GURU KASHI UNIVERSITY

Post Graduate Diploma in Computer Application

Session: 2025-26

Faculty of Computing

Graduate Attributes of the Programme: -

Type of learning outcomes	**The Learning Outcomes Descriptors**
Graduates should be able to demonstrate the acquisition of:	
Learning outcomes that are specific to disciplinary/interdisciplinary areas of learning	Demonstrate advanced knowledge of programming, database systems, cloud computing, AI, machine learning, and cybersecurity.
	Apply scientific research methodology and software project management principles in IT-related research and development.
	Integrate concepts across domains such as data science, IoT, digital image processing, and blockchain to design innovative IT solutions.
	Design, develop, and evaluate complex software and data-driven systems using appropriate methodologies, tools, and modern computing platforms.
Generic learning outcomes	Communicate technical ideas clearly using oral, written, and visual forms.
	Exhibit critical thinking, ethical reasoning, and decision-making in professional settings.
	Develop entrepreneurial mindset, team collaboration skills, and adaptability to emerging technologies.

Programme Learning outcomes: Post Graduate Diploma in Computer Applications Certificate is awarded to students who have demonstrated the achievement of the outcomes located at level 4.5:

Element of the Descriptor	**Programme learning outcomes relating to PGDCA**
The graduates should be able to demonstrate the acquisition of:	
Knowledge and understanding	Understand core principles of programming, including languages like Python.
	Gain in-depth knowledge of database systems, data structures, software engineering, and computer architecture.
	Learn the fundamentals of digital electronics and computer networks.
	Develop awareness of web technologies and the Indian Knowledge System.
General, technical and professional skills required to perform and accomplish tasks	Design and implement basic to intermediate software systems.
	Create and manage relational databases effectively.
	Develop websites using foundational web technologies.
Application of knowledge and skills	Solve practical problems using appropriate programming languages and logic structures. Analyze and develop software applications integrating system components.
Generic learning outcomes	Communicate effectively in professional and academic settings. Work independently and collaboratively in teams. Demonstrate problem-solving, planning, and analytical thinking abilities.
Constitutional, humanistic, ethical, and moral values	Apply ethical standards in technology use and software development. Exhibit respect for cultural values and inclusiveness in computing environments. Develop awareness of environmental sustainability and responsible IT practices.
Employability and job-ready skills, and entrepreneurship skills and capabilities/qualities and mindset	Be prepared for roles such as junior software developer, database assistant, or web support executive. Demonstrate readiness to engage in entrepreneurial ventures or internships. Apply IT knowledge to small-scale professional

	environments or further studies.
Credit requirements	A student will be allowed an exit option after passing first academic year of the M.Sc. IT Programme with requisite 46 credits.
Entry requirements	All those candidates who have Passed any graduation degree of minimum 3 years' duration with Mathematics/Statistics/Business Mathematics/Business Statistics/ Quantitative Techniques as Compulsory/Optional/Additional Paper as one of the subjects either at 10+2 or graduation level. Having passed the BCA course of a minimum three year duration from any recognized University with at least 45% in the aggregate.

Program Structure of the Post Graduate Diploma in Computer Application

SEMESTER 1st									
Course Code	**Course Title**	**Type of course**	**L**	**T**	**P**	**Credits**	**Int**	**Ext**	**Total Marks**
CGA1400	Introduction to programming languages	Core	3	0	0	3	30	70	100
CGA1401	Relational Database Management Systems	Core	3	0	0	3	30	70	100
CGA1402	Computer System Architecture	Core	4	0	0	4	30	70	100
CGA1403	Software Engineering	Core	4	0	0	4	30	70	100
CGA1404	Introduction to programming languages Lab	Core	0	0	2	1	30	70	100
CGA1405	Relational Database Management Systems Lab	Core	0	0	2	1	30	70	100
IKS0021	Introduction to Indian Knowledge System	Indian Knowledge System	4	0	0	4	30	70	100
Discipline Elective I (Any one of the following)									
CGA1406	Data Warehousing and Data Mining	Discipline Elective I	4	0	0	4	30	70	100
CGA1407	IoT and Its Applications								
CGA1408	Software Project Management								
Total			**22**	**0**	**4**	**24**	**240**	**560**	**800**

SEMESTER 2nd									
Course Code	**Course Title**	**Type of course**	**L**	**T**	**P**	**Credits**	**Int**	**Ext**	**Total Marks**
CGA2450	Data Structures	Core	3	0	0	3	30	70	100
CGA2451	Programming Using Python	Core	3	0	0	3	30	70	100
CGA2452	Digital Electronics	Core	4	0	0	4	30	70	100
CGA2453	Computer Networks	Core	4	0	0	4	30	70	100
CGA2454	Data Structures Lab	Core	0	0	2	1	30	70	100
CGA2455	Programming Using Python Lab	Core	0	0	2	1	30	70	100
CGA2456	Web Technologies I	Employability & Entrepreneurship Skill	0	0	4	2	30	70	100
Discipline Elective II (Any one of the following)									
CGA2457	Machine Learning	Discipline Elective II	4	0	0	4	30	70	100
CGA2458	Data Visualization								
CGA2459	Natural Language Processing								
Total			**18**	**0**	**8**	**22**	**240**	**560**	**800**

SEMESTER-I

Course Title: Introduction to programming languages	**L**	**T**	**P**	**Cr.**
Course Code: CGA1400	**3**	**0**	**0**	**3**

Total Hours: 45

Learning Outcomes: After the Completion of this course the learner will able to

1. Describe all the basic concepts of C++ and its features such as composition of objects, Operator overloading.
2. Implement the various access modifiers in C++ programs.
3. Analyze inheritance with the understanding of early binding and late binding.
4. Analyze and explore various Stream classes, I/O operations and exception handling.

Course Content

UNIT I **10 Hours**

Programming Basics: Introduction to Programming, Programming Paradigms, Programming Languages and Types. Basic Program Structure, Execution flow charts of Program, Directives, Basic Input /Output, Advantages, Applications, Data Types, Control Structures, Operators and Expressions.

Introduction Structure, Execution flow, Classes and Objects, Access modifiers, Data Members, Member Functions, Inline Functions, Passing parameters to a Function (pass by Value, Pass by Address, Pass by Reference), Function with default arguments, Function Overloading, Object as a Parameter, Returning Object Static data members and functions, Constant Data members and functions

Constructors- Default, Parameterized, Copy, Constructor Overloading, Destructors Arrays, Array as a Class Member, Array of Objects, Strings String Class.

