ARKA JAIN University
Jharkhand

Syllabus of

Bachelor of Computer Application (BCA)

Semester-I-II-III-IV-V-VI

for w.e.f Batch 2020

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Syllabus of

Bachelor of Computer Application

Semester-I

ARKA JAIN University, Jharkhand
School of Engineering & Information Technology
Department of Computer Science & Information Technology
Faculty – BCA
Scheme of Study (w.e.f Batch 2020)

SEMESTER -I

Sl.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Introduction to Computer Science	Core	5	5	100	70	20	5	5
2	Programming In C	Core	5	5	100	70	20	5	5
3	Discrete Mathematics	GS	5	5	100	70	20	5	5
4	Business Communication	AECC	5	5	100	70	20	5	5
	Practical								
5	Computer Science Lab	Core	2	4	50	35	10	2.5	2.5
6	Programming In C Lab	Core	2	4	50	35	10	2.5	2.5
	Total		**24**	**28**	**500**	**350**	**100**	**25**	**25**

SEMESTER –II

Sl.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Data Structure through C	Core	5	5	100	70	20	5	5
2	Object Oriented Programming with C++	Core	5	5	100	70	20	5	5
3	Operating System	Core	5	5	100	70	20	5	5
4	Numerical & Statistical Methods	GS	5	5	100	70	20	5	5
5	Environmental Science	AECC	5	5	100	70	20	5	5
	Practical								
6	Data Structure through C Lab	Core	2	4	50	35	10	2.5	2.5
7	Object Oriented Programming with C++ Lab	Core	2	4	50	35	10	2.5	2.5
	Total		**28**	**32**	**600**	**420**	**120**	**30**	**30**

SEMESTER –III

Sl.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Programming with Java	Core	5	5	100	70	20	5	5
2	Design and Analysis of Algorithms	Core	5	5	100	70	20	5	5
3	Database Management System	Core	5	5	100	70	20	5	5
4	Data Communication & Networking	Core	5	5	100	70	20	5	5
5	Python Programming	SECC	4	4	100	70	20	5	5
	Practical								
6	Programming with Java Lab	Core	2	4	50	35	10	2.5	2.5
7	Database Management System Lab	Core	2	4	50	35	10	2.5	2.5
8	Python Programming Lab	SECC	2	4	50	35	10	2.5	2.5
	TOTAL		**30**	**36**	**650**	**455**	**130**	**32.5**	**32.5**

SEMESTER –IV

Sl.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Introduction to Data Science	Core	5	5	100	70	20	5	5
2	Internet of Things	Core	5	5	100	70	20	5	5
3	Data Science - Elective I IOT - Elective I AI - Elective I	DSE	5	5	100	70	20	5	5
4	Data Science - Elective II IOT - Elective II AI - Elective II	DSE	5	5	100	70	20	5	5
	Practical								
5	Data Science - Elective I IOT - Elective I AI - Elective I	**DSE**	2	4	50	35	10	2.5	2.5
6	Data Science - Elective II IOT - Elective II AI - Elective II	DSE	2	4	50	35	10	2.5	2.5
	TOTAL		**24**	**28**	**500**	**350**	**100**	**25**	**25**

SEMESTER –V

Sl.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Enterprise Java	Core	5	5	100	70	20	5	5
2	Machine Learning	Core	5	5	100	70	20	5	5
3	Mobile Application Development	SECC	4	4	100	70	20	5	5
4	Data Science - Elective III IOT - Elective III AI - Elective III	DSE	5	5	100	70	20	5	5
5	Data Science - Elective IV IOT - Elective IV AI - Elective IV	DSE	5	5	100	70	20	5	5
	Practical								
6	Enterprise Java Lab	Core	2	4	50	35	10	2.5	2.5
7	Machine Learning Lab	Core	2	4	50	35	10	2.5	2.5
8	Mobile Application Development Lab	SECC	2	4	50	35	10	2.5	2.5
	TOTAL		**30**	**36**	**650**	**455**	**130**	**32.5**	**32.5**

SEMESTER –VI

Sl. No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Software Engineering	Core	5	5	100	70	20	5	5
2	Data Science - Elective V IOT - Elective V AI - Elective V	DSE	5	5	100	70	20	5	5
3	Data Science - Elective VI IOT - Elective VI AI - Elective VI	DSE	5	5	100	70	20	5	5
	Practical								
4	Project	DSE	5	5	100	70	30	0	0
5	Data Science - Elective V IOT - Elective V AI - Elective V	DSE	2	4	50	35	10	2.5	2.5
6	Data Science - Elective VI IOT - Elective VI AI - Elective VI	DSE	2	4	50	35	10	2.5	2.5
	TOTAL		**24**	**28**	**500**	**350**	**110**	**20**	**20**

Discipline Specific Elective (DSE) Courses

Elective I & II	Elective I & II	Elective I & II
Data Science (Select any Two)	**IOT (Select any Two)**	**AI (Select any Two)**
R Programming Language	Sensor Technologies	Introduction to RPA Tools
Python for Data Science	Embedded System	Introduction to Process Automation
Web Programming	Web Programming	Web Programming
Practical		
R Programming Language Lab	Sensor Technologies Lab	Introduction to RPA Tools Lab
Python for Data Science Lab	Embedded System Lab	Introduction to Process Automation Lab
Web Programming Lab	Web Programming Lab	Web Programming Lab

Elective III & IV	Elective III & IV	Elective III & IV
Data Science (Select any Two)	**IOT (Select any Two)**	**AI (Select any Two)**
Design and Analysis of Experiments	Artificial Intelligence	Six Sigma and Lean Methods
Probabilistic Graphical Models	Digital Image Processing	Digital Image Processing
Exploratory Data Analysis and Data Visualization Techniques	Cloud Computing	Business Intelligence

Elective V & VI	Elective V & VI	Elective V & VI
Data Science (Select any Two)	**IOT (Select any Two)**	**AI (Select any Two)**
Big Data Analytics	Embedded C with Arduino	Cloud Deployment And Management
NoSQL Databases	Digital Signal Processing	Natural Language Processing
Time Series Analysis	Artificial Neural Networks	Artificial Neural Networks
Practical		
Big Data Analytics Lab	Embedded C with Arduino Lab	Cloud Deployment And Management Lab
NoSQL Databases Lab	Digital Signal Processing Lab	Natural Language Processing Lab
Time Series Analysis Lab	Artificial Neural Networks Lab	Artificial Neural Networks Lab

Distribution of Credit across 6 semesters:

Sl. No	Type of Paper	No. of Paper	Total Credit
1	Core Paper	22	86
2	Ability Enhancement Compulsory Paper	2	10
3	Generic Paper	2	9
4	Discipline Specific Elective	11	43
5	Skill Enhancement	4	12
	Total	41	160

***CIA – Continuous Internal Assessment – Based on Projects / Assignment during the semester**
GS-Generic Subject | AECC -Ability Enhancement Compulsory Course
SECC -Skill Enhancement Compulsory Course | DSE - Discipline Specific Elective

ARKA JAIN University, Jharkhand
School of Engineering & Information Technology
Department of Computer Science & Information Technology
PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES
BCA – Semester–I

PROGRAM OUTCOMES

After completing this undergraduate program, a learner:

[PO.1]. Apply knowledge of Mathematics and science in solving computational problems

[PO.2]. Understand the Computing concepts and their applications using the acquired board based knowledge.

[PO.3]. Design, set up and conduct practical.

[PO.4]. Use the techniques, skills, and modern Software tools for software development.

[PO.5]. Identify and analyze software application problems in multiple aspect including coding, testing and implementation in industrial applications.

[PO.6]. Design, develop and verify software systems to meet desired needs within realistic constraints ensuring quality, reliability, security in addition to satisfying economical, ethical, social and environmental constraints.

[PO.7]. Apply Enterprise level application software for design of diverse software products.

[PO.8]. Communicate effectively in diverse groups and exhibit leadership qualities.

[PO.9]. Understanding of professional and ethical responsibility.

PROGRAM SPECIFIC OUTCOMES (COMMON ACROSS ALL SPECIALIZATIONS)

[PSO.1]. Prepare professionally trained in the areas of programming, databases, software engineering, web designing and networking and other application areas to acquire knowledge in various domain-based prospects.

[PSO.2]. Encourage to communicate effectively and to improve their competency skills to solve real time problems.

[PSO.3]. Understand to employ modern computer languages and applications for their successful career, to create platforms to become an entrepreneur and a relish for higher studies.

PROGRAM SPECIFIC OUTCOMES (DATA SCIENCE)

[PSO.4]. Ability to apply the knowledge of computing tools and techniques in the field of Data science for solving real world problems encountered in the Software Industries.

[PSO.5]. Ability to identify the challenges in Data analytics with respect to IT Industry and pursue quality research in this field with social relevance.

PROGRAM SPECIFIC OUTCOMES (INTERNET OF THINGS)

[PSO.4]. An ability to apply pattern recognition, machine learning, and artificial intelligent techniques including statistical data analysis and quantitative modelling techniques to solve real world problems from various domains such as healthcare, social computing, economics, etc.

[PSO.5]. An ability to recognize and analyze problems related to AI and ML applications along with their ethical implications.

PROGRAM SPECIFIC OUTCOMES (ARTIFICIAL INTELLIGENCE)

[PSO.4]. An ability to recognize and analyze problems related to artificial intelligence and machine learning applications along with their ethical implications

[PSO.5]. An ability to apply intelligent computer systems to a variety of applications.

Subject: Introduction to Computer Science

Code: CSC21001

5 Credits | Semester 1

Total Hours Required –75 Total Tutorials Required - 15

A. Introduction: The objective of the course is to provide complete knowledge of Computer Science. The students will be able to understand all the basics and various languages andabout the computer hardware and software.

The main objectives of the course are as follows:

- To describe the organization and operation of computer processor, primary and secondary memory, peripheral devices and to give computer specifications.
- To explain the representation of data and information.
- To use standard word, and spreadsheets, graphics generation packages
- To use standard database.
- To understanding computer hardware.
- To learning basic application software tools.

B. Course Outcomes : At the end of the course, students will be able to:

[CO.1]. Bridge the fundamental concepts of computers with the present level of knowledge of the students

[CO.2]. Familiarize Operating Systems, Programming languages, peripheral devices and internet.

[CO.3]. Assemble a PC

[CO.4]. Protect information and computers from basic abuses/attacks

[CO.5]. Connect it to external devices, write documents.

[CO.6]. Create worksheets, prepare presentations.

C. Assessment Plan:

Criteria	**Description**	**Maximum Marks**
Internal Assessment (Summative)	Internal Examination	20
	Assignment	05
	Attendance	05
End Term Exam (Summative)	End Term Examination	70
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

INTRODUCTION TO COMPUTERS, NUMBER SYSTEMS AND LOGIC GATES Introduction, Characteristics of computers, Evolution of computers, Generation of Computers, Classification of Computers, The Computer System, Applications of Computers, Introduction, Number Systems, Conversion between Number Bases ,Arithmetic System, Signed and Unsigned Numbers, Concept of Overflow, Binary Coding, Logic Gates, Boolean algebra, Combination of Logic Gates, Introduction, Central Processing Unit (CPU) Memory, Communication between Various Units of a Computer System, The Instruction Format, Instruction Set, Processor Speed, Multiprocessor Systems. **PRIMARY MEMORY** Introduction, Memory Hierarchy, Random Access Memory (RAM), Types of RAM, **SECONDARY STORAGE:** Introduction, Classification of Secondary Storage Devices, Magnetic Tape, Magnetic Disk, Optical Disk, Magneto Optical disk, **INPUT DEVICES:** Introduction, Keyboard, Pointing Devices, Speech Recognition, Digital Camera, Scanners, Optical Scanners, **OUTPUT DEVICES :** Introduction, Classification of Output, Hard Copy Output Devices, Printers, Plotters, Computer Output Microfilm(COM),Soft Copy Output Devices, Monitors, Audio Output, Projectors, Terminals, **Computer Program:** Introduction, Developing a Program, Algorithm, Flowchart, and Pseudo code (P Code). **Computer Languages:** Introduction, Evolution of Programming Languages ,Classification of Programming Languages, Generations of Programming Languages, Features of a Good Programming Language, Selection of a Programming Language. **Computer Software:** Introduction, Software: Definition, Relationship between Software and Hardware, Software Categories, System Software, Application Software, Software Terminology. **Operating System:** Introduction, Operating System, Evolution of Operating System, Types of Operating System, Functions of an Operating System, Modern Operating Systems, **Data Communication and Computer Network:** Introduction, Data Communication, Transmission Media, Multiplexing, Switching, Computer Network, Network Topologies, Communication Protocols, Network devices. **Internet Basics:** Introduction, Evolution of Internet, Basic Internet Term, Getting Connected to Internet, Internet Applications, Electronic Mail: An Introduction How E-Mail Works, Searching the Web (Search Engines), Languages of Internet, Internet and Viruses.

E. TEXT BOOKS:

T-1 ***Introduction to computer Science*****, ITL Education solution Limited, R&D Wing, PEARSON Education**

F. REFERENCE BOOKS:

R-1***Fundamentals of computers,*** **Raja Raman V Prentice hall of India Pvt.Ltd**

R2 ***Computer fundamentals concept, System, Application,*** **Nagapal, D.P., S.Chand**

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	COURSE OUTCOME STATEMENT	CORRELATION WITH PROGRAM OUTCOMES									CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	Bridge the fundamental concepts of computers with the present level of knowledge of the students	1	2	1	2	1	-	-	2	-	2	-	-
CO2	Familiarize Operating Systems, Programming languages, peripheral devices and internet.	2	2	1	2	-	2	-	1	-	2	1	-
CO3	Assemble a PC	3	1	2	1	1	-	1	-	-	3	-	1
CO4	Protect information and computers from basics abuses/attacks	1	2	2	1	-	1	-	-	-	2	-	-
CO5	Connect it to external devices, write documents.	2	1	2	3	-	-	-	-	-	-	1	1
CO6	Create worksheets, prepare presentations.	3	1	1	1	3	-	-	-	-	-	-	2

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Programming In C

Code: CSC21002
Credit - 5 | Semester 1
Total Hours Required –75 Total Tutorials Required - 15

A. Introduction: The objective of the course is to provide complete knowledge of C. Students will be able to develop logical abilities, which will help them to create programs, applications using C. The students will also develop an ability, which can easily help them switch to any other language inn future.

The main objectives of the course are as follows:

- Get knowledge about the basic concept of writing a program.
- Use of conditional statements and looping statements to solve problems associated with decision-making and repetitions.
- Concept of Array (1D, and 2D) and pointers dealing with memory management.
- Concept of Functions involving the idea of re-usability and modularity.
- Used defined data type : Structures and unions through which can be derived from basic data type
- To make students familiar with Computer Programming like Array, Pointers, Functions & File Handling in C

.

B. Course Outcomes: At the end of the course, students will be able to:

[CO.1]. Analyze the logic of a given problem

[CO.2]. Use branching control statements and iterative control statements

[CO.3]. Demonstrate the concepts of Reusability through the use of functions

[CO.4]. Analyze the problem statement and decide the logic to solve the problem using C Programming.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Internal Examination	20
	Assignment	05
	Attendance	05
End Term Exam (Summative)	End Term Examination	70
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical	

	leaves.

D. SYLLABUS

Introduction &Fundamentals of C: Types of Programming languages, History, features and application. Simple program logic, program development cycle, Pseudocode statements and flowchart symbols, programming and user environments, Evolution of programming models, desirable program characteristics. Structure of a program. Compilation and Execution of a Program, Character Set, identifiers and keywords, data types, constants, variables and arrays, Declarations, expressions, statements, Variable definition, symbolic constants. **Operators and expressions, data input and output:** Different Operators in C, library functions, Single character input and output, input/output data using functions. **Conditional statements:** Decision making within a Program, decision making statements, **Loops:** while Loop, do while, for Loop. Switch Statement, **Functions:** function prototypes, defining & accessing a function, recursion, standard library of c functions, passing arguments to a function: call by reference, call by value. **Storage classes**: different storage classes, **Preprocessor:** #define and #include, Directives and Macros, **Arrays:** Definition, processing, Passing arrays to functions, Multidimensional arrays, arrays and strings. **Pointers:** declarations, Pointers Address Operators, Pointer Assignment and initialization, Pointer Arithmetic, Functions and Pointers, Arrays and Pointers. **Structures and Unions:** Structure Variables, Structure Assignment, Nested Structure, Unions, Structures and pointers. **File Handling:** Create, read, and delete text files. Create, read, and delete binary files.

E. TEXT BOOKS:

T1. E. Balaguruswamy, ANSI C, Tata McGraw Hill

F. REFERENCE BOOKS:

R1. Yashwant P. Kanetkar, Let us C, BPB Publication

R2. Byron Gottfried, Programming with C, Tata McGraw Hill

R3. Joyce Farell, Programming Logic and Design, Cengage Learning

R4. Brian W. Kernighan and Denis M. Ritchie, “C” Programming, PHI

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	COURSE OUTCOME STATEMENT	CORRELATION WITH PROGRAM OUTCOMES									CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	Analyze the logic of a given problem	1	2	2	2	2	-	-	-	-	2	-	-
CO2	Use branching control statements and iterative control statements	2	2	2	2	-	2	-	-	-	2	1	-
CO3	Demonstrate the concepts of Reusability through the use of functions	3	2	2	1	1	-	-	-	-	3	-	1
CO4	Analyze the problem statement and decide the logic to solve the problem using C Programming	1	2	2	1	-	1	-	-	-	2	-	-

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Discrete Mathematics

Code: MTH21001

5 Credits | Semester 1

Total Hours Required –75 Total Tutorials Required - 15

A. Introduction: The objective of the course is to provide to specify computational problems precisely one needs to abstract the detail and then use mathematical objects such as sets, functions, relations, orders, and sequences. To prove that a proposed solution does work as specified, one needs to apply the principles of mathematical logic, and to use proof techniques such as induction. And to reason about the efficiency of an algorithm, one often needs to count the size of complex mathematical objects. The Discrete Mathematics course aims to provide this mathematical background.

The main objectives of the course are as follows:

- To prepare the students for a background in abstraction, notation, and critical thinking in the Discrete Mathematics
- To equip the students to deal with advanced level of mathematics and applications that would be essential for their disciplines
- To equip the students with standard concepts and tools at an intermediate to advanced level.

