, The junction transistor, Conventions for polarities of voltages and currents, Open circuited transistor, Transistor biased in the active region, Current components in transistors, Currents in a transistor, Emitter efficiency, Transport factor and transistor-α, Dynamic emitter resistance, Transistor as an amplifier, Transistor construction, Letter symbols for semiconductor Devices, Characteristic curves of junction transistor in common configuration, static characteristic curves of PNP junction transistor in common emitter configuration, The transistor in common collector Configuration.

Module-III	AC to DC converters	10Hrs

AC to DC converters- Introduction, Classification of Rectifiers, Half wave Rectifiers, Full wave Rectifiers, Comparison of Half wave and full wave rectifiers, Bridge Rectifiers, Bridge Rectifier

meter, Voltage multiplying Rectifier circuits, Capacitor filter, LC Filter, Metal Rectifiers, Regulated Power Supplies, Classification of Voltage Regulators, Short period Accuracy of Regulators, Long period .Accuracy of Voltage Regulator, Principle of automatic voltage Regulator, Simple D.C. Voltage stabilizer using Zener diode, D.C. Voltage Regulators, Series Voltage Regulators, Complete series voltage regulator circuit, Simple series voltage regulator.

Module-IV	Resistance welding controls	10Hrs

Resistance welding controls: Introduction, Resistance welding process, Basic Circuit for A.C. resistance welding, Types of Resistance welding, electronic welding control used in Resistance welding, Energy storage welding. Induction heating: Principle of induction heating, Theory of Induction heating merits of induction heating, Application of induction heating, High frequency power source of induction heating. Dielectric heating: Principle of dielectric heating, theory of dielectric heating, dielectric properties of typical materials, electrodes used in dielectric heating, method of coupling of electrodes to the R.F. generator, Thermal losses in Dielectric heating, Applications.

Module-V	Ultrasonics	9Hrs

Ultrasonics: Introduction, Generation of Ultrasonic waves, Application of Ultrasonic waves, Ultrasonic stroboscope, ultrasonic as means of communication, ultrasonic flaw detection, Optical image on non-homogeneities, ultrasonic study of structure of matter, Dispersive study of structure of matter, Dispersive and colloidal effect of Ultrasonic, Coagulating action of Ultrasonic, separation of mixtures by ultrasonic waves, cutting and machining of hard materials by ultrasonic vibrations, Degassing of liquids by ultrasonic waves, Physio-chemical effects of ultrasonics, chemical effects of ultrasonics, Thermal effects of ultrasonics, soldering and welding by ultrasonics, Ultrasonic Drying

Text Books:

1. Fundamentals of Industrial Electronics, Bogdan M Wilamowski, J David irwin, 2nd Edition, 2011.
2. Industrial and Power Electronics – G. K. Mithal and Maneesha Gupta, Khanna Publishers, 19th Ed., 2003.
3. Integrated Electronics – J. Millman and C.C Halkias, McGraw Hill, 1972.

References:

1. Electronic Devices and circuits – Theodore. H. Bogart, Pearson Education, 6th Edn., 2003.
2. Integrated Circuits and Semiconductor Devices – Deboo and Burroughs, ISE

Web References:

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CONSTRUCTION MANAGEMENT
(ME, CSE, AI&ML, CS, DS, ECE, EEE)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0152T	3:0:0:0	3	CIE:30 SEE:70	3 Hours	OEC

Course Objectives:

This course will enable students to:

- To make the student familiar with various construction activities, preparing construction schedule and maintaining documents and records of those activities
- To teach the students about various terms and technologies involved in earthwork of construction activities
- To make the students familiar with concepts involved in project management like bar charts and milestone charts
- To teach the students the concepts of time estimates involved in CPM and PERT , float and slack, critical path calculations

Course Outcomes (CO):

On completion of this course, student will be able to

- Identify the various construction activities like preparing construction schedule and maintaining documents and records of those activities
- Understand the concepts and techniques involved in earthwork activities
- To understand about the emerging infectious diseases and aids their management
- Understand the steps involved in developing a project scheduling and management and the application of bar charts and milestone charts.
- Understand the various elements of a network diagram like event, activity and dummy.
- Understand the concepts of calculation of time estimates of CPM and PERT

Syllabus		Total Hours:48
Module-I	**FUNDAMENTALS OF CONSTRUCTION TECHNOLOGY**	**9 Hrs**

Definitions and Discussion – Construction Activities –Construction Processes -Construction Works – Construction Estimating – Construction Schedule – Productivity and Mechanized Construction – Construction Documents – Construction Records – Quality – Safety – Codes and Regulations.