UNIT II **13 Hours**

Operator Overloading and Pointers: Operator Functions-Member and Non Member Functions, Friend Functions Overloading Unary operators Overloading binary operators(Arithmetic, Relational, Arithmetic Assignment, equality), Pointer and Address of Operator, Pointer to an Array and Array of Pointers, Pointer arithmetic, Pointer to a Constant and Constant Pointer, Pointer Initialization, Types of Pointers(void, null and dangling), Dynamic Memory Allocation, Advantages and Applications of pointers .

UNIT III **12 Hours**

Inheritance and Polymorphism: Inheritance Concept, protected modifier, Derivation of Inheritance- Public, Private and Protected,

Types of Inheritance-Simple, Multilevel, Hierarchical, Multiple, Hybrid, Constructors and Inheritance, Function Overriding and Member hiding Multiple Inheritance, Multipath inheritance – Ambiguities and solutions Polymorphism, Static and Dynamic Binding, Virtual Functions, Pure Virtual Functions, Virtual destructors, Abstract Classes, Interfaces

UNIT IV **10 Hours**

Streams and Exceptions: Files, Text and Binary Files, Stream Classes, File IO using Stream classes, File pointers, Error Streams, Random File Access, Manipulators, Overloading Insertion and extraction operators Error handling, Exceptions, Throwing and catching exceptions, Custom Exceptions, Built in exceptions , Casting- Static casts, Const Casts, Dynamic Casts, and Reinterpret Casts. Creating Libraries and header files. Namespaces Generic Programming, Templates, Class Templates, Function Templates, Template arguments.

Transactional modes

Lecture Method, E-Team Teaching, Video based learning, Demonstration, Peer Discussion, Open talk, Cooperative Teaching, Flipped Teaching, Collaborative Learning**.**

Suggested Readings

- *Kamthane, A. (2012). Programming in C++, 2/e. Pearson Education India.*
- *Salaria, R. S. (2016). Mastering Object-Oriented Programming with C++. KHANNA PUBLISHING HOUSE.*
- *Balagurusamy, E. (2001). Object-Oriented Programming with C++, 7e. McGraw-Hill Education.*

Course Title: Relational Database Management systems	L	T	P	Credits
Course Code: CGA1401	3	0	0	3

Total Hours: 45

Learning Outcomes: After the Completion of this course the learner will able to

1. Develops an Entity-Relationship model based on user requirements.
2. Implements the role of the database administrator and his responsibilities.
3. Apply Normalization techniques to normalize a database.
4. Declares and enforces integrity constraints on a database

Course Content

UNIT I **10 Hours**

Traditional file processing system: Characteristics, limitations, Database: Definition, composition. Database Management System: Definition, Characteristics, advantages over traditional file processing system, User of database, DBA and its responsibilities, Database schema, instance.

UNIT II **12 Hours**

DBMS architecture, data independence, mapping between different levels. Database languages: DDL, DML, DCL. Database utilities, Data Models, Keys: Super, candidate, primary, foreign.

UNIT III **13 Hours**

Entity relationship model: concepts, mapping cardinalities, entity relationship diagram, weak entity sets, strong entity set, aggregation, generalization, Overview of Network and Hierarchical model. Relational Data Model: concepts, constraints. Relational algebra: Basic operations, additional operations.

UNIT IV **10 Hours**

Database Design: Functional dependency, decomposition, problems arising out of bad database design, Normalization- Normal forms based on primary keys (1 NF, 2 NF, 3 NF, & BCNF), multi-valued dependency, Database design process, database protection, database integrity.

Database concurrency: Definition and problems arising out of concurrency.

Security and Authorization: Database Security Models, SQL Injection, Encryption Techniques. Transaction Management and Concurrency Control, Backup, Recovery, and Cloud Databases

Transactional modes

Lecture Method, E-Team Teaching, Video based learning, Demonstration, Peer Discussion, Open talk, Cooperative Teaching, Flipped Teaching, Collaborative Learning**.**

Suggested Readings

- *Ramakrishnan, R., Gehrke, J., &Gehrke, J. (2003). Database management systems (Vol. 3). New York: McGraw-Hill.KorthF. Henry. Database System Concepts, McGraw Hill.*
- *Dittrich, K. R., Gatziu, S., &Geppert, A. (1995, September). The active database management system manifesto: A rulebase of ADBMS features. In International Workshop on Rules in Database Systems (pp. 1-17). Springer, Berlin, Heidelberg.*

Course Title: Computer System Architecture	L	T	P	Credits
Course Code: CGA1402	4	0	0	4

Total Hours: 60

Learning Outcomes: After the Completion of the course the learner will be able to

1. Determine the designing process of combinational and sequential circuits.
2. Understanding of instruction pipelining and RISC architecture.
3. Simplify Boolean expressions.
4. Design basic Gates, Sequential & Combinational circuits.

Course Content

UNIT I **15 Hours**

Boolean Algebra: Boolean operations, Truth Tables, Boolean Laws, K-maps 2,3 and 4 variable maps, don't care about conditions).Basic Gates, Combinational logic design: half-adder, full adder, parallel adder.

UNIT II **15 Hours**

Sequential circuits: concept, flip-flops (D, RS, JK, T), counters (Ripple, Asynchronous, Synchronous). Instruction codes, Instruction formats, Instruction cycle, addressing modes.

UNIT III **15 Hours**

Register Transfer Language, Arithmetic, Logic and Shift micro-operations, Arithmetic Logic Shift Unit Control Memory: Design of control unit, Micro programmed and hardwired control unit (overview only), Features of RISC and CISC.

UNIT IV **15 Hours**

Memory hierarchy-cache and shared memory concepts-Cache memory organization-cache addressing models, Aliasing problem in cache, cache memory mapping techniques-Shared memory organization-Interleaved memory organization, Lower order interleaving, Higher order interleaving. Backplane bus systems-Bus addressing, arbitration and transaction.

Transaction Modes

Lecture Method, E-Team Teaching, Video based learning, Demonstration, Peer Discussion, Open talk, Cooperative Teaching, Flipped Teaching, Collaborative Learning**.**

Suggested Readings

- *M.M. Mano.Computer System Architecture. Third Edition, Prentice-Hall of India, 2002.*
- *A.S.Tanenbaum. (1999).Structured Computer Organisation. Prentice-Hall of India,*
- *William Stallings.(2002)Computer Organisation and Architecture. 6th Edition, Pearson Education.*

Course Title: Software Engineering	L	T	P	Credits
Course Code: CGA1403	4	0	0	4

Total Hours: 60

Learning Outcomes: After the Completion of the course the learner will be able to

1. Analyze and model customer's requirements and model its software design.
2. Estimate cost and efforts required in building software.
3. Analyze and compute impact of various risks involved in software development.
4. Design and build test cases, and to perform software testing.