B. Course Outcomes: At the end of the course, students will be able to

[CO.1]. Construct mathematical arguments using logical connectives and quantifiers

[CO.2]. Verify the correctness of an argument using propositional and predicate logic and truth tables

[CO.3]. Construct proofs using direct proof, proof by contraposition, proof by contradiction, proof by cases, and mathematical induction

[CO.4]. Perform operations on discrete structures such as sets, relations and functions and be familiar with concepts like Groups and Rings

C. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Internal Examination	20
	Assignment	05
	Attendance	05
End Term Exam (Summative)	End Term Examination	70
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

INTRODUCTION, SET THEORY: - Variables, The Language of Sets, The Language of Relations and Function **Set Theory:** Definitions and the Element Method of Proof Properties of Sets, Disproofs,

Algebraic Proofs Boolean Algebras Russell's Paradox and the Halting Problem. **RELATIONS, FUNCTIONS:** Relations on Sets, Reflexivity, Symmetry, and Transitivity, Equivalence Relations, Partial Order Relations, Functions Defined on General Sets One-to-One and Onto Inverse Functions, Composition of Functions Cardinality with Applications to Computability. **THE LOGIC OF COMPOUND STATEMENTS, QUANTIFIED STATEMENTS, ELEMENTARY NUMBER THEORY AND METHODS OF PROOF:** Logical Form and Logical Equivalence Conditional Statements, Valid and Invalid Arguments Predicates and Quantified Statements, Statements with Multiple Quantifiers Arguments with Quantified Statements Introduction to Direct Proofs, Rational Numbers Divisibility, Division into Cases and the Quotient-Remainder Theorem, Floor and Ceiling Indirect Argument: Contradiction and Contraposition, Two Classical Theorems, Applications in algorithms. **SEQUENCES, MATHEMATICAL INDUCTION, AND RECURSION, GRAPHS AND TREES**:- Sequences, Mathematical Induction, Strong Mathematical Induction and the Well-Ordering Principle for the Integers, Correctness of algorithms, defining sequences recursively, solving recurrence relations by iteration Second order linear homogenous recurrence relations with constant coefficients General recursive definitions and structural induction **Graphs and Trees:** Definitions and Basic Properties, Trails, Paths, and Circuits Matrix Representations of Graphs, Isomorphism's of Graphs Trees, Rooted Trees, Isomorphism's of Graphs, Spanning trees and shortest paths. **COUNTING AND PROBABILITY: Counting and Probability:** Introduction, Possibility Trees and the Multiplication Rule Counting Elements of Disjoint Sets: The Addition Rule, The Pigeonhole Principle Counting Subsets of a Set: Combinations, r- Combinations with Repetition Allowed, Probability Axioms and Expected Value Conditional Probability, Bayes' Formula, and Independent Events

E. TEXT BOOKS:

- **T1.** Discrete Mathematics, Schaum's Outlines Series, Seymour Lipschutz, Marc Lipson, Tata McGraw Hill

F. REFERENCE BOOKS:

- **R1.** Discrete Mathematics and its Applications, Kenneth H. Rosen, Tata McGraw Hill

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	COURSE OUTCOME STATEMENT	CORRELATION WITH PROGRAM OUTCOMES									CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	Construct mathematical arguments using logical connectives and quantifiers	1	2	2	2	2	-	-	-	-	2	-	-
CO2	Verify the correctness of an argument using propositional and predicate logic and truth tables	2	2	2	2	-	2	-	-	-	2	1	-
CO3	Construct proofs using direct proof, proof by contraposition, proof by contradiction, proof by cases, and mathematical induction	3	2	2	1	1	-	-	-	-	3	-	1
CO4	Perform operations on discrete structures such as sets, relations and functions and be familiar with concepts like Groups and Rings	1	2	2	1	-	1	-	-	-	2	-	-

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Business Communication

Code: MGT21001

5 Credits | Semester I

Total Hours Required –75 Total Tutorials Required - 15

A. Introduction: This course aims to acquaint the students with fundamentals of communication and help them to transform their communication abilities. It will help them to understand and demonstrate writing and speaking processes through invention, organization, drafting, revision, editing, and presentation. Studentswill be introduced to effective Organizational Communication. They will gain an insight towards the correct practices of the strategies of Effective Business writing. They will further understand and appropriately apply modes of expression, i.e., descriptive, expositive, narrative, scientific, and self-expressive, in written, visual, and oral communication. This paper also aims to develop the ability to research and write a documented paper and/or to give an oral presentation.

B. Course Outcomes: At the end of the course, students will be able

[CO.1]. To build the students' confidence and to enhance competitiveness by projecting a strong personality.
[CO.2]. Student shall be able to improve their listening & speaking abilities.
[CO.3]. They will be able to work on their ability to write error free while improvising vocabulary & grammar.
[CO.4]. Students will be able to deliver an effective oral business presentation.
[CO.5]. They will be able to demonstrate his verbal and non-verbal communication ability through presentations.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Internal Examination	20
	Assignment	05
	Attendance	05
End Term Exam (Summative)	End Term Examination	70
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

Basics of communication- Meaning, elements, Barriers in comm. & overcoming barriers, Comm..process/cycle, Types of comm.- Formal & Informal., Advantages & disadvantages of formal comm, Advantages & disadvantages of informal comm, Developing Listening skills., How to become a good speaker., **Report writing**– examples, **Letter writing**– basics, Letter writing – layout, Letter writing – examples, **Basic communication skills**, Developing listening skills, Developing speaking skills, Developing right body language, Developing basics of reading, Developing vocabulary, **Resume** – do's

&don’ts, Resume – layout, Resume – practice, Basics of Precise writing, Précis writing – format & practice, Interview – dos &don’ts, Formal Telephonic conversation, Basics of giving a PPT, Principles of oral communication, Creative writing – meaning & format, Creative writing – story, Creative writing – skit or peom, **Group Discussion** – meaning & cracking tips, GD- dos & don’ts, Helpful expression in communication, Common signs & symbols, Doubt solving session

E. TEXT BOOKS

T1. N. Gupta, K.Jain, Business Communication, SahityaBhawan Publication

T2. KumkumBharadwaj, Fundamentals of Business Communication, Dreamtech Press

T3.P.K.Pani, Business Communication

T4. SC Gupta, The best approach to Creative Writing, Arihant Publications

T5. Collins.S, Collins Letter Writing: Communicate Effectively by Letter or Email, Harper Collins

F. REFERENCE BOOKS

R1. Konar N, Communication Skills for Professionals, Prentice Hall India Learning Pvt Ltd

G. Course Articulation Matrix: (Mapping of COs withPOs)

S.No.	COURSE OUTCOME STATEMENT	CORRELATION WITH PROGRAM OUTCOMES									CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	To build the students' confidence and to enhance competitiveness by projecting a strong personality.		2	3					3	3		2	
CO2	Student shall be able to improve their listening & speaking abilities.		3	3					3	3	1	2	
CO3	They will be able to work on their ability to write error free while improvising vocabulary & grammar.		1	3					3	2		1	
CO4	Students will be able to deliver an effective oral business presentation.		3	3					2	3		2	
CO5	They will be able to demonstrate his verbal and non-verbal communication ability through presentations.		3	3					2	3		2	

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Computer Science Lab

Code: CSC21004

2 Credits | Semester I

Total Hours Required –60 Total Tutorials Required - 12

A. Introduction: The objective of the course is to provide complete knowledge of Computer Science. The students will be able to understand all the basics and various languages and about the computer hardware and software.

The main objectives of the course are as follows:

- To describe the organization and operation of computer processor, primary and secondary memory, peripheral devices and to give computer specifications.
- To explain the representation of data and information.
- To use standard word, and spreadsheets, graphics generation packages
- To use standard database.
- To understanding computer hardware.
- To learning basic application software tools.

B. Course Outcomes: At the end of the course, students will be able to:

[CO.1]. Bridge the fundamental concepts of computers with the present level of knowledge of the students

[CO.2]. Familiarize Operating Systems, Programming languages, peripheral devices and internet.

[CO.3]. Assemble a PC

[CO.4]. Protect information and computers from basic abuses/attacks

[CO.5]. Connect it to external devices, write documents.

[CO.6]. Create worksheets, prepare presentations.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Internal Examination	10
	Assignment	2.5
	Attendance	2.5
End Term Exam (Summative)	End Term Examination	35
	Total	50
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

LIST OF PRACTICALS

Disk Operating System: Internal DOS Commands, External DOSCommands**. Windows Operating Environment:** Features of MS – Windows, Control Panel, Taskbar, Desktop, Windows Application,

Windows Accessories. **MS-WORD:** Usage of Bookmarks, Footnotes, Columns & Hyperlink, Usage of Header, Footer, Bulleting and Numbering & Borders and Shading, Usage of Tables - Sorting &Formatting, Usage of Spell Check, Find and replace, Picture insertion and alignment, Creation of documents using templates, Mail Merge, Envelopes and Labels. **MS-EXCEL:** Cell Editing and Formatting, Usage of Formulae and Built-in functions, Data Sorting, filter, form, subtotal, validation, Goal seek, Inserting Clip arts, objects, pictures and Data Filter, Validation, Subtotals, Usage of auditing, comments, Graph, Usage of Auto Formatting, Conditional Formatting & Style. **MS-POWERPOINT:** Inserting New slides, text box, object, charts, tables, pictures, movies and sound, Slide layout, Colour Scheme, Background and Design template, Preparation of organizational charts, Preset and custom animation, action buttons and settings, Slide Transitions and animations, view show, slide sorter view, Presentation using Wizards, Usage of Design templates

E. TEXT BOOKS

T1. Introduction to computer Science, ITL Education solution Limited, R&D Wing, PEARSON Education

F. REFERENCE BOOKS

R1. Fundamentals of computers Rajaraman V Prentice hall of India Pvt.Ltd

R2. Computer Fundamentals Concept, System, Application Nagapal,D.P. S.Chand

G.Course Articulation Matrix: (Mapping of COs withPOs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES									CORRELATION WITH PROGRAM SPECIFICOUTCOMES		
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO 1	PSO 2	PSO3
CO1	Bridge the fundamental concepts of computers with the present level of knowledge of the students	1	2	1	2	1	-	-	2	-	2	-	-
CO2	Familiarize Operating Systems, Programming languages, peripheral devices and internet.	2	2	1	2	-	2	-	1	-	2	1	-
CO3	Assemble a PC	3	1	2	1	1	-	1	-	-	3	-	1
CO4	Protect information and computers from basics abuses/attacks	1	2	2	1	-	1	-	-	-	2	-	-
CO5	Connect it to external devices, write documents.	2	1	2	3	-	-	-	-	-	-	1	1
CO6	Create worksheets, prepare presentations.	3	1	1	1	3	-	-	-	-	-	-	2

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Programming In C Lab

Code: CSC21005

2 Credits | Semester I

Total Hours Required –60 Total Tutorials Required - 12

A. Introduction: The objective of the course is to provide complete knowledge of C. Students will be able to develop logical abilities, which will help them to create programs, applications using C. The students will also develop an ability, which can easily help them switch to any other language inn future.

The main objectives of the course are as follows:

- Get knowledge about the basic concept of writing a program.
- Use of conditional statements and looping statements to solve problems associated with decision-making and repetitions.
- Concept of Array (1D, and 2D) and pointers dealing with memory management.
- Concept of Functions involving the idea of re-usability and modularity.
- Used defined data type : Structures and unions through which can be derived from basic data type
- To make students familiar with Computer Programming like Array, Pointers, Functions & File Handling in C

.**B. Course Outcomes:** At the end of the course, students will be able to

[CO.1]. Analyze the logic of a given problem

[CO.2]. Use branching control statements and iterative control statements

[CO.3]. Demonstrate the concepts of Reusability through the use of functions

[CO.4]. Analyze the problem statement and decide the logic to solve the problem using C Programming.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Internal Examination	10
	Assignment	2.5
	Attendance	2.5
End Term Exam (Summative)	End Term Examination	35
	Total	50
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

LIST OF PRACTICALS

INTRODUCTION & FUNDAMENTALS OF C:

Write a program to Print Hello World
Write a program to take a variable print it.
Write a program to take user input and print it
Write a program to take different kind of data types value and print it.
Write a program to find size of variables.

OPERATORS AND EXPRESSIONS, DATA INPUT AND OUTPUT:

Write a program to add two number
Write a program to calculate Simple interest of a user given amount.
Write a program to demonstrate working of arithmetic operators.
Write a program to demonstrate working of Unary operators.
Write a program to print remainder of a division of two user given input.

CONDITIONAL STATEMENTS, LOOPS AND FUNCTIONS:

Write a program to check the largest number between two given number
Write a program to check the largest number between three given number
Write a program to convert Fahrenheit to Celsius
Write a C program to add first 10 number using while loop
Write a program in C to print sum of a user given numbers digits.
Write a program in C to print reverse of a user given input
Accept the salary of an employee from the user. Calculate the gross salary on the following basis:

Basic	**HRA**	**DA**
1 - 4000	10%	50%
4001 - 8000	20%	60%
8001 - 12000	25%	70%
12000 and above	30%	80%

Write a program to Display all prime numbers between 50 and 150.
Write a program in C to print following patterns:
(A)

```
*
* *
* * *
* * * *
* * * * *
```

(B)

1 2 3 4 5
1 2 3 4
1 2 3
1 2
1

Write a program to swap the values of two numbers using call by value
Write a program to print Fibonacci series using function

PROGRAM STRUCTURE, PREPROCESSOR, ARRAYS

Write a program in C to create an array and print its values
Write a program to find largest number of an array
Write a program to find smallest number of an array.
Write a program in C to swap smallest and largest number of an array.
Write a program to sort an array inputs.

POINTERS, STRUCTURES AND UNIONS, FILE HANDLING

Write a program in C to swap two number using call by reference
Write a program in C to Create a structure Student to store name, roll, marks of different data types.
Write a program in C to create Union Employee to store employee details.
Write a C program to read name and marks of n number of students and store them in a file..
Write a C program to read name and marks of n number of students from and store them in a file. If the file previously exits, add the information to the file.

E. TEXT BOOKS

T1. E. Balaguruswamy, ANSI C, Tata McGraw Hill

F. REFERENCE BOOKS

R1. Yashwant P. Kanetkar, Let us C, BPB Publication
R2. Byron Gottfried, Programming with C, Tata McGraw Hill
R3. JoyceFarell, Programming Logic and Design, Cengage Learning
R4. Brian W. Kernighan and Denis M. Ritchie, “C” Programming, PHI

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	COURSE OUTCOME STATEMENT	CORRELATION WITH PROGRAM OUTCOMES									CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	Analyze the logic of a given problem	1	2	2	2	2	-	-	-	-	2	-	-
CO2	Use branching control statements and iterative control statements	2	2	2	2	-	2	-	-	-	2	1	-
CO3	Demonstrate the concepts of Reusability through the use of functions	3	2	2	1	1	-	-	-	-	3	-	1
CO4	Analyze the problem statement and decide the logic to solve the problem using C Programming	1	2	2	1	-	1	-	-	-	2	-	-

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

ARKA JAIN University
Jharkhand

Syllabus of
Bachelor of Computer Applications
Semester-II

ARKAJAIN University, Jharkhand
School of Engineering & Information Technology
Department of Computer Science & Information Technology
Faculty – BCA
Scheme of Study (w.e.f Batch 2020)

SEMESTER -I

Sl.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Introduction to Computer Science	Core	5	5	100	70	20	5	5
2	Programming In C	Core	5	5	100	70	20	5	5
3	Discrete Mathematics	GS	5	5	100	70	20	5	5
4	Business Communication	AECC	5	5	100	70	20	5	5
	Practical								
5	Computer Science Lab	Core	2	4	50	35	10	2.5	2.5
6	Programming In C Lab	Core	2	4	50	35	10	2.5	2.5
	Total		**24**	**28**	**500**	**350**	**100**	**25**	**25**

SEMESTER –II

Sl.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Data Structure through C	Core	5	5	100	70	20	5	5
2	Object Oriented Programming with C++	Core	5	5	100	70	20	5	5
3	Operating System	Core	5	5	100	70	20	5	5
4	Numerical & Statistical Methods	GS	5	5	100	70	20	5	5
5	Environmental Science	AECC	5	5	100	70	20	5	5
	Practical								
6	Data Structure through C Lab	Core	2	4	50	35	10	2.5	2.5
7	Object Oriented Programming with C++ Lab	Core	2	4	50	35	10	2.5	2.5
	Total		**28**	**32**	**600**	**420**	**120**	**30**	**30**

SEMESTER –III

Sl.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Programming with Java	Core	5	5	100	70	20	5	5
2	Design and Analysis of Algorithms	Core	5	5	100	70	20	5	5
3	Database Management System	Core	5	5	100	70	20	5	5
4	Data Communication & Networking	Core	5	5	100	70	20	5	5
5	Python Programming	SECC	4	4	100	70	20	5	5
	Practical								
6	Programming with Java Lab	Core	2	4	50	35	10	2.5	2.5
7	Database Management System Lab	Core	2	4	50	35	10	2.5	2.5
8	Python Programming Lab	SECC	2	4	50	35	10	2.5	2.5
	TOTAL		**30**	**36**	**650**	**455**	**130**	**32.5**	**32.5**

SEMESTER –IV

Sl.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Introduction to Data Science	Core	5	5	100	70	20	5	5
2	Internet of Things	Core	5	5	100	70	20	5	5
3	Data Science - Elective I IOT - Elective I AI - Elective I	DSE	5	5	100	70	20	5	5
4	Data Science - Elective II IOT - Elective II AI - Elective II	DSE	5	5	100	70	20	5	5
	Practical								
5	Data Science - Elective I IOT - Elective I AI - Elective I	**DSE**	2	4	50	35	10	2.5	2.5
6	Data Science - Elective II IOT - Elective II AI - Elective II	DSE	2	4	50	35	10	2.5	2.5
	TOTAL		**24**	**28**	**500**	**350**	**100**	**25**	**25**