Module-II	EARTHWORK	9 Hrs

Classification of Soils – Project Site – Development – Setting Out - Mechanized Excavation – Groundwater Control – Trenchless (No-dig) Technology – Grading – Dredging. Rock Excavation – Basic Mechanics of Breakage – Blasting Theory – Drillability of Rocks – Kinds of Drilling – Selection of the Drilling Method and Equipment – Explosives – Blasting Patterns and Firing Sequence – Smooth Blasting – Environmental Effect of Blasting

Module-III	PROJECT MANAGEMENT AND BAR CHARTS AND MILESTONE CHARTS	10 Hrs
Project planning – Scheduling – Controlling – Role of decision in project management – Techniques for analyzing alternatives Operation research – Methods of planning and programming problems – Development of bar chart – Illustrative examples – Shortcomings of bar charts and remedial measures – Milestone charts		
Module-IV	**ELEMENTS OF NETWORK AND DEVELOPMENT OF NETWORK**	**10 Hrs**
Introduction – Event – Activity – Dummy – Network rules – Graphical guidelines for network – Common partial situations in network – Numbering the events – Cycles Problems.		
Module-V	**PERT AND CPM**	**10Hrs**
Time estimates – Frequency distribution – Mean, variance and standard deviation-Expected time Problems -Earliest expected time – Formulation for TE - Latest allowable occurrence time – Formulation for TL - Combined tabular computations for TE and TL problems Introduction - Slack – Critical path-Illustrative examples Problems.		

Text Books:

1. Construction project management by Jha ,Pearson publications, New Delhi 2nd Edition 2015
2. Construction Technology by SubirK.Sarkar and Subhajit Saraswati – Oxford Higher Education Univ.Press, Delhi 2008 edition
3. Project Planning and Controlwith PERT and CPM byDr.B.C.Punmia, K.K.Khandelwal, Lakshmi Publications New Delhi 2022 edition Delhi

Reference Books:

1. Optimal design of water distribution networks P.R.Bhave, Narosa Publishing house 2003.
2. Total Project management, the Indian context- by : P.K.JOY- Mac Millan Publishers India Limited.

Web Reference:

1. **https://nptel.ac.in/courses/105104161**

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Ph. No. 08622-212769, E-Mail: geethanjali@gist.edu.in, Website: www.gist.edu.in

Introduction to Robotics					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0331Tc	**3:0:0:0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**PEC**

Course Objectives:

The objectives of this course are Identify robots and its peripherals for satisfactory operation and control of robots for industrial and non-industrial applications.

Course Outcomes (CO):

After the completion of the course students will able to

1. List and explain the basic elements of industrial robots
2. Analyze robot kinematics and its control methods.
3. Classify the various sensors used in robots for better performance.
4. Summarize various industrial and non-industrial applications of robots

Syllabus		**Total Hours:48**
Module-I	**ROBOT BASICS**	**10Hrs**

Automation and Robotics: Robot-Basic concepts, Need, Law, History, Anatomy, specifications. Robot configurations-cartesian, cylinder, polar and articulate. Robot wrist mechanism, Precision, accuracy, repeatability, work and volume of robot.

Module-II	**ROBOT ELEMENTS**	**10Hrs**

End effectors-Classification- Types of Mechanical actuation, Gripper design, Robot drive system Types, Position and velocity feedback devices-Robot joints and links-Types, Motion interpolation

Module-III	**ROBOT KINEMATICS AND CONTROL**	**9Hrs**

Robot kinematics – Basics of direct and inverse kinematics, Robot trajectories, 2D and 3D Transformation-Scaling, Rotation, Translation Homogeneous transformation. Control of robot manipulators – Point to point, Continuous Path Control, Robot programming

Module-IV	**ROBOT SENSORS**	**9Hrs**

Sensors in robot – Touch sensors -Tactile sensor – Proximity and range sensors. Force sensor-Light sensors, Pressure sensors, Introduction to Machine Vision and Artificial Intelligence.