Course Content

UNIT I **15 Hours**

Introduction: Software Engineering – A Layered Approach; Software Process – Process Framework, Umbrella Activities; Process Models – Waterfall Model, Incremental Model, and Evolutionary process Model (Prototyping, Spiral Model); Introduction to Agile – Agility Principles, Agile Model – Scrum.

Software Requirements Analysis and Specifications: Use Case Approach, Software Requirement Specification Document, Flow oriented Modeling, Data Flow Modeling, Sequence Diagrams.

UNIT II **15 Hours**

Design Modeling: Translating the Requirements model into the Design Model, The Design Process, Design Concepts – Abstraction, Modularity and Functional Independence; Architectural Mapping using Data Flow.

Software Metrics and Project Estimations: Function based Metrics, Software Measurement, Metrics for Software Quality; Software Project Estimation (FP based estimations, COCOMO II Model); Project Scheduling (Timeline charts, tracking the schedule).

UNIT III **15 Hours**

Quality Control and Risk Management: Quality Control and Quality Assurance, Software Process Assessment and Improvement Capability Maturity Model Integration (CMMI); Software Risks, Risk Identification, Risk Projection and Risk Refinement, Risk Mitigation, Monitoring and Management.

UNIT IV **15 Hours**

Testing and maintenance: Software Testing Techniques, Software testing fundamentals: objectives principles, testability; test case design, Unit testing: white box testing, basis path testing: Control structure testing: Black box

testing, testing for specialized environments, Software Reliability and Quality Assurance: Quality concepts, Software quality assurance: SQA activities; Software reviews; cost impact of software defects, defect amplification and removal; formal technical reviews: The review meeting, review reporting record keeping, review guidelines; Formal approaches to SQA;

Transaction Mode

Lecture Method, E-Team Teaching, Video based learning, Demonstration, Peer Discussion, Open talk, Cooperative Teaching, Flipped Teaching, Collaborative Learning**.**

Suggested Readings

- *Pressman Roger S, Software Engineering - A Practitioner's Approach, MGH, New Delhi, New Delhi. Publications, New Delhi.*
- *Ian Sommerville, Software Engineering, Pearson Education, 5th Edition, New Delhi*
- *Jalote Pankaj, An Integrated Approach to Software Engineering, NarosaPublications,New Delhi.*
- *Mall Rajib, Fundamentals of Software Engineering, PHI, New Delhi.*
- *Ali Bethforooz, Frederick J. Software Engineering Fundamentals, Hudson Oxford University.*

Course Title: Introductiton to Programming Languages Lab	L	T	P	Credits
Course Code: CGA1404	0	0	2	1

Total Hours: 30

Learning Outcomes: After the Completion of the course the learner will be able to

1. Design an algorithmic solution for a given problem.
2. Debug a given Program.
3. Identify solutions to a problem and apply control structures and use defined functions for solving the problem.
4. Implement Programs with pointers and arrays, perform pointer arithmetic, and use the pre-processor.

Course Content

1. Program to display Names, Roll No., and grades of 3 learner who have appeared in the examination. Declare the class of name, Roll No. and grade. Create an array of class objects. Read and display the contents of the array.
2. Program to swap two Characters of different data types using function +++++++++overloading.
3. Program to demonstrate the use of inline, friend functions and this keyword.
4. Program to implement static data members and member functions.
5. Program to implement Constructor and Destructor.
6. Program to demonstrate Constructor Overloading.
7. Program to calculate factorial using Copy Constructor.
8. Program to allocate & deallocate memory using new [ ] and delete [ ].
9. Program to demonstrate the use of function overloading.
10. Program to overload comparison operator operator== and operator !=.
11. Program to create an array of pointers.
12. Create a base class containing the data member roll number and name. Also create a member function to read and display the data using the concept of single level inheritance. Create a derived class that contains marks of two subjects and total marks as the data members.
13. Program to create multilevel inheritance. (Hint: Classes A1, A2, A3)
14. Program to demonstrate the concept of function overriding.
15. Program to demonstrate the use of virtual functions and polymorphism.
16. Program to demonstrate the use of pure virtual functions.
17. Program to demonstrate the concepts of abstract class.
18. Program to perform exception handling.
19. Program to copy the contents of one file to another file.
20. Program to create Generic Functions using Template.

Course Title: Relational Database Management Systems Lab	L	T	P	Credits
Course Code: CGA1405	0	0	2	1

Total Hours: 30

Learning Outcomes: After the Completion of the course the learner will be able to:

1. Populate and query a database using SQL DML/DDL commands.
2. Designs SQL queries to create database tables and make structural modifications.
3. Design the concept of inbuilt functions.
4. Implement the concept of join, views and indexes.

Course Content

1. Data Definition, Table Creation, Constraints,
2. Insert, Select Commands, Update and Delete Commands.
3. Nested Queries and Join Queries
4. Views
5. High level programming language extensions (Control structures, Procedures and Functions).
6. Front end Tools
7. Forms
8. Triggers
9. Menu Design
10. Reports
11. Database Design and implementation (Mini Project).

Course Title: Introduction to Indian Knowledge System	L	T	P	Credits
Course Code: IKS0021	4	0	0	4

Total hours:60

Learning Outcomes: After completion of this course, the learner will be able to:

1. Students undetrstand the various pramanas used in Indian Knowledge System.
2. They have been introduced to some fields of IKS like Astronomy, Arts, Ayurveda and Architecture.
3. They can explore the different fields of study in IKS further with the references and the resources provided during the course.
4. Gain a foundational understanding of the diverse disciplines within the Indian Knowledge Systems, including their philosophical underpinnings, historical development, and relevance to contemporary knowledge and practice.

Course Content

UNIT I **8 Hours**

Astronomy and Mathematics: Introduction to various fields in traditional Indian Knowledge system. Methods and sources. Ancient Indian Observational astronomy. Foundation concepts - nakṣatra, graha, time units, phenomena like meteors, eclipses. Mathematical thinking - numerical and spatial thinking, śulbasūtra, zero, sundials, water clock, time measurement.

UNIT II **7 Hours**

Language, Literature and Art: Formation of words in saṃskṛta and some ideas from Pāṇini and Patañjali. Technical words and examples of their usage. Music Vedic chants, sāma, some concepts in ancient treatises like nāradīyaśikṣā nāṭyaśāstra. Basics of related concepts like dance, meter and rasa in poetry.

UNIT III **8 Hours**

Earth and Atmosphere: Anomalous phenomena, Earthquakes, clouds, rainfall, soil, agriculture and food science.

Material science : Knowledge and use of various materials in āyurveda, rasaśāstra and vāstuvidyā.