SEMESTER –V

Sl.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Enterprise Java	Core	5	5	100	70	20	5	5
2	Machine Learning	Core	5	5	100	70	20	5	5
3	Mobile Application Development	SECC	4	4	100	70	20	5	5
4	Data Science - Elective III IOT - Elective III AI - Elective III	DSE	5	5	100	70	20	5	5
5	Data Science - Elective IV IOT - Elective IV AI - Elective IV	DSE	5	5	100	70	20	5	5
	Practical								
6	Enterprise Java Lab	Core	2	4	50	35	10	2.5	2.5
7	Machine Learning Lab	Core	2	4	50	35	10	2.5	2.5
8	Mobile Application Development Lab	SECC	2	4	50	35	10	2.5	2.5
	TOTAL		**30**	**36**	**650**	**455**	**130**	**32.5**	**32.5**

SEMESTER –VI

Sl. No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Software Engineering	Core	5	5	100	70	20	5	5
2	Data Science - Elective V IOT - Elective V AI - Elective V	DSE	5	5	100	70	20	5	5
3	Data Science - Elective VI IOT - Elective VI AI - Elective VI	DSE	5	5	100	70	20	5	5
	Practical								
4	Project	DSE	5	5	100	70	30	0	0
5	Data Science - Elective V IOT - Elective V AI - Elective V	DSE	2	4	50	35	10	2.5	2.5
6	Data Science - Elective VI IOT - Elective VI AI - Elective VI	DSE	2	4	50	35	10	2.5	2.5
	TOTAL		**24**	**28**	**500**	**350**	**110**	**20**	**20**

Discipline Specific Elective (DSE) Courses

Elective I & II	Elective I & II	Elective I & II
Data Science (Select any Two)	**IOT (Select any Two)**	**AI (Select any Two)**
R Programming Language	Sensor Technologies	Introduction to RPA Tools
Python for Data Science	Embedded System	Introduction to Process Automation
Web Programming	Web Programming	Web Programming
Practical		
R Programming Language Lab	Sensor Technologies Lab	Introduction to RPA Tools Lab
Python for Data Science Lab	Embedded System Lab	Introduction to Process Automation Lab
Web Programming Lab	Web Programming Lab	Web Programming Lab

Elective III & IV	Elective III & IV	Elective III & IV
Data Science (Select any Two)	**IOT (Select any Two)**	**AI (Select any Two)**
Design and Analysis of Experiments	Artificial Intelligence	Six Sigma and Lean Methods
Probabilistic Graphical Models	Digital Image Processing	Digital Image Processing
Exploratory Data Analysis and Data Visualization Techniques	Cloud Computing	Business Intelligence

Elective V & VI	Elective V & VI	Elective V & VI
Data Science (Select any Two)	**IOT (Select any Two)**	**AI (Select any Two)**
Big Data Analytics	Embedded C with Adruino	Cloud Deployment And Management
NoSQL Databases	Digital Signal Processing	Natural Language Processing
Time Series Analysis	Artificial Neural Networks	Artificial Neural Networks
Practical		
Big Data Analytics Lab	Embedded C with Adruino Lab	Cloud Deployment And Management Lab
NoSQL Databases Lab	Digital Signal Processing Lab	Natural Language Processing Lab
Time Series Analysis Lab	Artificial Neural Networks Lab	Artificial Neural Networks Lab

Distribution of Credit across 6 semesters:

Sl. No	Type of Paper	No. of Paper	Total Credit
1	Core Paper	22	86
2	Ability Enhancement Compulsory Paper	2	10
3	Generic Paper	2	9
4	Discipline Specific Elective	11	43
5	Skill Enhancement	4	12
	Total	41	160

***CIA – Continuous Internal Assessment – Based on Projects / Assignment during the semester**
GS-Generic Subject | AECC -Ability Enhancement Compulsory Course
SECC -Skill Enhancement Compulsory Course | DSE - Discipline Specific Elective

ARKAJAINUniversity, Jharkhand
School of Engineering & Information Technology
Department of Computer Science & Information Technology
PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES
BCA – Semester–II

PROGRAM OUTCOMES

After completing this undergraduate program, a learner:

[PO.1]. Apply knowledge of Mathematics and science in solving computational problems

[PO.2]. Understand the Computing concepts and their applications using the acquired board based knowledge.

[PO.3]. Design, set up and conduct practical.

[PO.4]. Use the techniques, skills, and modern Software tools for software development.

[PO.5]. Identify and analyze software application problems in multiple aspect including coding, testing and implementation in industrial applications.

[PO.6]. Design, develop and verify software systems to meet desired needs within realistic constraints ensuring quality, reliability, security in addition to satisfying economical, ethical, social and environmental constraints.

[PO.7]. Apply Enterprise level application software for design of diverse software products.

[PO.8]. Communicate effectively in diverse groups and exhibit leadership qualities.

[PO.9]. Understanding of professional and ethical responsibility.

PROGRAM SPECIFIC OUTCOMES (COMMON ACROSS ALL SPECIALIZATIONS)

[PSO.1]. Prepare professionally trained in the areas of programming, databases, software engineering, web designing and networking and other application areas to acquire knowledge in various domain-based prospects.

[PSO.2]. Encourage to communicate effectively and to improve their competency skills to solve real time problems.

[PSO.3]. Understand to employ modern computer languages and applications for their successful career, to create platforms to become an entrepreneur and a relish for higher studies.

PROGRAM SPECIFIC OUTCOMES (DATA SCIENCE)

[PSO.4]. Ability to apply the knowledge of computing tools and techniques in the field of Data science for solving real world problems encountered in the Software Industries.

[PSO.5]. Ability to identify the challenges in Data analytics with respect to IT Industry and pursue quality research in this field with social relevance.

PROGRAM SPECIFIC OUTCOMES (INTERNET OF THINGS)

[PSO.4]. An ability to apply pattern recognition, machine learning, and artificial intelligent techniques including statistical data analysis and quantitative modelling techniques to solve real world problems from various domains such as healthcare, social computing, economics, etc.

[PSO.5]. An ability to recognize and analyze problems related to AI and ML applications along with their ethical implications.

PROGRAM SPECIFIC OUTCOMES (ARTIFICIAL INTELLIGENCE)

[PSO.4]. An ability to recognize and analyze problems related to artificial intelligence and machine learning applications along with their ethical implications

[PSO.5]. An ability to apply intelligent computer systems to a variety of applications.

Subject: Data Structure through C

Code: CSC22006
5 Credits | Semester II
Total Hours Required –75 Total Tutorials Required – 15

A. Introduction: The objective of the course is to provide complete knowledge of Algorithm. The students will be able to understand the concept of stack and queue in details.

The main objectives of the course are as follows:

- To impart the basic concepts of data structures and algorithms.
- To understand concepts about searching and sorting techniques.
- To understand basic concepts about stacks, queues, lists trees and graphs.
- To understanding about writing algorithms and step by step approach in solving problems with the help of fundamental data structures

B. Course Outcomes: At the end of the course, students will be able to

[CO.1]. Different operation can be implemented in data structure
[CO.2]. Prefix to postfix stack can be done on any given expression
[CO.3]. Insertion or deletion of data using link list
[CO.4]. Any expression can be converted into tree structure
[CO.5]. Minimize the over use of traversing

C. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Internal Examination	20
	Assignment	05
	Attendance	05
End Term Exam (Summative)	End Term Examination	70
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

Introduction to Data Structure, Overview, Objective & Learning Outcome, Pointers & Dynamic Memory Allocation, Algorithm Specification, Data Abstraction, Performance Analysis, Performance Measurement, **Arrays & Structure:** Abstract Data Type, Array in C, Dynamically Allocated Arrays, Internal Implementation of Structures, Self-Referential Structures, Polynomial Representation, Polynomial Addition, **Stacks & Queues**: Stack Abstract Data Type, Queue Abstract Data Type, Circular Queue Using Arrays, Mazing Problem, Evaluation of Expressions, Evaluation Postfix Expressions, Infix to Postfix, Circular list Operations on list Searching, Insertion and Deletion (Algorithms), Doubly list Operations on list Searching, Insertion and Deletion (Algorithms).**Linked Lists:** Pointers, Using

Dynamically Allocated Storage, Singly Linked Lists, Dynamically Linked Stacks and Queues, Polynomials, Representing Polynomials as Singly Linked Lists, Adding Polynomials, Erasing Polynomials, Polynomials as Circularly Linked Lists, Doubly Linked Lists.**Trees**: Introduction, Terminology, Representation of Trees, Binary Trees, Abstract Data Type, Properties of Binary Trees, Binary Tree Representations, Binary Tree Traversals, Binary Search Trees: Introduction, Searching a Binary Search Tree, Inserting an Element, Deleting an Element, Height of Binary Search Tree.**Searching& String**: Linear Search, Iterative Binary Search, Recursions, Recursive Binary Search, String Abstract Data Type, String in C, Pattern Matching, Sorting : Introduction, Bubble Sort, Selection Sort, Insertion Sort, Quick Sort, Performance Analysis, Merge Sort.

E. TEXT BOOKS

T1. Data Structures through C,Baluja,G.S. Dhanpat Rai & Co.

F. REFERENCE BOOKS

R1. Data Structures Salaria,R.S. Khanna Publishing House

R2. Fundamentals of Data Structure in C Horowitz, Ellis, Sahni, Sartaj, Anderson, Freed, Susan University Press

R3. Data Structures and Algorithms Concepts,Techniques and Applications Pai,G.A.V.,McGraw Hill Education

G. Course Articulation Matrix: (Mapping of COs withPOs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES									CORRELATION WITH PROGRAM SPECIFICOUTCOMES		
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO 1	PSO 2	PSO3
CO1	Different operation can be implemented in data structure	1	2	2	2	2	-	-	-	-	2	-	-
CO2	Prefix to postfix stack can be done on any given expression	2	2	2	2	-	2	-	-	-	2	1	-
CO3	Insertion or deletion of data using link list	3	2	2	1	1	-	-	-	-	3	-	1
CO4	Any expression can be converted into tree structure	1	2	2	1	-	1	-	-	-	2	-	-
CO5	Minimize the over use of traversing	1	1	2	2	2	-	-	-	-	-	-	3

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Object Oriented Programming with C++

Code: CSC22007
5 Credits |Semester II
Total Hours Required –75 Total Tutorials Required – 15

A. Introduction: The objective of the course is to introduce students with Object Oriented Programming. Students will be able to develop logical abilities, which will help them to create programs, applications using C++. The students will also develop an ability, which can easily help them switch to any other Object Oriented Programming language.

The main objectives of the course are as follows:

- Get knowledge about the basic concept of writing a C++ program.
- Use of conditional statements and looping statements to solve problems associated with decision-making and repetitions using C++.
- Concept of Array pointers & reference variable dealing with memory management.
- Concept of Class and object to implement complex logic.
- Concept of Functions involving the idea of re-usability.
- To make students familiar with Programming concept like polymorphism, abstraction, data hiding, file handling.

B. Course Outcomes: At the end of the course,

[CO.1]. Analyze the logic of a given problem
[CO.2]. Use branching control statements and iterative control statements using C++.
[CO.3]. Demonstrate the concepts of Reusability through the use of functions, Inheritance & Polymorphism
[CO.4]. Analyze the problem statement and decide the logic to solve the problem using C++ Programming.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Internal Examination	20
	Assignment	05
	Attendance	05
End Term Exam (Summative)	End Term Examination	70
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

Object Oriented Methodology & Principles of OOPS: Introduction to OOP. Advantages and

Disadvantages of Procedure Oriented Languages, **Object Oriented:** Benefits and Application of OOPS. OOPS Paradigm. Basic concepts of OOPS: Objects, Classes, & Data Abstraction & Data Encapsulation, Inheritance, Polymorphism Dynamic Binding, Message Passing **Classes& Objects:** Simple classes (Class specification, class members accessing), Defining member functions, Passing object as an argument, Returning object from functions, Friend classes, Pointer to object, Array of pointer to object, **Constructors & Destructors:** Introduction to Constructor, Default Constructor, Parameterized Constructor and examples, Destructors. **Polymorphism:** Concept of function overloading, overloaded operators, Overloading unary and binary operators, Overloading comparison operator, Overloading arithmetic assignment operator, Data Conversion between objects and basic types. **Virtual Functions:** Introduction to virtual function and need of Pure Virtual Functions, Static Functions, this Pointer, Abstract classes, virtual destructors. **Program Development Using Inheritance**: Introduction, understanding inheritance, Advantages provided by inheritance, choosing the access specifier, Class hierarchies, Multiple inheritance, multilevel inheritance, containership, hybrid inheritance. **Exception Handling:** Introduction, Exception Handling Mechanism, Concept of throw & catch with example **Templates:** Introduction, Function Template and examples, Class Template and examples. **Working With Files:** Introduction on Working with Files, File Operations, Various File Modes, File Pointer and their Manipulation.

E. TEXT BOOKS

T1. E. Balagurusamy, Object Oriented Programming with C++, Tata McGraw Hill

F. REFERENCE BOOKS

R1. E. Balaguruswamy, Object Oriented Analysis and Design, Tata McGraw Hill

R2. K R Venugopal, RajkumarBuyya, T Ravishankar, Mastering C++-Author, Tata McGraw Hill

G. Course Articulation Matrix: (Mapping of COs withPOs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES									CORRELATION WITH PROGRAM SPECIFICOUTCOMES		
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO 1	PSO 2	PSO3
CO1	Analyze the logic of a given problem	1	2	2	2	2	-	-	-	-	2	-	-
CO2	Use branching control statements and iterative control statements	2	2	2	2	-	2	-	-	-	2	1	-
CO3	Demonstrate the concepts of Reusability through the use of functions	3	2	2	1	1	-	-	-	-	3	-	1
CO4	Analyze the problem statement and decide the logic to solve the problem using C++ Programming	1	2	2	1	-	1	-	-	-	2	-	-

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Operating System

Code: CSC22008
5 Credits | Semester II
Total Hours Required –75 Total Tutorials Required – 15

A. Introduction: The objective of the course is to provide complete knowledge of Operating System. This course is an introduction to the concept behind modern computer operating systems. Topics will include what an operating system does (and doesn't) do, system calls and interfaces, processes, concurrent programming, resource scheduling and management (of the CPU, memory, etc.), virtual memory, deadlocks, distributed systems and algorithms, networked computing and programming, and security.

The main objectives of the course are as follows:

- Get knowledge about the basic concept of Operating System.
- To acquire the fundamental knowledge of the operating system architecture and components
- To know the various operations performed by the operating system

B. Course Outcomes: At the end of the course, students will be able to:

[CO.1]. To acquire the fundamental knowledge of the operating system architecture and components
[CO.2]. To know the various operations performed by the operating system
[CO.3]. To Know about the Types of operating systems and differences among them
[CO.4]. To Know about the Processes, threads, and the differences between the two
[CO.5]. To Know about the Interrupts, synchronization, waiting, and atomic behavior
[CO.6]. To Know about the Virtual memory, paging, and memory allocation Caching principles and quantitative estimation of cache behavior

C. Assessment Plan:

Criteria	**Description**	**Maximum Marks**
Internal Assessment (Summative)	Internal Examination	20
	Assignment	05
	Attendance	05
End Term Exam (Summative)	End Term Examination	70
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

INTRODUCTION TO OS, PROCESSES &THREADS: Introduction to Objective & Learning Outcome, What is an operating system? History of operating system, Computer Hardware, Different

Operating Systems, Operating System Concepts, system calls, operating system structure, Processes, threads, Inter process Communication, Scheduling, IPC problems. **MEMORY MANAGEMENT & FILE SYSTEMS:** No memory abstraction, memory abstraction: address spaces, Memory abstraction: virtual memory, page replacement algorithms Design issues for paging systems, implementation issues, and segmentation, Files, directories, file system implementation, File-system management and optimization, MS-DOS file systems, UNIX V7 file system, CD ROM file system. **INPUT – OUTPUT &DEADLOCKS:** Principles of I/O hardware, Principles of I/O software, I/O software layers, disks, clocks, User interfaces: keyboard, mouse, monitor, thin clients, and power management Deadlocks: Resources, introduction to deadlocks, The ostrich algorithm, Deadlock detection and recovery, Deadlock avoidance, deadlock prevention, issues. **VIRTUALIZATION, CLOUD & MULTIPLE PROCESSOR SYSTEMS:** History, requirements for virtualization Type 1 and 2 hypervisors, techniques for efficient virtualization Hypervisor microkernels, memory virtualization, I/O virtualization, Virtual appliances, virtual machines on multicore CPUs, Clouds, Multiprocessors Multicomputer, Distributed systems. **CASE STUDY ON LINUX, ANDROID &WINDOWS:** History of UNIX and Linux, Linux Overview, Processes in Linux Memory management in Linux, I/O in Linux, Linux file system Security in Linux Android History of windows through Windows 10 Programming windows, system structure, processes and threads in Windows Memory management, caching in windows, I/O in Windows, Windows NT file system, Windows power management, Security in windows.

E. TEXT BOOKS

T1. Modern Operating Systems –Author-Andrew S Tanenbaum, HerbertBos-Publisher-Pearson

F. REFERENCE BOOKS

R1. Operating System Concepts -Author-Abraham Silberschatz, Peter BGalvineg Gagne-Publisher-Wiley
R2. Operating Systems-Author-Godbole and Kahate, -Publisher-McGraw Hill

G. Course Articulation Matrix: (Mapping of COs withPOs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES									CORRELATION WITH PROGRAM SPECIFICOUTCOMES		
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	To acquire the fundamental knowledge of the operating system architecture andcomponents	2	2	2	2	2	2	2	-	-	2	-	2
CO2	To know the various operations performed by the operatingsystem	3	2	2	2	2	2	2	-	-	2	1	1
CO3	To Know about the Types of operating systems and differences among them	3	2	2	1	1	2	1	-	-	3	-	1
CO4	To Know about the Processes, threads, and the differences between the two	2	2	2	1	-	1	-	-	-	2	-	2
CO5	To Know about the Interrupts, synchronization, waiting, and atomic behavior	2	2	2	2	2	1				2		1
CO6	To Know about the Virtual memory, paging, and memory allocation Caching principles and quantitative estimation of cache behavior	2	2	2	2	2	1	1			2		1

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Numerical & Statistical Methods

Code: MTH22002
5 Credits | Semester II
Total Hours Required –75 Total Tutorials Required – 15

A. Introduction: The objective of the course is to provide the numerical methods of solving the non-linear equations, interpolation, differentiation, and integration. To improve the student's skills in numerical methods by using the numerical analysis software and computer facilities.