Module-V	ROBOT APPLICATIONS	10Hrs

Industrial applications of robots-Medical, Household, Entertainment, Space, Underwater, Defense, Disaster management. Applications, Micro and Nanorobots, Future Applications.

Text Books:

1. Mikell P. Groover, Mitchell Weiss, Roger N Nagel, Nicholas G Odrey, "Industrial Robotics Technology,
2. Programming and Applications", Tata –McGraw Hill Pub. Co., 2008.
3. Deb.S.R and Sankha Deb, "Robotics Technology and Flexible Automation", Tata McGraw Hill Publishing Company Limited, 2010.

Reference Books:

1. Klafter.R.D, Chmielewski.T.A, and Noggin's., "Robot Engineering: An Integrated Approach"', Prentice Hall of India Pvt. Ltd., 1994.
2. Fu.K.S, Gonzalez.R.C&Lee.C.S.G, "Robotics control, sensing, vision and intelligence", Tata-McGraw Hill Pub. Co., 2008
3. Yu. "Industrial Robotics", MIR Publishers Moscow, 1985

Web References:

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Mobile Application Development

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0537	1: 0:2:0	2	CIE: 30SEE:70	3Hours	SC

Course Objectives:

This course will enable students:

- To understand fundamentals of android operating systems.
- Illustrate the various components, layouts and views in creating android applications
- To understand fundamentals of android programming

Course Outcomes (CO):

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

- Define Android OS, gradle, Android Studio.
- Construct mobile application on physical device and emulator
- Develop mobile applications with various widgets
- Design mobile applications with various layouts
- Build mobile application along with Media
- Design and develop menus in mobile applications

Syllabus — **Total Hours:48**

Introduction to Android: Introduction**,** Understanding the Android Software Stack, installing the Android, Creating Android Virtual Devices, Creating the First Android Project, Using the Android Emulator, The Android Debug Bridge(ADB), Launching Android Applications on a Handset

Task 1: Set Up Mobile Development Environment using Android

Task 2: Create "Hello World" Application

1. Create a new Android Project
2. Run "Hello World" on the Emulator
3. On a Physical Device

Basic Widgets :, Overview of the Android Project Files, Understanding Activities, Role of the Android Manifest File, Event Handling, Displaying Messages Through Toast, Using the Edit Text Control, Choosing Options with Checkbox, Choosing Mutually Exclusive Items Using Radio Buttons

Task 3: Create an application using Text Edit control

Task4: Create an application by choosing Options with Checkbox

Task5: Create an application by choosing Mutually Exclusive Items Using Radio Buttons

Layouts: Introduction to Layouts, Linear Layout, Relative Layout, Using Image View, Frame Layout, Table Layout

Task 6: Design an application using Relative Layout

Task 7: Design an application using Frame Layout

Selection widgets: Using List View, Using the Spinner control

Task 8: Create an application by choosing Options with List View

Task 9: Create an application by choosing Options with Spinner

Utilizing Media: Switching States with Toggle Buttons, Creating an Images Switcher Application, Playing Audio, Playing Video

Task 10: Create an application to play an Audio clip

Task 11: Create an application to play the Video clip

Building Menus : Creating Interface Menus, Types of menus, Creating Menus Through XML

Task 12: Create an application to display a Menu

Text Books:

1. Android Programming by B.M Harwani, Pearson Education, 2013.

Reference Books:

1. Professional Android 4 applications development, Reto Meier, Wiley India, 2012.
2. Beginning Android 4 applications development, Wei- Meng Lee, Wiley India,2013

Web References:

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Semester-8 (Project)							
Sl. No.	**Category**	**Course Code**	**Course Title**	**Hours per week**			**Credits**
				L	**T**	**P**	**C**
1	Major Project	22A3209	Project work/Internship in Industry	0	0	24	12
						Total credits	12