UNIT IV **7 Hours**

Architecture and Civil Engineering: Sindhu-Sarasvatī cities, description in

purāṇa, arthaśāstra. A glance at selects texts like nāradaśilpa, mayamata, mānasāra.

Transaction Mode

Seminars, Group discussion, Team teaching, Focused group discussion, Assignments, Project-based learning, Simulations, reflection and Self-assessment

Suggested Readings

- *Dikshit, S. B. (1969, 1981). Bharatiya Jyotish Sastra (in Marathi) Poona (1896). (Transl. RV Vaidya, Vol.1). New Delhi: Government of India Press.*
- *Iyengar, R. N. (2016) Astronomy in Vedic texts, History of Indian Astronomy, A Handbook - Volume brought out on the occasion of IX International Conference on Oriental Astronomy November 14–18.*
- *Iyengar, R. N. (2013). Parāśara Tantra (Ed. Text, Trans. & Notes), Bangalore: Jain University Press.*
- *Iyengar, R. N.; Sudarshan, H.S. and Anand V (2019). Vrddhagārgīya Jyotiṣa (Part1). Tattvadīpaḥ, Journal of Academy of Sanskrit Research, Melkote, 25 (1). 60–81.*
- *Sastry T.S. K (Ed.). (1984). Vedānga Jyotiṣa of Lagadha, Indian Journal of History of Science, 4) Supplement, 1–74.*
- *Sen, S. N., and Shukla, K. S. (Ed.) (2000). History of Astronomy in India, 2nd Revised Edition. New Delhi: Indian National Science Academy.*
- *Thompson R.L. (2007) The Cosmology of the Bhāgavata Purāṇa (First Indian Edition) MLBD Publn. Delhi.*
- *Iyengar, R.N; Kannan K.S; Wakankar S. Y. (2018) Nārada Śilpaśāstra - Sanskrit Text on Architectural Civil Engineering, Jain University Press.*
- *Altekar A.S. (1944) Education in Ancient India.*

Course Title: Data warehousing and Data Mining	L	T	P	Credits
Course Code: CGA1406	4	0	0	4

Total Hours: 60

Learning Outcomes: After the Completion of the course the learner will be able to

1. Understand the functionality of various Data mining techniques.
2. Familiarize yourself with the process of data analysis, identifying the problems, and choosing the relevant models and algorithms to apply.
3. Identify the Classifications & Prediction Data Mining Techniques
4. Compare the classification Techniques.

Course Content

UNIT I **15 Hours**

Data Warehousing: Definition, Characteristics of a Data Warehouse, Data warehouse Usage, DBMS vs. Data warehouse.

Developing Data Warehouse: Data warehousing components, Steps and Crucial decisions for the design and construction of Data Warehouses, Three-tier Data warehouse architecture, Data Warehouse Implementation, Design, performance and technological considerations, Metadata.

UNIT II **15 Hours**

Developing Data Mart based Data warehouse: Types of data marts, Metadata for a data mart, Data model for a data mart, Maintenance of a data mart, Software components for a data mart, Performance issues, Security in data mart.

OLAP Systems: Types of OLAP, Relational vs. Multidimensional OLAP, Data modeling: Star schema, Snowflake schema, OLAP tools.

UNIT III **15 Hours**

Data Mining: Introduction to data mining, Data mining process, Major issues and Application of Data mining, Data preprocessing: Data cleaning, Data integration and transformation and Data reduction; Tools for data mining.

Data Mining Techniques: Association rules: Introduction, Market basket analysis, Frequent Pattern Mining algorithms: Apriori algorithm, Partition algorithm.

UNIT IV **15 Hours**

Classification and Prediction: Definition, Issues regarding Classification and Prediction, Classification by Decision Tree Induction, Support Vector

Machines, k-Nearest-Neighbour Prediction: Linear and Non-Linear Regression.

Clustering: Definition, Types of data in cluster analysis, Clustering paradigms: K-Means and K-Medoids, Mining Sequence patterns: Generalized Sequential Patterns(GSP) mining algorithm, Hidden Markov Model, Social Network Analysis.

Transaction Mode

Lecture Method, E-Team Teaching, Video based learning, Demonstration, Peer Discussion, Open talk, Cooperative Teaching, Flipped Teaching, Collaborative Learning**.**

Suggested Readings

- *Inmon, W. H., 2002: Building the Data Warehouse, John Wiley.*
- *Prabhu, C.S.R., 2010 : Data Warehousing, PHI.*
- *Jiawei Han, MichelineKamber, 2000: Data Mining: Concepts and Techniques, Morgan KoffmanElsvier.*
- *Pujari, Arun K, 2013 : Data Mining Techniques, Universities Press*

Course Title: IOT & Its Applications	L	T	P	Credits
Course Code: CGA1407	4	0	0	4

Total Hours: 60

Learning Outcomes: After the Completion of the course the learner will be able to

1. Identify the different types of sensors and devices used in IoT.
2. Understand the security and privacy challenges associated with IoT.
3. Compare and contrast different IoT platforms and architectures
4. Develop IoT prototypes using hardware and software components.

Course Content

UNIT I **15 Hours**

FUNDAMENTALS OF IoT- Evolution of Internet of Things, Enabling Technologies, M2M Communication, IoT World Forum (IoTWF) standardized architecture, Simplified IoT Architecture, Core IoT Functional Stack, Fog, Edge and Cloud in IoT, Functional blocks of an IoT ecosystem, Sensors, Actuators, Smart Objects and Connecting Smart Objects.

UNIT II **15 Hours**

IoT PROTOCOLS- IoT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.11ah and Lora WAN, Network Layer: IP versions, Constrained Nodes and Constrained Networks,6LoWPAN, Application Transport Methods: SCADA, Application Layer Protocols: CoAP and MQTT

UNIT III **15 Hours**

DESIGN AND DEVELOPMENT- Design Methodology, Embedded computing logic, Microcontroller, System on Chips, IoT system building blocks IoT Platform overview: Overview of IoT supported Hardware platforms such as: Raspberry pi, Arduino Board details

UNIT IV **15 Hours**

Data Analytics: Introduction, Structured Versus Unstructured Data, Data in Motion versus Data at Rest, IoT Data Analytics Challenges, Data Acquiring, Organizing in IoT/M2M

Supporting Services: Computing Using a Cloud Platform for IoT/M2M Applications/Services, Everything as a service and Cloud Service Models.

CASE STUDIES/INDUSTRIAL APPLICATIONS: IoT applications in home, infrastructures, buildings, security, Industries, Home appliances, other IoT electronic equipment, Industry 4.0 concepts.