The main objectives of the course are as follows:

- To acquaint students with various statistical methods
- To cultivate statistical thinking among students
- To prepare students for future courses having quantitative components
- This will help you to choose, develop and apply the appropriate numerical techniques for your problem
- The goal is to provide a basic understanding of the derivation, analysis, and use of these numerical methods

B. Course Outcomes: At the end of the course, students will be able to

[CO.1]. Understand and appreciate descriptive statistics

[CO.2]. Understand the concepts of probability and random variable

[CO.3]. Interpolation, approximation, and integration of Functions

[CO.4]. Initial values problems governed by ordinary differential equations

C. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Internal Examination	20
	Assignment	05
	Attendance	05
End Term Exam (Summative)	End Term Examination	70
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS: MATHEMATICAL MODELING & ENGINEERING PROBLEM SOLVING APPROXIMATIONS & ROUND–OFF ERRORS, TRUNCATION ERRORS & THE TAYLOR SERIES:- Introduction to Numerical And Statistical Methods, Objective& Learning Outcome Mathematical Modeling and Engineering Problem Solving A Simple Mathematical Model, Conservation Laws & Engineering Problems Approximations and Round-Off Errors Significant Figures, Accuracy and Precision Error Definitions, Round-Off Errors, Truncation Errors and the Taylor Series The Taylor Series Error Propagation, Total Numerical Errors, Formulation Errors & Data Uncertainty. **SOLUTIONS OF ALGEBRAIC & TRASCENDENTAL EQUATIONS, INTERPOLATION:** Solutions of Algebraic and Transcendental Equations The Bisection Method, The Newton-Raphson Method, The Regula-falsi

method The Secant Method, **Interpolation** Forward Difference, Backward Difference, Newton's Forward Difference Interpolation, Newton's Backward Difference Interpolation, Lagrange's Interpolation. **SOLUTIONS OF SIMULTANEOUS ALGEBRAIC EQUATIONS (LINEAR) USING ITERATIVE METHODS, NUMERICAL DIFFERENTIATION & INTEGRATION, NUMERICAL SOLUTION OF 1ST& 2ND ORDER DIFFERENTIAL EQUATIONS:** Solution of simultaneous algebraic equations (linear) using iterative methods Gauss-Jordan Method, Gauss-Seidel Method, Numerical differentiation & Integration Numerical differentiation, Numerical integration using Trapezoidal Rule, Simpson's 1/3rd and 3/8th rules, Numerical solution of 1st and 2nd order differential equations Taylor series, Euler's Method, Modified Euler's Method, Runge-Kutta Method 1st and 2nd Order Differential Equations. **LEAST-SQUARE REGRESSION, LINEAR PROGRAMMING:** Least-Squares Regression Linear Regression, Polynomial Regression, Multiple Linear Regression, General Linear Least Squares Nonlinear Regression, Linear Programming Linear optimization problem, Formulation & Graphical solution, Basic solution & feasible solution. **RANDOM VARIABLES, DISTRIBUTION:** Random variables Discrete and Continuous random variables, Probability density function, Probability distribution of random variables, Expected value, Variance, Distributions Discrete distributions: Uniform, Binomial, Poisson, Bernoulli, Continuous distributions: uniform distributions, exponential (derivation of mean and variance only and state other properties and discuss their applications), Normal distribution state all the properties and its applications.

E. Text Book:

T1. Introductory Methods of Numerical Methods –Author-S. S. Shastri -Publisher-Microsoft Press

T2. Numerical Methods for Engineers – Author- Steven C.Chapra, Raymond P. Canale-Publisher-TMH.

T3. Numerical Methods in Engineering and Science with Programs in C and C+ +, B. S. Grewal, Khanna Publishers

F. Recommended Readings:

R1. Numerical Analysis -Author-Richard L. Burden, J. Douglas Faires -Publisher-Cengage Learning

R2. Fundamentals of Mathematical Statistics -Author- S. C. Gupta, V. K. Kapoor

R3. Elements of Applied Mathematics-Author-P.N.Wartikar and J.N.Wartikar-Publisher-A. V. Griha, Pune

G. Course Articulation Matrix: (Mapping of COs withPOs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES									CORRELATION WITH PROGRAM SPECIFICOUTCOMES		
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	Understand and appreciate descriptive statistics	1	2	2	2	2	-	-	-	-	2	-	-
CO2	Understand the concepts of probability and random variable	2	2	2	2	-	2	-	-	-	2	1	-
CO3	Interpolation, approximation, and integration of Functions	3	2	2	1	1	-	-	-	-	3	-	1
CO4	Initial values problems governed by ordinary differential equations	1	2	2	1	-	1	-	-	-	2	-	-

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Environmental Science

Code: MGT22010
5 Credits | Semester II
Total Hours Required –75 Total Tutorials Required – 15

A. Introduction: The present paper will acquaint the student with basic concepts of environment and its components. It includes the anthropogenic activities and its harmful effects on environment. It also throws light on the harmful effects of solid waste and to learn new ways of disposing it off. Students be able to understand current hot topics in news related to environment such as red data book, hotspots. Students will have knowledge about the biodiversity and the threats to the species. They will understand the the causes and impact of Global warming and acid rain.

B. Course Outcomes: At the end of the course, students will be able to

[CO.1]. Concept clarification about the components of environment and their inter relatedness

[CO.2]. Understanding of all the resources available and their origin and the ways to conserve them for sustainable future.

[CO.3]. To evaluate the environment and various species present and their importance and ways to conserve biodiversity.

[CO.4]. To construct and evaluate ways of managing solid waste and safe disposal techniques.

[CO.5]. To understand various measures undertaken by Government and laws related to protection of environment.

C. Assessment Plan:

Criteria	**Description**	**Maximum Marks**
Internal Assessment (Summative)	Internal Examination	20
	Assignment	05
	Attendance	05
End Term Exam (Summative)	End Term Examination	70
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS: ECOSYSTEM AND HOW THEY WORK: Structure and function of an ecosystem, Types of ecosystem, Producers, Consumers and decomposers, Food chains, Food webs, ecological pyramids, energy flow in the ecosystem. Introduction, types, characteristic feature, structure and function of forest ecosystem, desert ecosystem, aquatic ecosystem, Lithosphere, Biosphere, and Hydrosphere, Major issues of Biodiversity, Biosphere reserves, National parks and sanctuaries. **CONCEPT OF SUSTAINABILITY AND INTERNATIONAL EFFORTS FOR ENVIRONM**ENTAL PROTECTION: Concept of sustainable development, Emergence of environmental Issues, International Agreement on Environmental management, Problem of population growth, Population explosion, Family welfare Programme. **RENEWABLE AND NON-RENEWABLERESOURCES:** Defining resources, classification of resources, Soil and land degradation, Economic development and resources use, Natural resources accounting, **POLLUTIONAND PUBLIC POLICY (AIR, WATER,SOLID & WASTE**): Water Pollution; Water resources of India, Hydrological Cycle, Methods of Water conservation and

management. Ground and surface water pollution, Recycling and management of water and waste water {domestic and industrial}. Water borne diseases and health related issues, Air pollution and air pollutants, sources of air pollution, its effect on human health and vegetation. Greenhouse effect, global warming and climate change., Ambient air quality standards, steps taken by government to control air pollution, Its impact on human health, Municipal solid waste management, segregation, disposal methods, composting, land fill sites etc, Hazardous waste management, biomedical waste management, **MANAGING, GROWING AND ENDING THE VENTURE:** Legal framework; Constitutional provisions, The Indian Penal Code, Role of Judiciary in Environmental protection, Wild life {protection} Act, 1972,Water [prevention and control of pollution] Act,1974, Environment [protection] Act,1986,Air [prevention and control of pollution]Act,1981, Forest Conservation Act.

E. Text Book:

T1: Singh, Y.K, *Environmental Science*, New Age International Publishers

F. Recommended Readings:

R1. Uberoi,N.K, *Environmental Management*, Excel books
R2. Bharucha, Erach, *Environmental Studies for Undergraduate Courses*, UGC
R3. Kumar, Arvind, *Environmental Science*, APH Publishing

G. Course Articulation Matrix: (Mapping of COs withPOs)

S.No.	COURSE OUTCOME STATEMENT	CORRELATION WITH PROGRAM OUTCOMES									CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	Concept clarification about the components of environment and their inter relatedness	1		2		1	3		1	2		**1**	
CO2	Understanding of all the resources available and their origin and the ways to conserve them for sustainable future	2		2		2	3		2	1		1	
CO3	To evaluate the environment and various species present and their importance and ways to conserve biodiversity	**1**		**2**		**2**	**3**		**2**	**3**		**1**	
CO4	To construct and evaluate ways of managing solid waste and safe disposal techniques	**3**		**2**	**2**		**3**		**2**	**1**		**1**	
CO5	To understand various measures undertaken by Government and laws related to protection of environment	**3**		**2**	**2**		**3**		**2**	**2**		**1**	

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Data Structure through C Lab

Code: CSC22010
2 Credits | Semester II
Total Hours Required –60 Total Tutorials Required – 12

A. Introduction: The objective of the course is to provide complete knowledge of Algorithm. The students will be able to understand the concept of stack and queue in details.

The main objectives of the course are as follows:

- To impart the basic concepts of data structures and algorithms.
- To understand concepts about searching and sorting techniques.
- To understand basic concepts about stacks, queues, lists trees and graphs.
- To understanding about writing algorithms and step by step approach in solving problems with the help of fundamental data structures

B. Course Outcomes: At the end of the course, students will be able to
[CO.1]. Analyze the logic of a given problem
[CO.2]. Use array to store same type of data
[CO.3]. Use of Structure to create nodes which can store different data types data
[CO.4]. Learn best way to store, add, delete and retrieve data very fast.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Internal Examination	10
	Assignment	2.5
	Attendance	2.5
End Term Exam (Summative)	End Term Examination	35
	Total	50
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS:

List of Practical:

Strings: Write a menu driven program to compare, concatenate, copy strings and find the length of a string.Write a menu driven program to find the index of a pattern in a given string and to extract a substring.**Two dimensional arrays :** Insertion, Deletion.**Searching Techniques:** Write a program to implement Linear Search with sentinels.Write a program to implement Binary Search.**Singly Linked List Insertion & Deletion:** Creation of a linked list and insertion.Deletion from a linked list.**Recursion :**Fibonacci series using recursion, Towers of Hanoi with 3 pegs and n disks.**Stack:** Write a program to implement different operations on a stack using linked list.Write a program to implement different operations on a stack using an array.**Queue:** Write a program to implement different operations on a

queue using linked list.Write a program to implement different operations on a queue using an array.**Binary search trees:** Write a program to create a binary search tree and to perform Insertion and different types of traversal.**Sortingtechniques:**Write a program to implement insertion sort, Write a program to implement selection sort. Write a program to implement quick sort.

E. Text Book:

T1: Fundamental of Data Structures in C, HorowitzSahni Anderson-Freed, University Press

F. Recommended Readings:

R1: Data Structures through C, YashwantKanetkar, BPB.

R2: An Introduction to Data Structures with Applications, Tremblay J.P and Sorenson P.G, TMH

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	COURSE OUTCOME STATEMENT	CORRELATION WITH PROGRAM OUTCOMES									CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	Get knowledge about the basic concept of Implement data structure	1	2	2	2	2	-	-	-	-	2	-	-
CO2	Use array to store same type of data	2	2	2	2	-	2	-	-	-	2	1	-
CO3	Use of Structure to create nodes which can store different data types data	3	2	2	1	1	-	-	-	-	3	-	1
CO4	Learn best way to store, add, delete and retrieve data very fast.	1	2	2	1	-	1	-	-	-	2	-	-

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Object Oriented Programming with C++ Lab

Code: CSC22011

2 Credits | Semester II

Total Hours Required –60 Total Tutorials Required – 12

A. Introduction: The objective of the course is to provide complete knowledge of C++. Students will be able to develop logical abilities, which will help them to create programs, applications using C++. The students will also develop an ability, which can easily help them switch to any other language in future. It will be also helpful for development of different types of application on the basis of C++.

The main objectives of the course are as follows:

- Get knowledge about the basic concept of writing a program.
- Use of OOP concept to implement a program in C++.
- Concept of operator overloading.
- Concept of Polymorphism and Inheritance.
- To make students familiar with Computer Programming in C++ to develop applications.
- To make students aware about the concept of file handling in C++.

B. Course Outcomes: At the end of the course, students will be able to

[CO.1]. Analyze the logic of a given problem

[CO.2]. Demonstrate the concepts of Reusability through the use of functions

[CO.3]. Understanding the principles behind the object oriented development process

[CO.4]. Understanding the use of object oriented programming language in the development of small to medium sized application program

C. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Internal Examination	10
	Assignment	2.5
	Attendance	2.5
End Term Exam (Summative)	End Term Examination	35
	Total	50
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS:

List of Practical:

SL. NO.	TO BE IMPLEMENTED USING OBJECT ORIENTED LANGUAGE
1	Implementation of classes & objects.
2	Implementation of default arguments.
3	Implementation of method overloading.
4	Implementation of pass by value, pass by reference & return by reference.
5	Implementation of default constructors.
6	Implementation of parameterized constructors.
7	Implementation of constructor overloading.
8	Implementation of copy constructor.
9	Implementation of static functions.
10	Implementation of friend functions.
11	Implementation of Unary operator overloading.
12	Implementation of Binary operator overloading
13	Implementation of subscript operator overloading.
14	Implementation of dynamic memory allocation & de-allocation (new and delete) using constructors and destructors.
15	Implementation of simple & multi-level inheritance.
16	Implementation of multiple inheritance & hybrid inheritance.
17	Implementation of virtual functions & abstract classes.
18	To demonstrate conversion from basic to class & class to basic.
19	Implementation of I/O Streams and database file creation & display.
20	Implementation of Templates.

E. TEXT BOOKS

T1. E. Balaguruswamy, Object Oriented Programming with C++, Tata McGraw Hill

F. REFERENCE BOOKS

R1. E. Balaguruswamy, Object Oriented Analysis and Design, Tata McGraw Hill
R2. K R Venugopal, RajkumarBuyya, T Ravishankar, Mastering C++-Author, Tata McGraw Hill
R3. Byron Gottfried, Programming with C++, Tata McGraw Hill
R4. Yashwant P. Kanetkar, Let us C++, BPB Publication

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	COURSE OUTCOME STATEMENT	CORRELATION WITH PROGRAM OUTCOMES									CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	Analyze the logic of a given problem	1	2	1	2	1	-	-	2	-	2	-	-
CO2	Demonstrate the concepts of Reusability through the use of functions	2	2	1	2	-	2	-	1	-	2	1	-
CO3	Understanding the principles behind the object oriented development process.	3	1	2	1	1	-	1	-	-	3	-	1
CO4	Understanding the use of object oriented programming language in the development of small to medium sized application program	1	2	2	1	-	1	-	-	-	2	-	-

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

ARKA JAIN University
Jharkhand

Syllabus of

Bachelor of Computer Applications

Semester-III

ARKAJAIN University, Jharkhand
School of Engineering & Information Technology
Department of Computer Science & Information Technology
Faculty – BCA
Scheme of Study (w.e.f Batch 2020)

SEMESTER -I

Sl.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Introduction to Computer Science	Core	5	5	100	70	20	5	5
2	Programming In C	Core	5	5	100	70	20	5	5
3	Discrete Mathematics	GS	5	5	100	70	20	5	5
4	Business Communication	AECC	5	5	100	70	20	5	5
	Practical								
5	Computer Science Lab	Core	2	4	50	35	10	2.5	2.5
6	Programming In C Lab	Core	2	4	50	35	10	2.5	2.5
	Total		**24**	**28**	**500**	**350**	**100**	**25**	**25**

SEMESTER –II

Sl.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Data Structure through C	Core	5	5	100	70	20	5	5
2	Object Oriented Programming with C++	Core	5	5	100	70	20	5	5
3	Operating System	Core	5	5	100	70	20	5	5
4	Numerical & Statistical Methods	GS	5	5	100	70	20	5	5
5	Environmental Science	AECC	5	5	100	70	20	5	5
	Practical								
6	Data Structure through C Lab	Core	2	4	50	35	10	2.5	2.5
7	Object Oriented Programming with C++ Lab	Core	2	4	50	35	10	2.5	2.5
	Total		**28**	**32**	**600**	**420**	**120**	**30**	**30**

SEMESTER –III

Sl.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Programming with Java	Core	5	5	100	70	20	5	5
2	Design and Analysis of Algorithms	Core	5	5	100	70	20	5	5
3	Database Management System	Core	5	5	100	70	20	5	5
4	Data Communication & Networking	Core	5	5	100	70	20	5	5
5	Python Programming	SECC	4	4	100	70	20	5	5
	Practical								
6	Programming with Java Lab	Core	2	4	50	35	10	2.5	2.5
7	Database Management System Lab	Core	2	4	50	35	10	2.5	2.5
8	Python Programming Lab	SECC	2	4	50	35	10	2.5	2.5
	TOTAL		**30**	**36**	**650**	**455**	**130**	**32.5**	**32.5**

SEMESTER –IV

Sl.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Introduction to Data Science	Core	5	5	100	70	20	5	5
2	Internet of Things	Core	5	5	100	70	20	5	5
3	Data Science - Elective I IOT - Elective I AI - Elective I	DSE	5	5	100	70	20	5	5
4	Data Science - Elective II IOT - Elective II AI - Elective II	DSE	5	5	100	70	20	5	5
	Practical								
5	Data Science - Elective I IOT - Elective I AI - Elective I	**DSE**	2	4	50	35	10	2.5	2.5
6	Data Science - Elective II IOT - Elective II AI - Elective II	DSE	2	4	50	35	10	2.5	2.5
	TOTAL		**24**	**28**	**500**	**350**	**100**	**25**	**25**

SEMESTER –V

Sl.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Enterprise Java	Core	5	5	100	70	20	5	5
2	Machine Learning	Core	5	5	100	70	20	5	5
3	Mobile Application Development	SECC	4	4	100	70	20	5	5
4	Data Science - Elective III IOT - Elective III AI - Elective III	DSE	5	5	100	70	20	5	5
5	Data Science - Elective IV IOT - Elective IV AI - Elective IV	DSE	5	5	100	70	20	5	5
	Practical								
6	Enterprise Java Lab	Core	2	4	50	35	10	2.5	2.5
7	Machine Learning Lab	Core	2	4	50	35	10	2.5	2.5
8	Mobile Application Development Lab	SECC	2	4	50	35	10	2.5	2.5
	TOTAL		**30**	**36**	**650**	**455**	**130**	**32.5**	**32.5**

SEMESTER –VI

Sl. No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Software Engineering	Core	5	5	100	70	20	5	5
2	Data Science - Elective V IOT - Elective V AI - Elective V	DSE	5	5	100	70	20	5	5
3	Data Science - Elective VI IOT - Elective VI AI - Elective VI	DSE	5	5	100	70	20	5	5
	Practical								
4	Project	DSE	5	5	100	70	30	0	0
5	Data Science - Elective V IOT - Elective V AI - Elective V	DSE	2	4	50	35	10	2.5	2.5
6	Data Science - Elective VI IOT - Elective VI AI - Elective VI	DSE	2	4	50	35	10	2.5	2.5
	TOTAL		**24**	**28**	**500**	**350**	**110**	**20**	**20**

Discipline Specific Elective (DSE) Courses

Elective I & II	Elective I & II	Elective I & II
Data Science (Select any Two)	**IOT (Select any Two)**	**AI (Select any Two)**
R Programming Language	Sensor Technologies	Introduction to RPA Tools
Python for Data Science	Embedded System	Introduction to Process Automation
Web Programming	Web Programming	Web Programming
Practical		
R Programming Language Lab	Sensor Technologies Lab	Introduction to RPA Tools Lab
Python for Data Science Lab	Embedded System Lab	Introduction to Process Automation Lab
Web Programming Lab	Web Programming Lab	Web Programming Lab

Elective III & IV	Elective III & IV	Elective III & IV
Data Science (Select any Two)	**IOT (Select any Two)**	**AI (Select any Two)**
Design and Analysis of Experiments	Artificial Intelligence	Six Sigma and Lean Methods
Probabilistic Graphical Models	Digital Image Processing	Digital Image Processing
Exploratory Data Analysis and Data Visualization Techniques	Cloud Computing	Business Intelligence

Elective V & VI	Elective V & VI	Elective V & VI
Data Science (Select any Two)	**IOT (Select any Two)**	**AI (Select any Two)**
Big Data Analytics	Embedded C with Adruino	Cloud Deployment And Management
NoSQL Databases	Digital Signal Processing	Natural Language Processing
Time Series Analysis	Artificial Neural Networks	Artificial Neural Networks
Practical		
Big Data Analytics Lab	Embedded C with Adruino Lab	Cloud Deployment And Management Lab
NoSQL Databases Lab	Digital Signal Processing Lab	Natural Language Processing Lab
Time Series Analysis Lab	Artificial Neural Networks Lab	Artificial Neural Networks Lab

Distribution of Credit across 6 semesters:

Sl. No	Type of Paper	No. of Paper	Total Credit
1	Core Paper	22	86
2	Ability Enhancement Compulsory Paper	2	10
3	Generic Paper	2	9
4	Discipline Specific Elective	11	43
5	Skill Enhancement	4	12
	Total	41	160

***CIA – Continuous Internal Assessment – Based on Projects / Assignment during the semester**
GS-Generic Subject | AECC -Ability Enhancement Compulsory Course
SECC -Skill Enhancement Compulsory Course | DSE - Discipline Specific Elective

ARKAJAINUniversity, Jharkhand
School of Engineering & Information Technology
Department of Computer Science & Information Technology
PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES
BCA – Semester–III

PROGRAM OUTCOMES

After completing this undergraduate program, a learner:

[PO.1]. Apply knowledge of Mathematics and science in solving computational problems

[PO.2]. Understand the Computing concepts and their applications using the acquired board based knowledge.

[PO.3]. Design, set up and conduct practical.

[PO.4]. Use the techniques, skills, and modern Software tools for software development.

[PO.5]. Identify and analyze software application problems in multiple aspect including coding, testing and implementation in industrial applications.

[PO.6]. Design, develop and verify software systems to meet desired needs within realistic constraints ensuring quality, reliability, security in addition to satisfying economical, ethical, social and environmental constraints.

[PO.7]. Apply Enterprise level application software for design of diverse software products.

[PO.8]. Communicate effectively in diverse groups and exhibit leadership qualities.

[PO.9]. Understanding of professional and ethical responsibility.

PROGRAM SPECIFIC OUTCOMES (COMMON ACROSS ALL SPECIALIZATIONS)

[PSO.1]. Prepare professionally trained in the areas of programming, databases, software engineering, web designing and networking and other application areas to acquire knowledge in various domain-based prospects.

[PSO.2]. Encourage to communicate effectively and to improve their competency skills to solve real time problems.

[PSO.3]. Understand to employ modern computer languages and applications for their successful career, to create platforms to become an entrepreneur and a relish for higher studies.

PROGRAM SPECIFIC OUTCOMES (DATA SCIENCE)

[PSO.4]. Ability to apply the knowledge of computing tools and techniques in the field of Data science for solving real world problems encountered in the Software Industries.

[PSO.5]. Ability to identify the challenges in Data analytics with respect to IT Industry and pursue quality research in this field with social relevance.

PROGRAM SPECIFIC OUTCOMES (INTERNET OF THINGS)

[PSO.4]. An ability to apply pattern recognition, machine learning, and artificial intelligent techniques including statistical data analysis and quantitative modelling techniques to solve real world problems from various domains such as healthcare, social computing, economics, etc.

[PSO.5]. An ability to recognize and analyze problems related to AI and ML applications along with their ethical implications.

PROGRAM SPECIFIC OUTCOMES (ARTIFICIAL INTELLIGENCE)

[PSO.4]. An ability to recognize and analyze problems related to artificial intelligence and machine learning applications along with their ethical implications

[PSO.5]. An ability to apply intelligent computer systems to a variety of applications.

Subject: Programming with Java

Code: CSC23013
5 Credits | Semester III
Total Hours Required –75 Total Tutorials Required – 15

A. Introduction: The objective of the course is to provide complete knowledge of Java which is use to develop OOP Concepts and feature. Students will be able to develop stand-alone applications using AWT.

The main objectives of the course are as follows:

- Use of Class and Object
- Implementing Array and String
- Concept of Interface
- Web programming through Applet.
- Use of Servlet to process client request at server site.

B. Course Outcomes: At the end of the course, students will be able to:

[CO.1]. Analyze the logic of a given problem
[CO.2]. Use branching control statements and iterative control statements
[CO.3]. Achieving Multiple inheritance using interface
[CO.4]. Applet and AWT to design application

C. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Internal Examination	20
	Assignment	05
	Attendance	05
End Term Exam (Summative)	End Term Examination	70
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

INTRODUCTION & FUNDAMENTALS OF JAVA: History, architecture, Java Class File, Java Runtime Environment, Java Virtual Machine, Java Development Kit, Java Compiler And Interpreter. Java programs. **Data types:** primitive data types, Object Reference Types, Strings, operators and its different types. **Control Flow Statements:** if…else Statement, switch…case Statement. **Iterations:** while Loop, do … while Loop, for Loop, for each Loop, break and continue Statements, return Statement.**Classes:** Types of Classes, Scope Rules, Access Modifier, Class objects,Class Methods, Method Overloading, Constructors, this Instance, super Instance. **Inheritance:** Inheritance Basics, Types of Inheritance, Base class, Derived Class Objects. Abstract Classes, Abstract Methods. **Interfaces**: Introduction, Abstract Classes and Interfaces, Multiple Inheritance.Default Implementation, Adding New Functionality, Method

Implementation, Classes V/s Interfaces, Defining An Interface, Implementing Interfaces.**Arrays:** One Dimensional Arrays, Multi-Dimensional Arrays. **Strings:** Handling strings in Java.**Multi threading:** the thread control methods, thread life cycle.**Exceptions:** Catching Java Exceptions, Catching Run-Time Exceptions, Handling Multiple Exceptions, The finally Clause, The throws Clause. **Byte streams:** reading console input, writing console output, reading file, writing file, writing, binarydata,readingbinarydata,getting started with character streams, writing file, readingfile. **Applet:** Applet Basics, How Applet differs from Applications, Applet Architecture,Appletlifecycle. **Applet display methods:** Repaint, Status window, passing parameters to applets, getDocumentBase and get CodeBase, AppletContext and showDocument. **Event Handling:** Delegation Event Model, Events, Event classes, Event listener interfaces, Using delegation event model, adapter classes and inner classes.**Abstract Window Toolkit:** Window Fundamentals, Component, Container, Panel, Window, Frame, Canvas. Components – Labels, Buttons, Check Boxes, RadioButtons,ChoiceMenus,TextFields,Text,ScrollingList,Scrollbars,Panels, Frames. **Layouts:** Flow Layout, Grid Layout, Border Layout, Card Layout

E. TEXT BOOKS

T1. Programming with Java - E. Balagurusamy, TMH
T2. Murach's beginning Java with Net Beans - Joel Murach , Michael Urban, SPD

F. REFERENCE BOOKS

R1. Core Java, Volume I: Fundamentals - Hortsman, Pearson
R2. Core Java, Volume II: Advanced Features - Gary Cornell and Hortsman, Pearson
R3. Core Java: An Integrated Approach - R. Nageswara Rao, DreamTech
R4. Java: The Complete Reference - Herbert Schildt, McGraw Hill
R5. Core Java 8 for Beginners - Vaishali Shah, Sharnam Shah, SPD

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	COURSE OUTCOME STATEMENT	CORRELATION WITH PROGRAM OUTCOMES									CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	Analyze the logic of a given problem	3	2	2	2	3	3	-	-	1	2	-	2
CO2	Use branching control statements and iterative control statements	2	2	2	2	2	2	2	-	-	2	1	2
CO3	Achieving Multiple inheritance using interface	3	2	2	1	1	-	-	-	-	3	-	1
CO4	Applet and AWT to design application	1	2	2	1	2	1	2	-	1	2	-	3

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Design and Analysis of Algorithms

Code: CSC23014
5 Credits | Semester III
Total Hours Required –75 Total Tutorials Required – 15

A. Introduction: The objective of the course is to provide complete knowledge of Algorithm. The students will be able to understand the concept of stack and queue in details. Analysis of algorithm is very important to know how feasible the algorithm is.

The main objectives of the course are as follows:

- To analyze the performance of recursive and nor-recursive algorithms.
- To use of different paradigms of problem solving.
- To understand various algorithm design techniques.
- To find efficient ways to solve a given problem.
- To compare various algorithms of a given problem.

B. Course Outcomes: At the end of the course, students will be able to

[CO.1]. Design algorithms for a given problem using standard algorithm design techniques.
[CO.2]. Define the concepts and mathematical foundation for analysis of algorithm.
[CO.3]. Analyze and compare the efficiency of various algorithms of a given problem
[CO.4]. Explain different standard algorithm design techniques, namely, divide & conquer, greedy, dynamic programming, backtracking and branch & bound.
[CO.5]. Demonstrate standard algorithms for fundamental problems in Computer Science.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Internal Examination	20
	Assignment	05
	Attendance	05
End Term Exam (Summative)	End Term Examination	70
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

Introduction ,What is Algorithm, Analysis of Algorithm, Analysis of Complexity, 3 Notation of Complexity, Example on complexity, Difference on algorithm and pseudo code, Insertion sort, Insertion sort algorithm, Analysis of complexity, Applications of DAC, Polynomial vs. exponential, Min max problem, Problem solving, basic Algorithm, Min max algorithm, Quick sort, Analysis of worst case, Binary Search, Strassen's Matrix Multiplication, Strassen's Matrix Multiplication Algorithm, Greedy Algorithms, Krushkals Algorithm, Minimum cost spanning tree, Prim's algorithm, Optimal Merge

Pattern, all shortest path, TSP, N-queen, sum of subset, graph coloring , Hamiltonian cycle, Adj.matrix, Adj.list, DFS, BFS,Depth First search numerical,breadth first search numerical.

E. TEXT BOOKS

T1. Introduction to Algorithms. Cormen Thomas H. 3rd Edition, PHI Learning, latest edition.

F. REFERENCE BOOKS

R1. Fundamentals of Computer Algorithms Horowitz E., SahaniGalgotiaPublication Pvt. Ltd.

R2. Design and Analysis of Algorithms Dave and Dave2nd Edition, Pearson.

R3. Algorithm Design Goodrich Wiley

G. Course Articulation Matrix: (Mapping of COs withPOs)

CO	COURSE OUTCOME STATEMENT	CORRELATION WITH PROGRAM OUTCOMES									CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	Design algorithms for a given problem using standard algorithm design techniques.	**1**	**2**	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**2**	**-**	**-**
CO2	Define the concepts and mathematical foundation for analysis of algorithm.	**2**	**2**	**2**	**2**	**-**	**2**	**-**	**-**	**-**	**2**	**1**	**-**
CO3	Analyze and compare the efficiency of various algorithms of a given problem	**3**	**2**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**3**	**-**	**1**
CO4	Explain different standard algorithm design techniques, namely, divide & conquer, greedy dynamic programming, backtracking.	**1**	**2**	**2**	**1**	**-**	**1**	**-**	**-**	**-**	**2**	**-**	**-**
CO5	Demonstrate standard algorithms for fundamental problems in Computer Science.	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**-**	**-**

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Database Management System

Code: CSC23016
5 Credits | Semester III
Total Hours Required –75 Total Tutorials Required – 15

A. Introduction: The objective of the course is to provide course is to present an introduction to database management systems, with an emphasis on how to organize, maintain and retrieve - efficiently, and effectively - information from a DBMS. It also exposes the students to advanced database concepts.

The main objectives of the course are as follows:

- To know about the fundamental concepts of a relational database system
- To know about the Utilize a wide range of features available in a DBMS package.
- To know about the analyze database requirements and determine the entities involved in the system and their relationship to one another.
- To know about the manipulate a database using SQL
- To know about the assess the quality and ease of use of data modelling and diagramming tools

B. Course Outcomes: At the end of the course, students will be able to

[CO.1]. To understanding Describe the fundamental elements of relational database management systems

[CO.2]. To understanding Explain the basic concepts of relational data model, entity-relationship model, relational database design, relational algebra, and SQL.

[CO.3]. To understanding the Design ER-models to represent simple database application scenarios

[CO.4]. To understanding the Convert the ER-model to relational tables, populate relational database and formulate SQL queries on data.

[CO.5]. To understanding the Improve, the database design by normalization.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Internal Examination	20
	Assignment	05
	Attendance	05
End Term Exam (Summative)	End Term Examination	70
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS:

Introduction to Databases: What is database system, purpose of database system, view of data, relational databases, database architecture, transaction management, **Data Models -** The importance of data models, Basic building blocks, Business rules, The evolution of data models, Degrees of data abstraction. **Database Design, ER Diagram and Unified Modeling Language -**Database design and ER Model: overview, ER Model, Constraints, ER Diagrams, ERD Issues, weak entity sets, Codd's rules, Relational Schemas Introduction to UML**Relational database model:** Logical view of data, keys, integrity rules **Relational Database design:** features of good relational database design Normalization (1NF, 2NF, 3NF, BCNF) **Relational algebra:** introduction, Selection and projection, set operations, renaming, Joins, Division, syntax, semantics. Operators, grouping and ungrouping, relational comparison. **Calculus:** Tuple relational calculus, Domain relational Calculus, calculus vs algebra, computational capabilities **SQL, CONSTRAINTS AND VIEWS SQL:** Basic SQL Commands Single-Row functions Aggregate and group functions Joins and Sub-queries Modifying Data Constraints, types of constrains, Integrity constraints Views: Introduction to views, data independence, security, updates on views, comparison between tables and views, **TRANSACTION MANAGEMENT AND CONCURRENCY** Control Transaction management: ACID properties, serialize ability Concurrency control, Lock based concurrency control (2PL, Deadlocks) Time stamping methods, optimistic methods, database recovery concepts and techniques.**PL-SQL** Beginning with PL / SQL, Identifiers and Keywords, Operators, Expressions, Sequences Control Structures Cursors and Transaction Collections and composite data types Procedures and Functions

E. TEXT BOOKS

T1. A Silberschatz, H Korth, S Sudarshan, Database System and Concepts, McGraw- Hill
T2. Ivan Bayross, PL/SQL Programming, BPB

F. REFERENCE BOOKS

R1. Rob Coronel, Database Systems, Cengage Learning
R2. C.J. Date, Introduction to Database, Pearson
R3. H. Dand, R. Patil and T. Sambare, Programming with PL/SQL for Beginners, X –Team

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	COURSE OUTCOME STATEMENT	CORRELATION WITH PROGRAM OUTCOMES									CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	To understanding Describe the fundamental elements of relational database management systems	**3**	**2**	**2**	**2**	**2**	**2**	**-**	**-**	**-**	**2**	**-**	**2**
CO2	To understanding Explain the basic concepts of relational data model, entity-relationship model, relational database design, relational algebra, and SQL.	**3**	**2**	**2**	**2**	**3**	**2**	**2**	**-**	**-**	**2**	**1**	**2**
CO3	To understanding the Design ER-models to represent simple database application scenarios	**3**	**2**	**2**	**1**	**1**	**2**	**1**	**-**	**-**	**3**	**-**	**1**
CO4	To understanding the Convert the ER-model to relational tables, populate relational database and formulate SQL queries on data.	**3**	**2**	**2**	**1**	**2**	**1**	**-**	**-**	**-**	**2**	**-**	**1**
CO5	To understanding the Improve, the database design by normalization.	**1**	**2**	**3**	**2**	**2**	**2**	**1**			**2**	**1**	**1**

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Data Communication & Networking

Code: CSC23017

5 Credits | Semester III

Total Hours Required –75 Total Tutorials Required – 15

A. INTRODUCTION: The objective of the course is to provide complete knowledge cover both the principles and paradigms of modern distributed systems. In the first part, it covers the principles of communication, processes, naming, synchronization, consistency and replication, fault tolerance, and security in detail.