Transaction Mode

Lecture Method, E-Team Teaching, Video based learning, Demonstration, Peer Discussion, Open talk, Cooperative Teaching, Flipped Teaching, Collaborative Learning**.**

Suggested Readings

- *David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry,Cisco (2017),IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, Press.*
- *ArshdeepBahga, Vijay Madisetti (2015),Internet of Things – A hands-on approach, Universities Press.*
- *Rajkamal, Internet of Things: Architecture, Design Principles and Applications, McGraw Hill Higher Education.*

Course Title: Software Project Management	L	T	P	Credits
Course Code: CGA1408	4	0	0	4

Total Hours: 60

Learning Outcomes: On completion of this course, the learner will able to

1. Identify the different project contexts and suggest an appropriate project management strategy.
2. Practice the role of project planning, risks associated in successful software development.
3. Understand the role of resource allocation and effort estimation in the project management process.
4. Learn to apply the concept of project management and planning to organize team and people's behavior.

Course Content

UNIT I **15 Hours**

Introduction to Software Project Management: Project Definition, Contract Management, Activities Covered by Software Project Management, Overview Of Project Planning, plan methods, methodology.

Project Evaluation: Strategic Assessment, Technical Assessment, Cost Benefit Analysis, Cash Flow Forecasting, Cost Benefit Evaluation Techniques, Risk Evaluation, selection of project approach: discussion on models, choice of process models.

UNIT II **15 Hours**

Activity Planning : Objectives, Project Schedule, Sequencing and Scheduling Activities, Network Planning Models, Forward Pass, Backward Pass, Activity Float, Shortening Project Duration, Activity on Arrow Networks,

Risk Management: Nature Of Risk, Types Of Risk, Managing Risk, Hazard Identification, Hazard Analysis, Risk Planning And Control.

UNIT III **15 Hours**

Monitoring and Control: Creating Framework, Collecting the Data, Visualizing Progress, Cost Monitoring, Earned Value analysis, Prioritizing Monitoring, Getting Project Back to Target, and Change Control.

Managing Contracts: Introduction, Types of Contract, Stages in Contract Placement, Typical Terms of a Contract, Contract Management, Acceptance.

Resource allocation: introduction and nature of resources, identification of resource requirements, scheduling, creating critical path, cost schedule, counting cost.

UNIT IV **15 Hours**

Effort estimation: basics of software estimation, techniques, COCOMO-II, cost, staffing pattern.

Managing People and Organizing Teams: Introduction, Understanding Behavior, Organizational Behavior: Background, Selecting The Right Person For The Job, Instruction In The Best Methods, Motivation , The Oldman, Hackman Job Characteristics Model, Working In Groups, Becoming A Team, Decision Making, Leadership, Organizational Structures, Stress, Health And Safety

Transactional modes

Lecture Method, E-Team Teaching, Video based learning, Demonstration, Peer Discussion, Open talk, Cooperative Teaching, Flipped Teaching, Collaborative Learning.

Suggested Readings

- *Bob Hughes, Mike Cotterell, Software Project Management, Tata McGraw Hill Publishing*
- *Ramesh, GopalaSwamy, Managing Global Projects, Tata McGraw Hill Publishing*
- *Royce, Software Project Management, Pearson Education Publishing*
- *Jalote, Software Project Management in Practice, Pearson Education Publishing*

SEMESTER II

Course Title: Data Structures	L	T	P	Credits
Course Code: CGA2450	3	0	0	3

Total Hours: 45

Learning Outcomes: On the completion of this course, the learner will be able to

1. Algorithms and algorithm complexity.
2. Attain knowledge of tree and graph concepts.
3. Implement link list and its applications in data structures.
4. Apply the different linear data structures like stack and queue to various computing problems.

Course Content

UNIT I **10 Hours**

Basic concept and notations: data structures and data structures operations, mathematical notation and functions, algorithmic complexity, Big'O'notations and time space tradeoff.

Arrays: Linear array, representation of linear array in memory, Traversing linear array, insertion and deletion in an array, multi-dimensional array: row-major, column major order, sparse array.

UNIT II **12 Hours**

Stacks: Push and Pop in stack. Representation of stack in memory (linked and sequential) application so f Stack: conversion from infix notation to postfix notations, evolution of postfix notation, matching of Parentheses, recursion, Tower of Hanoi.

UNIT III **10 Hours**

Queue: Queues and Dequeue, Priority Queues, Operations on queues.

Linked list: Representation of linked list using static and dynamic data structures, Comparison of Linear and non-lineardata structures, Insertion and deletion of a node from a linear linked list, Introduction to doubly and circular linked lists, Application of linked lists.

UNIT IV **13 Hours**

Trees: Basic terminology, binary trees, binary search trees (BST), Tree traversal: In-order, pre-order, post-order, AVL trees and balanced binary trees (basic concepts)

Graphs: Terminology and representations (adjacency matrix/list), Traversal: BFS and DFS, Applications of trees and graphs (e.g., shortest path, minimum spanning tree overview)

Searching and Sorting: Linear and binary search, Bubble Sort, Insertion Sort, Selection Sort, Merge Sort, Radix Sort and Quick sort comparison of various searching and sorting algorithms.

Transaction Mode

Lecture Method, E-Team Teaching, Video based learning, Demonstration, Peer Discussion, Open talk, Cooperative Teaching, Flipped Teaching, Collaborative Learning**.**

Suggested Readings

- *Samet, H. (1990).The design and analysis of spatial data structures (Vol.85,p.87).Reading, MA: Addison-Wesley.*
- *Wirth, N.(1985).Algorithms & data structures. Prentice-Hall, Inc.*
- *Samet, H.(1990). Applications of spatial data structures: computer graphics, image processing, and GIS. Addison-Wesley Longman Publishing Co. Inc.*

Course Title: Programming using Python	L	T	P	Credits
Course Code: CGA2451	3	0	0	3

Total hours: 45

Learning Outcomes: After the Completion of this course, the learner will be able to:

1. Understand basic of Python Programming
2. Apply conditional and looping constructs.
3. Learn basic algorithmic problem-solving techniques (decision structures, loops, functions).
4. Know the basics of Strings and Dictionaries of programming.