The main objectives of the course are as follows:

- To learn the fundamental layered structure of networks,
- To understand common offered layered services,
- To know about the protocols and algorithms used to operate the network.
- To be the familiar with various types of computer networks
- To be the exposed to the TCP/IP protocol suite

B. COURSE OUTCOMES: By the end of this course, students will be able to:

[CO.1]. Analyze the topologies and network models.
[CO.2]. Understand the various network protocols, algorithms. Multiplexing, Error Detention, and Data Link Control
[CO.3]. Analyze the Network Layer and Next Generation IP, Data-Link and Network-Layer Protocols
[CO.4]. Understand about the Wired Networks and Virtual LANs

C. ASSESSMENT PLAN:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Internal Examination	20
	Assignment	05
	Attendance	05
End Term Exam (Summative)	End Term Examination	70
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS:

PHYSICAL LAYER: Data communications, networks, network types, Internet history, standards and administration. **Network Models:** Protocol layering, TCP/IP protocol suite, The OSI model. **Introduction to Physical layer:** Data and signals, periodic analog signals, digital signals, transmission impairment, data rate limits, performance. **Digital and Analog transmission:** Digital-to-digital conversion, analog-to-digital conversion, transmission modes, digital-to-analog conversion, analog-to-analog conversion. **Multiplexing and Spectrum Spreading:** Multiplexing-Frequency division multiplexing – Time division multiplexing , Spread Spectrum **Transmission media:** Guided Media: Twisted pair cable – coaxial cable – fiber optic cable, Unguided Media: radio waves - micro waves – infrared. **DATA LINK LAYER Switching:** Introduction, circuit switched networks, packet switching,

structure of a switch **Introduction to the Data Link Layer:** Link layer addressing, Data Link Layer Design Issues, Errordetection and correction, block coding, cyclic codes, checksum, forward error correction, error correcting codes, error detecting codes. **Data Link Control:** DLC services, data link layer protocols, HDLC, Point-to-point protocol. **Multiple Access:** Random access- Aloha-CSMA-CSMA/CD-CSMA/CA Controlled access: reservation, polling, token passing. **WIRED &WIRELESS LANs Media Access Control**: Random Access, Controlled Access, Channelization: FDMA,TDMA, CDMA. **Wired LANs –** Ethernet Protocol, standard ethernet, fast ethernet, gigabit ethernet, 10 gigabit Ethernet **Wireless LANs:** Introduction, IEEE 802.11 architecture, MAC sublayer addressing mechanism, physical layer Bluetooth: architecture-Bluetooth layers-radio layer-baseband layer-L2CAP-other upper layers. WiMAX, Cellular telephony, Satellite networks. **Connecting devices and Virtual LANs. Introduction to the Network Layer**: Network layer services, packet switching, network layer performance, IPv4 addressing, forwarding of IP packets, Internet Protocol, ICMPv4, Mobile IP **Unicast Routing:** Introduction, routing algorithms, unicast routing protocols. **Next generation IP:** IPv6 addressing, IPv6 protocol, ICMPv6 protocol, transition from IPv4 to IPv6. **Introduction to the Transport Layer**: Introduction, Transport layer protocols (Simple protocol, Stop-and-wait protocol, Go-Back-n protocol, Selective repeat protocol, Bidirectional protocols), Transport layer services, User datagram protocol, Transmission control protocol **Standard Client / Server Protocols:** Worldwide- web and HTTP,FTP, Electronic mail, Telnet, Secured Shell, Domain name system. **Application layer: DNS:** Name space – domain name space – distribution of name space **Electronic mail Architecture – FILE transfer:** FTP **WWW and HTTP:** Architecture – web documents – HTTP **Network Security:** Introduction - definitions – two categories - symmetric key cryptography – traditional ciphers – asymmetric key cryptography

E. TEXT BOOK:

T1. Behrouz A. Forouzan, Data Communication and Networking, TMH

F. REFERENCE BOOK:

R1. Andrew Tanenbaum, Computer Networks, Pearson

R2. Behrouz A .Forouzan, TCP/IP Protocol Suite, TMH

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	COURSE OUTCOME STATEMENT	CORRELATION WITH PROGRAM OUTCOMES									CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	Analyze the topologies and network models.	1	2	2	2	2	-	-	-	-	2	-	-
CO2	Understand the various network protocols, algorithms. Multiplexing, Error Detention, and Data Link Control	2	2	2	2	-	2	-	-	-	2	1	-
CO3	Analyze the Network Layer and Next Generation IP, Data-Link and Network-Layer Protocols	3	2	2	1	1	-	-	-	-	3	-	1
CO4	Understand about the Wired Networks and Virtual LANs	1	2	2	1	-	1	-	-	-	2	-	-

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Python Programming

Code: CSC23018

4 Credits | Semester III

Total Hours Required –60 Total Tutorials Required – 12

A. INTRODUCTION: The objective of this course is to introduce the concepts of python programming. This course will help students to learn the python programming from basic to advanced level. Thiscourse is also to help the students to get familiar with:

- Basics of Python programming
- Decision Making and Functions in Python
- Object Oriented Programming using Python
- Files Handling in Python
- GUI Programming and Databases operations in Python
- Network Programming in Python

B. COURSE OUTCOMES: By the end of this course, students will be able to:

[CO.1]. Describe the Numbers, Math functions, Strings, List, Tuples and Dictionaries in Python
[CO.2]. Express different Decision Making statements and Functions
[CO.3]. Interpret Object oriented programming in Python
[CO.4]. Understand and summarize different File handling operations
[CO.5]. Explain how to design GUI Applications in Python and evaluate different database operations
[CO.6]. Design and develop Client Server network applications using Python

C. ASSESSMENT PLAN:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Internal Examination	20
	Assignment	05
	Attendance	05
End Term Exam (Summative)	End Term Examination	70
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS:

Introduction: The Python Programming Language, History, features, Installing Python, Running Python program. Debugging, Difference Between Brackets, Braces, and Parentheses. **Variables and Expressions**, **Conditional Statements:** if, if-else, nested if –else. **Looping:** for, while, nested loops, **Control statements:** Terminating loops, skipping specific conditions. **Functions in Python, Strings:** A String Is a Sequence, Traversal with a for Loop, String Slices, Strings Are Immutable, Searching, Looping and Counting, String Methods, The in Operator, String Comparison, String Operations.**Regular Expressions** – Concept of regular expression, various types of regular expressions, using match function.

OBJECT ORIENTED PROGRAMMING USING PYTHON PROGRAMMING: Classes and Objects: Introduction, Class Definition, Creating Objects, Instances as Arguments, Instances as return values, Built-in Class Attributes, Constructor, Inheritance, Method Overriding, Data Encapsulation, Data Hiding, Operator Overloading, Method Overloading & Overriding, Interfaces in Python. Multithreaded Programming: Thread Module, creating a thread, synchronizing threads. **Modules:** Creating Modules and Packages. **FILE HANDLING:** Lists: traversing a List, Deleting elements from List, Built-in List Operators, In Operator, Built-in List functions and methods. Tuples: Tuple Assignment, Tuples as return values, Variable-length argument tuples, Basic tuples operations. Dictionaries: Properties of Dictionary keys, Operations in Dictionary, Built-In Dictionary Functions, Built-in Dictionary Methods. Files: Text Files, The File Object Attributes, Directories. Exceptions: Built-in Exceptions, Handling Exceptions, Exception withArguments, User-defined Exceptions. **Creating the GUI Form and Adding Widgets:**Widgets, Handling Standard attributes and Properties of Widgets.**Layout Management:** Designing GUI applications with proper Layout Management features. **Storing Data in Our MySQL Database via Our GUI:** Connecting to a My SQL database from Python, Configuring the MySQL connection, Designing the Python GUI database, Using the INSERT command,Using the UPDATE command, Using the DELETE command, Storing and retrieving data from MySQL database.

E. TEXT BOOK

T1. Think Python - Allen Downey, O'Reilly

T2. Introduction to Problem Solving with Python - E. Balagurusamy, TMH

F. REFERENCE BOOK

R1. Python GUI Programming Cookbook - Burkhard A. Meier, Packt

R2. An Introduction to Computer Science using Python 3 –JasonMontojo, Jennifer Campbell, Paul Gries, SPD

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	COURSE OUTCOME STATEMENT	CORRELATION WITH PROGRAM OUTCOMES									CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	Describe the Numbers, Math functions, Strings, List, Tuples and Dictionaries in Python	1	2	2	2	2	-	-	-	-	2	-	2
CO2	Express different Decision Making statements and Functions	2	2	2	2	-	2	-	-	-	2	1	3
CO3	Interpret Object oriented programming in Python	3	2	2	1	1	-	-	-	-	3	3	1
CO4	Understand and summarize different File handling operations	1	2	2	3	2	2	-	-	-	2	-	3
CO5	Explain how to design GUI Applications in Python and evaluate different database operations	1	2	2	3	-	2	-	-	-	3	2	3
CO6	Design and develop Client Server network applications using Python	3	2	3	3	2	2	2	-	-	2	3	2

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Programming with Java Lab

Code: CSC23019
2 Credits | Semester III
Total Hours Required –60 Total Tutorials Required – 12

A. Introduction: The objective of the course is to provide complete knowledge of Java which is used to develop OOP Concepts and feature. Students will be able to develop standalone applications using AWT.

The main objectives of the course are as follows:

- Use of Class and Object
- Implementing Array and String
- Concept of Interface
- Web programming through Applet.
- Use of Servlet to process client request at server site.

B. Course Outcomes : At the end of the course, students will be able to:

[CO.1]. Analyze the logic of Java Program.
[CO.2]. Use of object to design complex logic
[CO.3]. Achieving Multiple inheritance using interface
[CO.4]. Applet and AWT to design application

C. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Internal Examination	10
	Assignment	2.5
	Attendance	2.5
End Term Exam (Summative)	End Term Examination	35
	Total	50
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

List of Practical	
1.	**Java Basics**
a.	WriteaJavaprogramthattakesanumberasinputandprintsitsmultiplicationtable upto 10.

b.	Write a Java program to display the following pattern. ***** **** *** ** *
c.	Write a Java program to print the area and perimeter of a circle.
2.	**Use of Operators**
a.	Write a Java program to add two binary numbers.
b.	WriteaJavaprogramtoconvertadecimalnumbertobinarynumberandviceversa.
c.	Write a Java program to reverse a string.
3.	**Java Data Types**
a.	Write a Java program to count the letters, spaces, numbers and other characters of an input string.
b.	Implement a Java function that calculates the sum of digits for a given char array consisting of the digits '0' to '9'. The function should return the digit sum as a long value.
c.	Find the smallest and largest element from the array
4.	**Methods and Constructors**
a.	Designed a class SortData that contains the method asec() and desc().
b.	Designed a class that demonstrates the use of constructor and destructor.
c.	Write a java program to demonstrate the implementation of abstract class.
5.	**Inheritance**
a.	Write a java program to implement single level inheritance.
b.	Write a java program to implement method overriding
c.	Write a java program to implement multiple inheritance.
6.	**Packages and Arrays**
a.	Create a package, Add the necessary classes and import the package in java class.
b.	Write a java program to add two matrices and print the resultant matrix.
c.	Write a java program for multiplying two matrices and print the product for the same.
7.	**Vectors and Multithreading**
a.	Write a java program to implement the vectors.
b.	Write a java program to implement thread life cycle.
c.	Write a java program to implement multithreading.
8.	**File Handling**
a.	Write a java program to open a file and display the contents in the consolewindow.
b.	Write a java program to copy the contents from one file to other file.
c.	Write a java program to read the student data from user and store it in the file.

9.	**GUI and Exception Handling**
a.	Design an AWT program to print the factorial for an input value.
b.	Design an AWT program to perform various string operations like reverse string, string concatenation etc.
c.	Write a java program to implement exception handling.
10.	**GUI Programming.**
a.	Design an AWT application that contains the interface to add student information and display the same.
b.	Design a calculator based on AWT application.
c.	Design an AWT application to generate result marks sheet.

E. TEXT BOOKS

T1. Programming with Java - E. Balagurusamy, TMH

T2. Murach's beginning Java with Net Beans - Joel Murach , Michael Urban, SPD

F. REFERENCE BOOKS

R1. Core Java, Volume I: Fundamentals - Hortsman, Pearson

R2. Core Java, Volume II: Advanced Features - Gary Cornell and Hortsman, Pearson

R3. Core Java: An Integrated Approach - R. Nageswara Rao, DreamTech

R4. Java: The Complete Reference - Herbert Schildt, McGraw Hill

R5. Core Java 8 for Beginners - Vaishali Shah, Sharnam Shah, SPD

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	COURSE OUTCOME STATEMENT	CORRELATION WITH PROGRAM OUTCOMES									CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	Analyze the logic of a given problem	3	2	2	2	3	3	-	-	1	2	-	2
CO2	Use branching control statements and iterative control statements	2	2	2	2	2	2	2	-	-	2	1	2
CO3	Achieving Multiple inheritance using interface	3	2	2	1	1	-	-	-	-	3	-	1
CO4	Applet and AWT to design application	1	2	2	1	2	1	2	-	1	2	-	3

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Database Management System Lab

Code: CSC23020
2 Credits | Semester III
Total Hours Required –60 Total Tutorials Required – 12

A. Introduction: The objective of the course is to provide complete knowledge of Data structure. Student is expected to work towards a sound practical understanding of Data Structures and also compliment the same with hands on implementing experience.

The main objectives of the course are as follows:

- To be able to practically implement the database query to create database.
- To run DDL and DML query
- Working on PL/SQL.

B. Course Outcomes: At the end of the course, students will be able to

[CO.1]. Describe the fundamental elements of relationaldatabase management systems
[CO.2]. Explain the basic concepts of relational data model, entity-relationship model, relational database design, relational algebra, and SQL.
[CO.3]. Design ER-models to represent simple database application scenarios
[CO.4]. Convert the ER-model to relational tables, populate relational database and formulate SQL queries on data.
[CO.5]. Improve the database design by normalization. Working with PL/SQL

C. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Internal Examination	10
	Assignment	2.5
	Attendance	2.5
End Term Exam (Summative)	End Term Examination	35
	Total	50
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS:

List of Practical	
1.	**SQL Statements – 1**
a.	Writing Basic SQL SELECT Statements
b.	Restricting and Sorting Data
c.	Single-Row Functions

2.	**SQL Statements – 2**
a.	Displaying Data from Multiple Tables
b.	Aggregating Data Using Group Functions
c.	Subqueries
3.	**Manipulating Data**
a.	Using INSERT statement
b.	Using DELETE statement
c.	Using UPDATE statement
4.	**Creating and Managing Tables**
a.	Creating and Managing Tables
b.	Including Constraints
5.	**Creating and Managing other database objects**
a.	Creating Views
b.	Other Database Objects
c.	Controlling User Access
6.	**Using SET operators, Date/Time Functions, GROUP BY clause (advanced features) and advanced subqueries**
a.	Using SET Operators
b.	Datetime Functions
c.	Enhancements to the GROUP BY Clause
d.	Advanced Subqueries
7.	**PL/SQL Basics**
a.	Declaring Variables
b.	Writing Executable Statements
c.	Interacting with the Oracle Server
d.	Writing Control Structures
8.	**Composite data types, cursors and exceptions.**
a.	Working with Composite Data Types
b.	Writing Explicit Cursors
c.	Handling Exceptions
9.	**Procedures and Functions**
a.	Creating Procedures
b.	Creating Functions
c.	Managing Subprograms
d.	Creating Packages
10.	**Creating Database Triggers**

E. TEXT BOOKS

T1. A Silberschatz, H Korth, S Sudarshan, Database System and Concepts, McGraw- Hill
T2. Ivan Bayross, PL/SQL Programming, BPB

F. REFERENCE BOOKS

R1. H. Dand, R. Patil and T. Sambare, Programming with PL/SQL for Beginners, X –Team

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	COURSE OUTCOME STATEMENT	CORRELATION WITH PROGRAM OUTCOMES									CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	Describe the fundamental elements of relationaldatabase management systems	**1**	**2**	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**2**	**-**	**-**
CO2	Explain the basic concepts of relational data model, entity-relationship model, relational database design, relational algebra, and SQL	**2**	**2**	**2**	**2**	**-**	**2**	**-**	**-**	**-**	**2**	**1**	**-**
CO3	Design ER-models to represent simple database application scenarios	**3**	**2**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**3**	**-**	**1**
CO4	Convert the ER-model to relational tables, populate relational database and formulate SQL queries on data.	**1**	**2**	**2**	**1**	**-**	**1**	**-**	**-**	**-**	**2**	**-**	**-**
CO5	Improve the database design by normalization. Working with PL/SQL	**3**	**2**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**3**	**-**	**1**

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Python Programming Lab

Code: CSC23021
2 Credits | Semester III
Total Hours Required –60 Total Tutorials Required – 12

A. INTRODUCTION: The objective of this course is to introduce the concepts of python programming. This course will help students to learn the python programming from basic to advanced level.Thiscourse is also to help the students to get familiar with:

- Basics of Python programming
- Decision Making and Functions in Python
- Object Oriented Programming using Python
- Files Handling in Python
- GUI Programming and Databases operations in Python
- Network Programming in Python

B. COURSE OUTCOMES: By the end of this course, students will be:

[CO.1]. Describe the Numbers, Math functions, Strings, List, Tuples and Dictionaries in Python
[CO.2]. Express different Decision Making statements and Functions
[CO.3]. Interpret Object oriented programming in Python
[CO.4]. Understand and summarize different File handling operations
[CO.5]. Explain how to design GUI Applications in Python and evaluate different database operations
[CO.6]. Design and develop Client Server network applications using Python

C. ASSESSMENT PLAN:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Internal Examination	10
	Assignment	2.5
	Attendance	2.5
End Term Exam (Summative)	End Term Examination	35
	Total	50
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS:

List of Practical	
1.	**Write the program for the following:**
a.	Create a program that asks the user to enter their name and their age. Print out a message addressed to them that tells them the year that they will turn 100 years old.
b.	Enter the number from the user and depending on whether the number is even or odd, print out an appropriate message to the user.

c.	Write a program to generate the Fibonacci series.
d.	Write a function that reverses the user defined value.
e.	Write a function to check the input value is Armstrong and also write the function for Palindrome.
f.	Write a recursive function to print the factorial for a given number.
2.	**Write the program for the following:**
a.	Write a function that takes a character (i.e. a string of length 1) and returns True if it is a vowel, False otherwise.
b.	Define a function that computes the *length* of a given list or string.
c.	Define a *procedure* histogram() that takes a list of integers and prints a histogram to the screen. For example, histogram([4, 9, 7])should print the following: **** ********* *******
3.	**Write the program for the following:**
a.	A*pangram*isasentencethatcontainsallthelettersoftheEnglishalphabetatleast once,forexample:*Thequickbrownfoxjumpsoverthelazydog*.Yourtaskhere is to write a function to check a sentence to see if it is a pangram or not.
b.	Take a list, say for example this one: a = [1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89] and write a program that prints out all the elements of the list that are less than 5.
4.	**Write the program for the following:**
a.	Write a program that takes two lists and returns True if they have at least one common member.
b.	Write a Python program to print a specified list after removing the 0th, 2nd, 4th and 5th elements.
c.	Write a Python program to clone or copy a list
5.	**Write the program for the following:**
a.	Write a Python script to sort (ascending and descending) a dictionary by value.
b.	Write a Python script to concatenate following dictionaries to create a new one. Sample Dictionary : dic1={1:10, 2:20} dic2={3:30, 4:40} dic3={5:50,6:60} Expected Result : {1: 10, 2: 20, 3: 30, 4: 40, 5: 50, 6: 60}
c.	Write a Python program to sum all the items in a dictionary.
6.	**Write the program for the following:**
a.	Write a Python program to read an entire text file.

b.	Write a Python program to append text to a file and display the text.
c.	Write a Python program to read last n lines of a file.
7.	**Write the program for the following:**
a.	Design a class that store the information of student and display the same
b.	Implement the concept of inheritance using python
c.	Create a class called Numbers, which has a single class attribute called MULTIPLIER, and a constructor which takes the parameters x and y (these should all be numbers). 1. Write a method called add which returns the sum of the attributes x and y. 2. Write a class method called multiply, which takes a single number parameter a and returns the product of a and MULTIPLIER. 3. Write a static method called subtract, which takes two number parameters, b and c, and returns b - c. 4. Write a method called value which returns a tuple containing the values of x and y. Make this method into a property, and write a setter and a delete formanipulating the values of x and y.
8.	**Write the program for the following:**
a.	Open a new file in IDLE (“New Window” in the “File” menu) and save it as geometry.py in the directory where you keep the files you create for this course. Then copy the functions you wrote for calculating volumes and areas in the “Control Flow and Functions” exercise into this file and save it. Now open a new file and save it in the same directory. You should now be able to import your own module like this: import geometry
	Try and add print dir(geometry) to the file and run it. Now write a function pointyShapeVolume(x, y, squareBase) that calculates the volume of a square pyramid if squareBase is True and of a right circular cone if squareBase is False. x is the length of an edge on a square if squareBase is True and the radius of a circle when squareBase is False. y is the height of the object. First use squareBase to distinguish the cases. Use the circleArea and squareArea from the geometry module to calculate the base areas.
b.	Write a program to implement exception handling.
9.	**Write the program for the following:**
a.	Try to configure the widget with various options like: bg=”red”, family=”times”, size=18
b.	Try to change the widget type and configuration options to experiment with other widget types like Message, Button, Entry, Checkbutton, Radiobutton, Scale etc.
10.	**Design the database applications for the following:**
a.	Design a simple database application that stores the records and retrieve the same.
b.	Design a database application to search the specified record from the database.

c.	Design a database application to that allows the user to add, delete and modify the records.

E. TEXT BOOK

T1. Think Python - Allen Downey, O'Reilly

T2. Introduction to Problem Solving with Python - E. Balagurusamy, TMH

F. REFERENCE BOOK

R1. Python GUI Programming Cookbook - Burkhard A. Meier, Packt

R2. An Introduction to Computer Science using Python 3 –JasonMontojo, Jennifer Campbell, Paul Gries, SPD

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	COURSE OUTCOME STATEMENT	CORRELATION WITH PROGRAM OUTCOMES									CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	Describe the Numbers, Math functions, Strings, List, Tuples and Dictionaries in Python	1	2	2	2	2	-	-	-	-	2	-	2
CO2	Express different Decision Making statements and Functions	2	2	2	2	-	2	-	-	-	2	1	3
CO3	Interpret Object oriented programming in Python	3	2	2	1	1	-	-	-	-	3	3	1
CO4	Understand and summarize different File handling operations	1	2	2	3	2	2	-	-	-	2	-	3
CO5	Explain how to design GUI Applications in Python and evaluate different database operations	1	2	2	3	-	2	-	-	-	3	2	3
CO6	Design and develop Client Server network applications using Python	3	2	3	3	2	2	2	-	-	2	3	2

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

ARKA JAIN University
Jharkhand

Syllabus of

Bachelor of Computer Applications

Semester-IV

ARKAJAIN University, Jharkhand
School of Engineering & Information Technology
Department of Computer Science & Information Technology
Faculty – BCA
Scheme of Study (w.e.f Batch 2020)

SEMESTER -I

Sl.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Introduction to Computer Science	Core	5	5	100	70	20	5	5
2	Programming In C	Core	5	5	100	70	20	5	5
3	Discrete Mathematics	GS	5	5	100	70	20	5	5
4	Business Communication	AECC	5	5	100	70	20	5	5
	Practical								
5	Computer Science Lab	Core	2	4	50	35	10	2.5	2.5
6	Programming In C Lab	Core	2	4	50	35	10	2.5	2.5
	Total		**24**	**28**	**500**	**350**	**100**	**25**	**25**

SEMESTER –II

Sl.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Data Structure through C	Core	5	5	100	70	20	5	5
2	Object Oriented Programming with C++	Core	5	5	100	70	20	5	5
3	Operating System	Core	5	5	100	70	20	5	5
4	Numerical & Statistical Methods	GS	5	5	100	70	20	5	5
5	Environmental Science	AECC	5	5	100	70	20	5	5
	Practical								
6	Data Structure through C Lab	Core	2	4	50	35	10	2.5	2.5
7	Object Oriented Programming with C++ Lab	Core	2	4	50	35	10	2.5	2.5

	Total		**28**	**32**	**600**	**420**	**120**	**30**	**30**

SEMESTER –III

Sl.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Programming with Java	Core	5	5	100	70	20	5	5
2	Design and Analysis of Algorithms	Core	5	5	100	70	20	5	5
3	Database Management System	Core	5	5	100	70	20	5	5
4	Data Communication & Networking	Core	5	5	100	70	20	5	5
5	Python Programming	SECC	4	4	100	70	20	5	5
	Practical								
6	Programming with Java Lab	Core	2	4	50	35	10	2.5	2.5
7	Database Management System Lab	Core	2	4	50	35	10	2.5	2.5
8	Python Programming Lab	SECC	2	4	50	35	10	2.5	2.5
	TOTAL		**30**	**36**	**650**	**455**	**130**	**32.5**	**32.5**

SEMESTER –IV

Sl.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Introduction to Data Science	Core	5	5	100	70	20	5	5
2	Internet of Things	Core	5	5	100	70	20	5	5
3	Data Science - Elective I IOT - Elective I AI - Elective I	DSE	5	5	100	70	20	5	5
4	Data Science - Elective II IOT - Elective II AI - Elective II	DSE	5	5	100	70	20	5	5
	Practical								
5	Data Science - Elective I IOT - Elective I AI - Elective I	**DSE**	2	4	50	35	10	2.5	2.5
6	Data Science - Elective II IOT - Elective II AI - Elective II	DSE	2	4	50	35	10	2.5	2.5
	TOTAL		**24**	**28**	**500**	**350**	**100**	**25**	**25**

SEMESTER –V

Sl.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Enterprise Java	Core	5	5	100	70	20	5	5
2	Machine Learning	Core	5	5	100	70	20	5	5
3	Mobile Application Development	SECC	4	4	100	70	20	5	5
4	Data Science - Elective III IOT - Elective III AI - Elective III	DSE	5	5	100	70	20	5	5
5	Data Science - Elective IV IOT - Elective IV AI - Elective IV	DSE	5	5	100	70	20	5	5
	Practical								
6	Enterprise Java Lab	Core	2	4	50	35	10	2.5	2.5
7	Machine Learning Lab	Core	2	4	50	35	10	2.5	2.5
8	Mobile Application Development Lab	SECC	2	4	50	35	10	2.5	2.5
	TOTAL		**30**	**36**	**650**	**455**	**130**	**32.5**	**32.5**

SEMESTER –VI

Sl. No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Software Engineering	Core	5	5	100	70	20	5	5
2	Data Science - Elective V IOT - Elective V AI - Elective V	DSE	5	5	100	70	20	5	5
3	Data Science - Elective VI IOT - Elective VI AI - Elective VI	DSE	5	5	100	70	20	5	5
	Practical								
4	Project	DSE	5	5	100	70	30	0	0
5	Data Science - Elective V IOT - Elective V AI - Elective V	DSE	2	4	50	35	10	2.5	2.5
6	Data Science - Elective VI IOT - Elective VI AI - Elective VI	DSE	2	4	50	35	10	2.5	2.5
	TOTAL		**24**	**28**	**500**	**350**	**110**	**20**	**20**

Discipline Specific Elective (DSE) Courses

Elective I & II	Elective I & II	Elective I & II
Data Science (Select any Two)	**IOT (Select any Two)**	**AI (Select any Two)**
R Programming Language	Sensor Technologies	Introduction to RPA Tools
Python for Data Science	Embedded System	Introduction to Process Automation
Web Programming	Web Programming	Web Programming
Practical		
R Programming Language Lab	Sensor Technologies Lab	Introduction to RPA Tools Lab
Python for Data Science Lab	Embedded System Lab	Introduction to Process Automation Lab
Web Programming Lab	Web Programming Lab	Web Programming Lab

Elective III & IV	Elective III & IV	Elective III & IV
Data Science (Select any Two)	**IOT (Select any Two)**	**AI (Select any Two)**
Design and Analysis of Experiments	Artificial Intelligence	Six Sigma and Lean Methods
Probabilistic Graphical Models	Digital Image Processing	Digital Image Processing
Exploratory Data Analysis and Data Visualization Techniques	Cloud Computing	Business Intelligence

Elective V & VI	Elective V & VI	Elective V & VI
Data Science (Select any Two)	**IOT (Select any Two)**	**AI (Select any Two)**
Big Data Analytics	Embedded C with Adruino	Cloud Deployment And Management
NoSQL Databases	Digital Signal Processing	Natural Language Processing
Time Series Analysis	Artificial Neural Networks	Artificial Neural Networks
Practical		
Big Data Analytics Lab	Embedded C with Adruino Lab	Cloud Deployment And Management Lab
NoSQL Databases Lab	Digital Signal Processing Lab	Natural Language Processing Lab
Time Series Analysis Lab	Artificial Neural Networks Lab	Artificial Neural Networks Lab

Distribution of Credit across 6 semesters:

Sl. No	Type of Paper	No. of Paper	Total Credit
1	Core Paper	22	86
2	Ability Enhancement Compulsory Paper	2	10
3	Generic Paper	2	9
4	Discipline Specific Elective	11	43
5	Skill Enhancement	4	12
	Total	41	160

***CIA – Continuous Internal Assessment – Based on Projects / Assignment during the semester**
GS-Generic Subject | AECC -Ability Enhancement Compulsory Course
SECC -Skill Enhancement Compulsory Course | DSE - Discipline Specific Elective

ARKAJAINUniversity, Jharkhand
School of Engineering & Information Technology
Department of Computer Science & Information Technology
PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES
BCA – Semester–IV

PROGRAM OUTCOMES

After completing this undergraduate program, a learner:

[PO.1]. Apply knowledge of Mathematics and science in solving computational problems

[PO.2]. Understand the Computing concepts and their applications using the acquired board based knowledge.

[PO.3]. Design, set up and conduct practical.

[PO.4]. Use the techniques, skills, and modern Software tools for software development.

[PO.5]. Identify and analyze software application problems in multiple aspect including coding, testing and implementation in industrial applications.

[PO.6]. Design, develop and verify software systems to meet desired needs within realistic constraints ensuring quality, reliability, security in addition to satisfying economical, ethical, social and environmental constraints.

[PO.7]. Apply Enterprise level application software for design of diverse software products.

[PO.8]. Communicate effectively in diverse groups and exhibit leadership qualities.

[PO.9]. Understanding of professional and ethical responsibility.

PROGRAM SPECIFIC OUTCOMES (COMMON ACROSS ALL SPECIALIZATIONS)

[PSO.1]. Prepare professionally trained in the areas of programming, databases, software engineering, web designing and networking and other application areas to acquire knowledge in various domain-based prospects.

[PSO.2]. Encourage to communicate effectively and to improve their competency skills to solve real time problems.

[PSO.3]. Understand to employ modern computer languages and applications for their successful career, to create platforms to become an entrepreneur and a relish for higher studies.

PROGRAM SPECIFIC OUTCOMES (DATA SCIENCE)

[PSO.4]. Ability to apply the knowledge of computing tools and techniques in the field of Data science for solving real world problems encountered in the Software Industries.

[PSO.5]. Ability to identify the challenges in Data analytics with respect to IT Industry and pursue quality research in this field with social relevance.

PROGRAM SPECIFIC OUTCOMES (INTERNET OF THINGS)

[PSO.4]. An ability to apply pattern recognition, machine learning, and artificial intelligent techniques including statistical data analysis and quantitative modelling techniques to solve real world problems from various domains such as healthcare, social computing, economics, etc.

[PSO.5]. An ability to recognize and analyze problems related to AI and ML applications along with their ethical implications.

PROGRAM SPECIFIC OUTCOMES (ARTIFICIAL INTELLIGENCE)

[PSO.4]. An ability to recognize and analyze problems related to artificial intelligence and machine learning applications along with their ethical implications

[PSO.5]. An ability to apply intelligent computer systems to a variety of applications.

Subject: Introduction to Data Science

Code: CSC24120
5 Credits | Semester IV
Total Hours Required –75 Total Tutorials Required – 15

A. Introduction: The key objective of data science is to extract valuable information for use in strategic decision making, product development, trends analysis, and forecasting. The key techniques in use are data mining, big data analysis, data extraction and data retrieval.

The main objectives of the course are as follows:

- Apply quantitative modeling and data analysis techniques to the solution of real world business problems, communicate findings, and effectively present results using data visualization techniques.
- Recognize and analyze ethical issues in business related to intellectual property, data security, integrity, and privacy.
- Apply ethical practices in everyday business activities and make well-reasoned ethical business and data management decisions.
- Demonstrate knowledge of statistical data analysis techniques utilized in business decision making.
- Apply principles of Data Science to the analysis of business problems.
- Use data mining software to solve real-world problems.
- Employ cutting edge tools and technologies to analyze Big Data.
- Apply algorithms to build machine intelligence.

B. Course Outcomes: At the end of the course, students will be able to

[CO.1]. Analyse the data and carry out supervised, unsupervised learning processes.
[CO.2]. Students will develop relevant programming
[CO.3]. Students will demonstrate proficiency with statisticalanalysis of data.
[CO.4]. Students will develop the ability to build and assess Databased models.
[CO.5]. Students can design more complexalgorithms involving morecomplex data structures, and can implement their solutions in multiple languages

C. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Internal Examination	20
	Assignment	05
	Attendance	05
End Term Exam (Summative)	End Term Examination	70
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

Introduction: Data Mining and its features, Use of Data mining, area of applications of data mining, technologies and techniques used for data mining.**Major Issues in Data Mining, Data Pre-processing:** An Overview,Data Pre-processing: Data Cleaning,Data Pre-processing: Data Integration, Data Pre-

processing: Data Reduction, Data Transformation, Data Discretization,Mining Frequent Patterns, Frequent Itemset Mining Methods. Patterns used for data mining, numericals on apriorialgorithm,PatternEvaluationMethods,Advanced Pattern Mining,Pattern Mining: A Road Map,Pattern Mining in Multilevel,MultidimensionalSpace,Constraint-Based Frequent Pattern Mining,Mining High-Dimensional Data,ColossalPatterns,Mining Compressed or Approximate Patterns,Classification,Decision Tree Induction,Bayes Classification methods,Rule-Based classification,Model evaluation and classification,Techniques to Improve Classification Accuracy,Support Vector Machines,Lazy Learners (or Learning from Your neighbors),Cluster Analysis,PartitioningMethods,HierarchicalMethods,Density-Based Methods,Grid-Based Methods,Evaluation of Clustering,Clustering High-Dimensional Data,Clustering Graph and Network Data,Mining Complex Data Types,Other Methodologies of Data mining,Applications and Trends in Data Mining,Data Mining and Society,Data Mining Applications,Data mining trends.

E. TEXT BOOKS

T1. Data Mining Concepts and Techniques, Jiawei Han and MichelineKamber, Morgan KaufmannThird Edition,2011

F. REFERENCE BOOKS

R1. Introduction to Data MiningPang-Ning Tan, Michael Steinbach and Vipin Kumar, Pearson Education,2007.

R2. Insight into Data mining Theory and PracticeK.P. Soman, ShyamDiwakar and V. Ajay, Eastern Economy Edition, Prentice Hall of India, 2016.

R3. Introduction to Data Mining with Case StudiesGupta, Eastern Economy Edition, Prentice Hall of India,2006.

G. **Course Articulation Matrix: (Mapping of COs withPOs)**

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES									CORRELATION WITH PROGRAM SPECIFICOUTCOMES				
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	Analyse the data and carry out supervised, unsupervised learning processes.	3	2	`1	2	2	-	-	1	-	2	-	-	1	1
CO2	Students will develop relevant programming	2	3	2	2	-	1	-	1	-	2	1	-	1	1
CO3	Students will demonstrate proficiency with statistical analysis of data.	3	2	2	1	1	-	-	-	-	3	-	1	2	-
CO4	Students will develop the ability to build and assess Data-basedmodels.	1	2	2	1	-	1	-	-	-	2	-	-	1	3
CO5	Students can design more complex algorithm involving more complex data structures, and can implement their solutions in multiple languages.	2	-	-	3	1	1	-	-	-	-	-	1	1	-

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Internet of Things

Code: CSC25030
5 Credits | Semester IV
Total Hours Required –75 Total Tutorials Required – 15

A. Introduction: The main objective of IoT is to unify everything in world including things, people, place and process under a common infrastructure to provide information and control of state of objects around us.