Course Content

UNIT I **10Hours**

Introduction to Python Getting Started: Introduction to Python-an interpreted high-level language, interactive mode and script mode.
Variables, Expressions and Statements: Values, Variables and keywords; Operators and Operands in Python: (Arithmetic, relational and logical operators), operator precedence, Expressions and Statements (Assignment statement); Taking input (using raw input () and input ()) and displaying output (print statement); Putting Comments
Conditional constructs and looping: if else statement While, for (range function), break, continue, else, pass, Nested loops, use of compound expression in conditional constructs and looping

UNIT II **12Hours**

Functions: Importing Modules (entire module or selected objects), invoking built in functions, functions from math module, using random () and randint() functions of random module to generate random numbers, composition.
Defining functions, invoking functions, passing parameters, scope of variables, void functions and functions returning values, flow of execution

UNIT III **13Hours**

Strings: Creating, initializing and accessing the elements; String operators: +, *, in, not in, range slice [n:m]; Comparing strings using relational operators; String functions & methods: len, capitalize, find, isalnum, isalpha, isdigit, lower, islower, isupper, upper, lstrip, rstrip, isspace, istitile, partition, replace, join, split, count, decode, encode, swap case, Pattern Matching.
Lists: Concept of mutable lists, creating, initializing and accessing the

elements, traversing, appending, updating and deleting elements; List Operations (joining, list slices); List functions & methods: len, insert, append, extend, sort, remove, reverse, pop

UNIT IV **10 Hours**

Dictionaries: Concept of key-value pair, creating, initializing and accessing the elements in a dictionary, traversing, appending, updating and deleting elements. Dictionary functions & Methods: cmp, len, clear(),get(), has_key() ,items(), keys(), update(), values()

Tuples: Immutable concept, creating, initializing and accessing the elements in a tuple; Tuple functions: cmp(), len(), max(), min(), tuple()

Input and Output: Output Formatting, Reading and Writing Files

Errors and Exceptions: Syntax Errors, Exceptions, Handling Exceptions, Raising Exceptions, User-defined Exceptions, Defining Clean-up Actions, Predefined Clean-up Actions

Transaction Mode

Lecture Method, E-Team Teaching, Video based learning, Demonstration, Peer Discussion, Open talk, Cooperative Teaching, Flipped Teaching, Collaborative Learning.

Suggested Readings

- *Dawson Michael. Programming with python,Ausers Book Cengage Learning*
- *Beazley Davi. Python EssentialReference,ThirdEdition*

Course Title: Digital Electronics	L	T	P	Credits
Course Code: CGA2452	4	0	0	4

Total Hours: 60

Learning Outcomes: On the completion of his course, the learner will be able to:

1. Solve the conversions of various number systems.
2. Learn the basics of Logic Gates.
3. Analyze and Design various combinational and sequential circuits.
4. Analyzeandpreventvarioushazardsandtimingproblemsinadigitaldesign.

Course Content

UNIT I **15Hours**

Information Representation: Number systems, Integer and floating pointer presentation, character codes (ASCII, EBCDIC).
Digital IC's: Logic gates, flip-flops, clocks and timers, shift registers, counters.

UNIT II **15Hours**

Boolean Algebra & Circuit Design: Basic laws of Boolean algebra, circuit design using standard (NAND)Gates, Adder, coder/De-multiplexer, encoder/multiplexer design.

UNIT III **15Hours**

MOS & LSI Digital Systems: Semiconductor memory, static and dynamic devices, read only & random-access memory chips, PROMS and EPROMS. Address selection logic. Read and write control timing diagrams for memory ICs.

UNIT IV **15 Hours**

Logical Families: TTL, STTL, CMOS logic families.
ADC (Analog to Digital Converter) and DAC (Digital to Analog Converter)
Digital Peripherals: Keyboard, multiplexed seven segment display, CRT display schemes, Printers, Control interfaces (parallel and serial) for the peripheral units.

Transaction Mode

Lecture Method, E-Team Teaching, Video based learning, Demonstration, Peer Discussion, Open talk, Cooperative Teaching, Flipped Teaching, Collaborative Learning**.**

Suggested Readings

- *Maini,A. K.(2007).Digital electronics: principles, devices* and applicatio ns *.John Wiley &Sons.*
- *Cook, N.P. (2001). Digital electronics with PLD integration.*
- *Rosen berg, P.(2005).Audel Basic Electronics(Vol.29).John Wiley & Sons*

Course Title: Computer Network	L	T	P	Credits
Course Code: CGA2453	4	0	0	4

Total Hours: 60

Learning Outcomes: After the Completion of the course the learner will be able to

1. Understand the fundamental concepts of data networks
2. Explain the different network security threats and vulnerabilities
3. Evaluate network security measures and technologies
4. Implement network security controls

Course Content

UNIT I **15 Hours**

Introduction to Computer networks and applications: Network Structure and Architecture, Network Hardware and Software (protocol hierarchies, design issues for layers, interfaces and services: connection oriented and connection less), Network structure and architecture-point to point, multicast, broadcast, Classification of networks on the basis of Geographical Span (PAN, LAN, MAN and WAN) , LAN topologies (Bus, Ring, Star, Mesh, Tree and Hybrid). Network Connecting Devices: Repeaters, Hubs, Bridges, Routers, Gateways and Switches, Network Reference models: OSI model, TCP / IP model. Comparison between OSI and TCP/IP.

UNIT II **15 Hours**

Introduction: Attacks, Services and Mechanisms, Security Attacks, Security Services, Integrity check, digital Signature, authentication, has algorithms.
Secret Key Cryptography: Block Encryption, DES rounds, S-Boxes IDEA: Overview, comparison with DES, Key expansion, IDEA rounds, Uses of Secret key Cryptography; ECB, CBC, OFB, CFB, Multiple encryptions DES.

UNIT III **15 Hours**

Hash Functions and Message Digests: Length of hash, uses, algorithms (MD2, MD4, MD5, SHS) MD2: Algorithm (Padding, checksum, passes.) MD4 and 5: algorithm (padding, stages, digest computation.) SHS: Overview, padding, stages.
Public key Cryptography: Algorithms, examples, Modular arithmetic (addition, multiplication, inverse, and exponentiation) RSA: generating keys, encryption and decryption. Other Algorithms: PKCS, Diffie-Hellman, El-Gamal signatures, DSS, Zero-knowledge signatures.

UNIT IV **15 Hours**

Authentication: Password Based, Address Based, Cryptographic Authentication. Passwords in distributed systems, on-line vs offline guessing,

storing. Cryptographic Authentication: passwords as keys, protocols, KDC's Certification Revocation, Inter domain, groups, delegation. Authentication of People: Verification techniques, passwords, length of passwords, password distribution, smart cards, biometrics.

Security Policies and Security Handshake Pitfalls: What is security policy, high and low level policy, user issues? Protocol problems, assumptions, Shared secret protocols, public key protocols, mutual authentication, reflection attacks, use of timestamps, nonce and sequence numbers, session keys, one-and two-way public key based authentication.

Transaction Mode

Lecture Method, E-Team Teaching, Video based learning, Demonstration, Peer Discussion, Open talk, Cooperative Teaching, Flipped Teaching, Collaborative Learning**.**

Suggested Readings

- *Tanenbaum, A. S. (2002). Computer networks. Pearson Education India.*
- *Peterson, L. L., & Davie, B. S. (2007). Computer networks: a systems approach. Elsevier.*
- *Kiesler, S. (1986). The hidden messages in computer networks (pp. 46-47). Harvard Business Review Case Services.*
- *AtulKahate .Cryptography and Network Security ,TMH.*
- *Behourz A Forouzan,Data Communications and Networking*

Course Title: Data Structures Lab	L	T	P	Credits
Course Code: CGA2454	0	0	2	1

Total Hours: 30

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

1. Create the applications of data structures.
2. Solve the algorithmic problems like insertion and deletion of data.
3. Interpret the programming code to implement the Link List Structure.
4. Analyze Singly, Doubly, Circular Singly linked lists and its operations.
5. Implement the insertion and deletion on BST and heap sort.

Course Content

1. Program to input 1-D Array
2. Program to perform insertion in Arrays
3. Program to perform deletion in Arrays
4. Program to input 2-D arrays (Matrices)
5. Program to find transpose of a matrix. Multiply 2 matrices.
6. Program to implement sparse matrices.
7. Program to perform linear search
8. Program to perform Binary search
9. Program to reverse array without using another variables.
10. Program to perform sorting using Insertion Sort.
11. Program to input and traverse N-nodes in a one way linked list.
12. Program to reverse a one way linked list.
13. Program to perform insertion/deletion in linked lists.
14. Program to input and traverse doubly linked list.
15. Program to implement stack operations.
16. Program to implement Queues.
17. Program to find factorial using recursion.
18. Program to print Fibonacci series using recursion.
19. Program to input a BST.
20. Program to perform insertion in a BST.
21. Program to perform deletion in a BST.
22. Program to implement min-heaps.
23. Program to implement max-heaps.
24. Program to implement AVL trees.
25. Program to perform rotations in AVL trees.
26. Program to perform rotations in AVL trees.
27. Program to input a graph.
28. Program to print adjacency list of a graph.
29. Program to perform traversal in graphs using DFS.
30. Program to perform traversal in graphs using BFS.

31. Program to implement shortest path methods.
32. Programs to perform Dynamic memory allocation.
33. Programs to perform sorting on data stored in a file.
34. Programs to delete duplicates in arrays and linked lists.

Course Title: Programming Using Python Lab	L	T	P	Credits
Course Code: CGA2455	0	0	2	1

Total Hours:30

Learning Outcomes: After the Completion of this course, the learner will be able to:

1. Demonstrate proficiency in writing Python programs.
2. Solve the algorithmic problems like insertion and deletion of data.
3. Summarize and describe the flow control structures (conditionals, loops) In Python.

Course Content

Program 1: Print hello world
Program 2: add numbers and concatenate strings
Program 3: input from user
Program 4: using loops (for,while)
Program 5: Loop control statements (break, continue, pass)
Program 6: if-else - conditional checking
Program 7: functions
Program 8: math library
Program 9: strings
Program 10: exceptional handling
Program 11: random numbers/string
Program 12: demo of data structure - list
Program 13: demo of data structure – dictionary
Program 14: demo of data structure – tuple
Program 15: command line argument
Program 16: Filter Even Numbers
Program 17: Convert Decimal to Binary
Program 18: Read a File
Program 19: Find the Largest Number in a List
Program 20: Sort a List

Course Title: Web Technologies-I	L	T	P	Credits
Course Code: CGA2456	0	0	4	2

Total Hours:60

Course Content

1. **HTML & CSS Fundamentals**
- Design a basic web page using HTML elements such as headings, paragraphs, lists, and tables.
- Implement internal, inline, and external CSS to style the web page.
- Create a responsive layout using CSS media queries

2. **Forms and Input Validation**
- Develop a registration form incorporating various input types like text fields, radio buttons, checkboxes, and dropdowns.
- Use JavaScript to validate form inputs, ensuring data integrity before submission

3. **JavaScript Programming**
- Write scripts to perform operations such as sorting an array of numbers in descending order.
- Create a script that converts numerical input into its corresponding word representation, handling edge cases like non-numeric input or out-of-range values.

4. **Document Object Model (DOM) Manipulation**
- Use JavaScript to dynamically modify HTML content and styles based on user interactions.
- Implement event listeners to respond to user actions like clicks and form submissions.

5. **PHP Basics**
- Develop simple PHP scripts to display text and variables.
- Implement loops and arrays in PHP to process and display data.
- Create functions in PHP to perform tasks such as calculating the factorial of a number or comparing two values.

6. **Form Handling with PHP**
- Design forms that send data to the server using GET and POST methods.
- Process and validate form data on the server side using PHP.

7. **Session Management**
- Implement cookies and sessions in PHP to maintain user state across multiple pages.
- Create login systems that utilize sessions to authenticate users.

8. **Mini Project**
- Develop a small-scale web application that integrates HTML, CSS, JavaScript, and PHP.

- Examples include a personal blog, a simple e-commerce site, or a task management tool.

Course Title: Machine Learning	L	T	P	Credits
Course Code: CGA2457	4	0	0	4

Total Hours: 60

Learning Outcomes:

After the Completion of the course the learner will be able to

1. Recognize the basic concepts of Bayesian Decision Theory.
2. Apply structured thinking to unstructured problems.
3. Class conditional probability distributions.
4. Apply Multi-Layer Perceptions and Back Propagation learning.

Course Content

UNIT I **15 Hours**

Overview and Introduction to Bayes Decision Theory: Machine intelligence and applications, pattern recognition concepts classification, regression, feature selection, supervised learning class conditional probability distributions, Examples of classifiers bayes optimal classifier and error, learning classification approaches.

UNIT II **15 Hours**

Linear machines: General and linear discriminates, decision regions, single layer neural network, linear reparability, general gradient descent, perception learning algorithm, mean square criterion and widrow-Hoff learning algorithm; multi-Layer perceptions: two-layers universal approximates, back propagation learning, on-line, off-line error surface, important parameters.

UNIT III **15 Hours**

Learning decision trees: Inference model, general domains, symbolic decision trees, consistency, learning trees from training examples entropy, mutual information, ID3 algorithm criterion, C4.5 algorithm continuous test nodes, confidence, pruning, learning with incomplete data

Instance-based Learning: Nearest neighbor classification, k-nearest neighbor, nearest neighbor error probability

UNIT IV **15 Hour**

Machine learning concepts and limitations: Learning theory, formal model of the learnable, sample complexity, learning in zero-bayes and realizable case, VC-dimension, fundamental algorithm independent concepts, hypothesis class, target class, inductive bias, occam's razor, empirical risk, limitations of inference machines, approximation and estimation errors, Trade off.

Transaction Mode

Lecture Method, E-Team Teaching, Video based learning, Demonstration, Peer Discussion, Open talk, Cooperative Teaching, Flipped Teaching, Collaborative Learning**.**

Suggested Readings

- *Zhang, C., & Ma, Y. (Eds.). (2012). Ensemble machine learning: methods and applications. Springer Science & Business Media.*
- *Marsland, S. (2011). Machine learning: an algorithmic perspective. Chapman and Hall/CRC..*
- *C. M. Bishop.Pattern Recognition and Machine Learning, Springer, (2006).*

Course Title: Data visualization	L	T	P	Credits
Course Code: CGA2458	4	0	0	4

Total Hours:60

Learning Outcomes: After the Completion of this course learner will be able to

1. Build and maintain reliable, scalable, distributed systems with Apache Hadoop
2. Understand Spark framework and explore various ML tools for data processing
3. Apply HIVEQL, PIG techniques to solve big data queries
4. Understand conventional SQL query language and No SQL
5. Design, build and query Mongo DB
6. Visualize big data to perform decision making in real world problems

Course Content

UNIT I **15 Hours**

Introduction to Big Data: Distributed file system– Big data and its importance, 3Vs of Data Volume, Velocity and Variety, Data sets, Data analysis, Data analytics, Business intelligence, KPI, Big data characteristics, Different types of data, Drivers for big data adoption. Big Data Analysis Techniques: Quantitative analysis, Qualitative analysis, Data mining, Statistical analysis, Machine learning, Semantic analysis, Visual analysis, Case studies.

UNIT II **15 Hours**

Hadoop Architecture: Overview of Distributed database Systems, Hadoop eco-system, Hadoopcore components, Hadoop distributions, Developing enterprise applications with Hadoop. Storing Datain Hadoop: Moving data in and out of Hadoop, HDFS architecture, HDFS files, Hadoop specific file types, HDFS federation and high availability, working with HDFS Commands, Fundamentals of HBASE, Zookeeper concepts and methods to build applications with Zookeeper.

UNIT III **15 Hours**

Introduction to SPARK: Introduction to Data Analysis with Spark, Downloading Spark and Getting Started, Programming with RDDs, Machine Learning with MLlib. HIVE, HIVQL and PIG: HIVE: Architecture and installation, Comparison with traditional database, HIVQL querying data, Sorting and aggregating, Joins & sub queries, HIVEVs PIG, PIG: Architecture and installation, Execution Mechanisms, load/store operator, Pig scripts.

UNIT IV **15 Hours**

No SQL and Mongo DB: Introduction, Types of NoSQL databases, Advantages of No SQL, Use of No SQL in industry, SQL VS No SQL, Mongo DB: Mongo

DB Support for dynamic queries, Replications, Sharding, Create Database and Drop Database, Collections and Documents, MongoDB Query Language.

Transaction Mode

Lecture Method, E-Team Teaching, Video based learning, Demonstration, Peer Discussion, Open talk, Cooperative Teaching, Flipped Teaching, Collaborative Learning**.**

Suggested Readings

- Borislublinsky,Kevint.Smith,AlexeyYakubovich,"*ProfessionalHadoopSolutions* ",Wiley, ISBN: 9788126551071, 2015
- ThomasErl*," BigDataFundamentals-Concepts,DriversandTechniques"*,Pearson publication,2016
- KyleBanker,PiterBakkum,ShaunVerch,"*MongoDBinAction",*SecondEdition,Dreamtech Press
- TomWhite,"*HADOOP:ThedefinitiveGuide*", O Reilly2012
- AlainF. Zuur,ElenaN. Ieno,ErikH.W.G.Meesters, "*Beginner'sGuidetoR*",Springer2009

Course Title: Natural Language Processing	L	T	P	Credits
Course Code: CGA2459	4	0	0	4

Total Hours: 60

Learning Outcomes: After the completion of this course, the learner are expected to Develop interactive augmented reality applications for both PC based mobile devices using a variety of novel input devices

1. In depth understanding of the computational properties of natural languages and the commonly used algorithms for processing linguistic information
2. The course examines NLP models and algorithms using both the traditional symbolic and the more recent statistical approaches

UNIT I **15 Hours**

Introduction: Knowledge in speech and language processing, Ambiguity, Models and Algorithms, Brief History. Regular Expressions and Automata, Morphology and Transducers: Inflectional and derivational morphology, finite state morphological parsing, Combining FST Lexicon and rules. Lexicon free FST: Porter Stemmer N-grams: Counting Words in Corpora, Simple Unsmoothed n-grams, Smoothing, Entropy HMM and Speech Recognition: Speech Recognition Architecture, Overview of HMM, A* decoding.

UNIT II **15 Hours**

World Classes and Part-of-Speech Tagging: English word classes, Targets for English, Part of Speech tagging, Rule based part of speech Tagging, Transformation based tagging. Context Free Grammars for English: Constituency, Context Free rules and Trees, Sentence level construction, The Noun Phrase, Coordination, Agreement, The verb phrase and sub categorization. Spoken Language Syntax, Grammar Equivalence and Normal form, Finite state context free grammars, Grammar and human processing.

UNIT III **15 Hours**

Parsing with context free grammars: Parsing as Search, basic Top Down Parser, Problems with basic top-down-parsers, the early Algorithm, Finite state parsing method. Features and Unifications: Feature Structures, Unification of Features Structures, Features Structures in the grammar, Implementing Unification. Lexicalized and probabilistic parsing: Probabilistic context free grammars, problems with probabilistic context free grammars

UNIT IV **15 Hours**

Semantics: (Representing Meaning): Computational Desiderata for representation, meaning structure of language, First order predicate calculus, linguistically relevant concept, Related Representational approaches, Alternative approaches to meaning. Semantic Analysis: Syntax driven semantic analysis, Attachment of Fragment of English, Robust Semantic

Analysis Lexical Semantics: Relation among lexemes and their senses, Internal Structure of words

Transactional Mode

Project based learning, Team Teaching, flipped teaching, Open talk, Collaborative Teaching, Case Analysis, Panel Discussions, Group Discussions

Suggested Readings

- Speech and Language processing an introduction to Natural Language Processing, Computational Linguistics and speech Recognition by Daniel Jura sky and James H. Martin
- Natural Language Processing with Python by Steven Bird, Ewan Klein, Edward Lopper
- Handbook of Natural Language Processing, Second Edition—NitinIndurkhya, Fred J.Damerau,Fred J. Damerau