The main objectives of the course are as follows:

- Students will be explored to the interconnection and integration of the physical world and the cyber space. They are also able to design & develop IOT Devices.
- This course focuses on the latest microcontrollers with application development, product design and prototyping.
- Ideally suited for engineering students and graduates with a basic understanding of electronics and microprocessors.
- The Internet of Things (IOT) is the next wave, world is going to witness. Today we live in an era of connected devices (mobile phones, computers etc.), the future is of connected things (Eg: home appliances, vehicles, lamp-posts, personal accessories, your pets, industrial equipment's and everything which you use in day-to-day life).

B. Course Outcomes: At the end of the course, students will be able to

[CO.1]. Understand the application areas of IOT
[CO.2]. Realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks
[CO.3]. Understand building blocks of Internet of Things and characteristics.
[CO.4]. Design some IOT based prototypes

C. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Internal Examination	20
	Assignment	05
	Attendance	05
End Term Exam (Summative)	End Term Examination	70
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

The Internet of Things: Introduction,Definition and Characteristics of IoT,Physical Design of IOT,Logical Design of IOT,IoT Protocols, IoT communication models,IoTCommunication,APIs,IoT Enabled Technologies,Wireless Sensor Networks,CloudComputing,Big data analytics,Communicationprotocols,EmbeddedSystems,IOTLevels,InternetCommunications,IP, TCP,

The IP Protocol Suite (TCP/IP), UDP,IP, TCP, IP Addresses,DNS,Static IP Address Assignment,Dynamic IP Address Assignment, IPv6,MAC Addresses,TCP and UDP Ports,HTTP Ports, Other,CommonPorts,Application Layer Protocols,HTTP, HTTPS: Encrypted HTTP,Other Application Layer Protocols.**Prototyping the Physical Design:**Non digital Methods,LaserCutting,Choosing a Laser Cutter, Software, Hinges andJoints,3D Printing, Types of 3D Printing, Software,Getting Started with an API, Mashing Up APIs, Scraping, Legalities,Writing a New API - Clockodillo, Security, Implementing theAPI, Using Curl to Test,switching,multiplexing,Real-Time Reactions - Polling, Comet,An Introduction to Data Analytics for IoT, Machine Learning, Big Data Analytics Tools and Technology,Edge Streaming Analytics, Network Analytics, Securing IoT,A Brief History of OT Security, Common Challenges in OT Security, How IT and OT Security Practices and Systems Vary,Formal Risk Analysis Structures: OCTAVE and FAIR,The Phased Application of SecurityinanOperationalEnvironment, Introduction to RaspberryPi,About the RaspberryPi Board: Hardware Layout, Operating Systems on RaspberryPi,ConfiguringRaspberryPi, Programming RaspberryPiwithPython,Wireless Temperature Monitoring System Using Pi,DS18B20 Temperature Sensor, Connecting Raspberry Pi via SSH,Accessing Temperature from DS18B20 sensors, Remote access to RaspberryPi,Smart and Connected Cities, An IoT Strategy for Smarter Cities, Smart City IoT Architecture, Smart City Security Architecture, Smart City Use-Case Examples.

E. TEXT BOOKS

T1. Kumar, Keval J (2012). Mass Communication in India. Mumbai: Jaico Publishing House

T2. ChatterjiPC , Broadcasting in India 1987, 2nd revised edition 1992, New Delhi, Sage Publications.

T3. Luthra H. K. Indian Broadcasting, New Delhi Publication Division 1987.

F. REFERENCE BOOKS

R1. All India radio Handbook, New Delhi, 2005

R2. Radio Production by Robert Mcleish (4th Edition), Focal Press Publication.

R3. Television Production Hand book (9th Edition) by Herbert Zettl, Thomson Wadsworth Publication.

R4. Ted White, Frank Barnas,(2013), Broadcast News Writing, Reporting, and Producing-5th Edition Focal Press, 2013

R5. Luthra H. K. Indian Broadcasting, New Delhi Publication Division 1987.

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	COURSE OUTCOME STATEMENT	CORRELATION WITH PROGRAM OUTCOMES									CORRELATION WITH PROGRAM SPECIFIC OUTCOMES				
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	Able to understand the application areas of IOT	1	2	1	2	1	-	-	2	-	2	-	-	2	-
CO2	Able to realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks	2	2	1	2	-	2	-	1	-	2	1	-	1	3
CO3	Able to understand building blocks of Internet of Things and characteristics.	3	1	2	1	1	-	1	-	-	3	-	1	1	-
CO4	the students will be able design some IOT based prototypes	1	2	2	1	-	1	-	-	-	2	-	-	2	1

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Discipline Specific Elective (DSE) Course
Data Science (Select any TWO)

Subject: R Programming Language

Code: CSC24121
5 Credits | Semester IV
Total Hours Required –75 Total Tutorials Required – 15

A. Introduction: The objective of the course is to provide complete knowledge of R programming language. Students will be able to develop logical abilities, which will help them to create programs, applications. The students will also develop an ability, which can easily help them switch to any other language in future.

The main objectives of the course are as follows:

- Understanding and being able to use basic programming concepts
- Automate data analysis
- Working collaboratively and openly on code
- Knowing how to generate dynamic documents
- Being able to use a continuous test-driven development approach

B. Course Outcomes: At the end of the course, students will be able to
[CO.1]. Use and program in the programming language R
[CO.2]. Use R to solve statistical problems
[CO.3]. Implement and describe Monte Carlo the technology
[CO.4]. Minimize and maximize functions using R

C. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Internal Examination	20
	Assignment	05
	Attendance	05
End Term Exam (Summative)	End Term Examination	70
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

Introduction: Overview of R, R data types and objects, reading and writing data,subsetting R Objects, Essentials of the R Language, Installing R,Running R, Packages in R.Calculations, Complex numbers in R, Rounding, Arithmetic,Modulo and integer quotients ,Variable names and assignment, Operators,

Integers, Factors, Logical operations.**Control Structures, Functions, Vectors and Matrices** :Control structures, functions, scoping rules, dates and times : Introduction to Functions, preview of Some Important R Data Structures, Vectors, Character Strings, Matrices, Lists, DataFrames, Classes. Vectors: Generating sequences, Vectors and subscripts, Extracting elements of a vector using subscripts. Working with logical subscripts, Scalars, Vectors, Arrays, and Matrices, Adding and Deleting Vector Elements, Obtaining the Length of a Vector. Matrices and Arrays as Vectors Vector Arithmetic and Logical Operations, Vector Indexing, Common Vector Operations.**Lists**: Creating Lists, General List Operations, List Indexing Adding and Deleting List Elements, Getting the Size of a List. Extended Example: Text Concordance Accessing List Components and Values Applying Functions to Lists, DATA FRAMES .Creating Data Frames, Accessing Data Frames, Other Matrix-Like Operations .**Factors and Tables:** Factors and Levels, Common Functions Used with Factors Working with Tables, Matrix/Array-Like Operations on Tables, Extracting a Subtable ,Finding the Largest Cells in a Table, Math Functions Calculating a Probability, Cumulative Sums and Products ,Minima and Maxima, Calculus, Functions for Statistical Distributions.**Object oriented programming:** S Classes, S Generic Functions, Writing S Classes Using Inheritance, S Classes, Writing S Classes, Implementing a Generic Function on an S Class Visualization, Simulation, code profiling, Statistical Analysis with R,data manipulation.

E. TEXT BOOKS

T1.R Programming for Data Science by Roger D. Peng

T2. The Art of R Programming by Prashanthsingh, VivekMourya, Cengage Learning India.

F. REFERENCE BOOKS

R1. An Introduction to R, W. N. Venables, D. M. Smith, R Core Team, 2018.

R2.simpleR – Using R for Introductory Statistics, John Verzani, CRC Press, Taylor & Francis Group,2005

R3. Beginner's guide for Data Analysis using R Programming by Dr. Jeeva Jose

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	COURSE OUTCOME STATEMENT	CORRELATION WITH PROGRAM OUTCOMES									CORRELATION WITH PROGRAM SPECIFIC OUTCOMES				
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	Use and program in the programming language R	1	2	2	2	2	2	-	-	-	2	2	-	3	3
CO2	Use R to solve statistical problems	2	2	2	3	3	2	-	-	-	2	1	-	3	3
CO3	Implement and describe Monte Carlo the technology	3	2	2	1	1	-	-	-	-	3	-	1	2	3
CO4	Minimize and maximize functions using R	1	2	2	1	3	1	-	-	-	2	3	2	3	2

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Discipline Specific Elective (DSE) Course
Data Science (Select any TWO)

Subject: Python for Data Science

Code: CSC24122
5 Credits | Semester IV
Total Hours Required –75 Total Tutorials Required – 15

A. Introduction: This course provides good knowledge of python for data science. The students will also learn to program and programming paradigms brought in by Python with a focus on File Handling and Regular Expressions. A major component of this course will be learning how to use python-based programming tools to apply these methods to real-life datasets.

B. Course Outcomes: At the end of the course, students will be able to
[CO.1]. Acquire data through web-scraping and data APIs.
[CO.2]. Clean and reshape messy datasets
[CO.3]. Use exploratory tools such as clustering and visualization tools to analyze data.
[CO.4]. Use methods such as logistic regression, nearest neighbors, decision trees, and support vectormachines to build a classifier.
[CO.5]. Apply dimensionality reduction tools such as principle component analysis

C. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Internal Examination	20
	Assignment	05
	Attendance	05
End Term Exam (Summative)	End Term Examination	70
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

Introduction: What is Data Science? Motivating Hypothetical: Data Sciencester ,Python - The Basics, Getting Python, The Zen of Python, Whitespace Formatting, Modules Arithmetic , Functions, Strings, Exceptions, Lists, The Not-So-Basics, Visualizing Data- Matplotlib, Bar Charts, Line Charts, Scatter plots, Linear Algebra, Vectors, Matrices. **Statistics:** Describing a Single Set of Data, Central Tendencies, Dispersion, Correlation, Simpson's Paradox, Some Other Correlational Caveats, Correlation and Causation, Probability: Dependence and Independence, Conditional Probability **Hypthesis:**Bayes's Theorem, Random Variables, Continuous Distributions, The Normal Distribution, The Central Limit

Theorem, Hypothesis and Inference: Statistical Hypothesis Testing, Example:Flipping a Coin, Confidence Intervals, P-hacking, Example: Running an A/B Test, Bayesian Inference.**Gradient Descent:** The Idea behind Gradient Descent, Estimating the Gradient, Using the Gradient, Choosing the Right Step Size, Putting It All Together, Stochastic Gradient Descent,Getting Data: stdin and stdout, Reading Files. Scraping the Web, Using APIs, Example: Using the Twitter APIs **Working with Data:** Exploring Your Data, Cleaning and Munging,Manipulating Data, Rescaling, Dimensionality Reduction, Machine Learning: Modeling, What Is Machine Learning?, Overfitting and Underfitting, Correctness, The Bias-Variance Trade-off, Feature Extraction and Selection, k-Nearest Neighbors, The Model, Example: Favorite Languages, The Curse of Dimensionality, Naïve Bayes

E. TEXT BOOKS

T1. Programming in Python 3 - A Complete Introduction to the Python Language, Mark Summerfield, Addison-Wesely Reprint 2011

F. REFERENCE BOOKS

R1. Think Python, Version 2.0.17, Allen Downey, Green Tea Press, Needham, Massachusetts, 2012

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	COURSE OUTCOME STATEMENT	CORRELATION WITH PROGRAM OUTCOMES									CORRELATION WITH PROGRAM SPECIFIC OUTCOMES				
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	Acquire data through web-scraping and data APIs	1	2	2	2	2	-	-	-	-	2	-	-	3	3
CO2	Clean and reshape messy datasets.	2	2	2	2	-	2	-	-	-	2	1	-	2	1
CO3	Use exploratory tools such as clustering and visualization tools to analyze data.	3	2	2	1	1	-	-	-	-	3	-	1	2	2
CO4	Use methods such as logistic regression, nearest neighbors, decision trees, and support vector machines to build a classifier	1	2	2	1	-	1	-	-	-	2	-	-	2	3
CO5	Apply dimensionality reduction tools such as principle component analysis	1	2	2	1		1				2			3	2

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Discipline Specific Elective (DSE) Course
Data Science (Select any TWO)

Subject: Web Programming

Code: CSC24022
5 Credits | Semester IV
Total Hours Required –75 Total Tutorials Required – 15

A. Introduction: This course introduces the fundamental concept of Web Programming. The objective of the course is to provide complete knowledge of Web Programming Fundamentals. It willhelp the students getting started with web programming using HTML5, PHP and My SQL.They will learn how to build their own website, create dynamic content and user interface and integrating the front end and backend perspective of the application.

The main objectives of the course are as follows:

- To help the students getting started with web programming using HTML5, PHP and My SQL.
- To learn how to build own website.
- To create dynamic content and user interface.
- Embed objects in a web page.
- Integrating the front end and backend perspective of the application.

B. Course Outcomes: At the end of the course, students will be able to
[CO.1]. Create static HTML pages.
[CO.2]. Create well-structured and easily maintained CSS code to present HTML pages in different ways.
[CO.3]. Use JavaScript to add dynamic content to pages.
[CO.4]. Create dynamic web pages using PHP and My SQL.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Internal Examination	20
	Assignment	05
	Attendance	05
End Term Exam (Summative)	End Term Examination	70
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

Internet and the World Wide Web: Introduction to internet and its applications, E-mail, telnet, FTP, e-commerce, video conferencing, e-business. Internet service providers, World Wide Web (WWW): World Wide Web and its evolution, uniform resource locator (URL), Different browsers. Search engine, web saver – Apache, IIS, Proxy Server, HTTP protocol. **HTML5:**Introduction, Why HTML5? Style sheets, CSS formatting text using style sheets. **HTML5 Page layout and navigation:** Creating navigational aids: planning site organization, creating text-based and graphical navigation bar, creating division based layouts, HTML5 semantic layout. **HTML5 Tables, Forms and Media:** Creating tables, merging table cells, using tables for page layout, formatting tables. Creating user forms : Creating basic form, using check boxes and option buttons, creating lists, Incorporating sound and video in HTML5. **Java Script:** Introduction, Client-Side JavaScript, Server-Side JavaScript, JavaScript Objects, JavaScript Security Operators: Assignment Operators, Comparison Operators, Arithmetic Operators, Logical Operators, String Operators, Special Operators. Statements: Break, comment, continue, delete, do...while, export, for, for...in function, if...else, Core JavaScript (Properties and Methods of Each) : Array, Boolean, Date, Function, Math, Number, Object, String, regExp Document and its associated objects: document, Link, Area, Anchor, Image, Applet, Layer. **Events and Event Handlers :** General Information about Events, Defining EventHandlers, different events of JavaScript. **PHP:**Introduction of PHP and MySQL. Server-side scripting, PHPsyntax and variables,comments, types, control structures, branching,looping,termination,functions, passing information with PHP, GET, POST, formatting form variables,super global arrays, strings and string functions, regular expressions, arrays,number handling, basic PHP errors/problems.**Advanced PHP and MySQL:** PHP/My SQL Functions, Integrating web formsand databases, Displaying queries in tables, Building Formsfromqueries,String and Regular Expressions, Sessions, Cookies and HTTP, E-Mail.

E. TEXT BOOKS

T1. Web Design The Complete Reference - Thomas Powell - Tata McGraw Hill
T2. PHP 5.1 for Beginners - Ivan Bayross, Sharanam Shah - SPD
T3. JavaScript 2.0: The Complete Reference - Thomas Powell and Fritz Schneider - Tata McGraw Hill

F. REFERENCE BOOKS

R1. HTML5 Step by Step – FaitheWempen - Microsoft Press
R2. PHP Project for Beginners - Sharanam Shah, Vaishali Shah - SPD

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	COURSE OUTCOME STATEMENT	CORRELATION WITH PROGRAM OUTCOMES									CORRELATION WITH PROGRAM SPECIFIC OUTCOMES				
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	Create static HTML pages.	1	2	2	2	2	-	-	-	-	2	-	-	2	-
CO2	Create well-structured and easily maintained CSS code to present HTML pages in different ways.	2	2	2	2	-	2	-	-	-	2	1	-	2	1
CO3	Use JavaScript to add dynamic content to pages.	3	2	2	1	1	-	-	-	-	3	-	1	3	-
CO4	Create dynamic web pages using PHP and My SQL.	1	2	2	1	-	1	-	-	-	2	-	-	2	-

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Discipline Specific Elective (DSE) Course
Internet of Things (Select any TWO)

Subject: Sensor Technologies

Code: CSC24114
5 Credits | Semester IV
Total Hours Required –75 Total Tutorials Required – 15

A. Introduction: The objective of the course is to provide complete knowledge of SENSORS and implementation of various kinds of sensors using ARDUINO. Students will be able to know the about various technologies developed & currently used in this field. They will be able to make various kinds of hardware/software projects using various kinds of sensors.

- The course objective is to provide good knowledge of working of different types of sensors used in various application areas.
- The course also provides with the knowledge of interfacing of electronic circuits with different sensors for its applications in different fields.
- It also explains about different kind of transducers, actuators, sensors.

B. Course Outcomes: At the end of the course, students will be able to
[CO.1]. Concept behind working of measurement systems and different types of sensors and transducers.
[CO.2]. Sensor to measure various physical parameters used in Industry and normal measurement applications.
[CO.3]. Working principle of resistive, inductive and capacitive transducers and their applications.
[CO.4]. Understanding of thermocouples, piezoelectric and pyro-electric transducers and their applications.
[CO.5]. Understanding of digital and proximity sensors and their applications.
[CO.6]. Understand about the basic of Nano Technology and materials used in fabrication of Sensors.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Internal Examination	20
	Assignment	05
	Attendance	05
End Term Exam (Summative)	End Term Examination	70
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

Sensors Fundamentals and Characteristics: Sensors, Signals and Systems; Sensor Classification; Units of Measurements; Sensor Characteristics. **Physical Principles of Sensing:** Electric Charges, Fields, and Potentials, Capacitance; Magnetism, Induction, Resistance, Piezoelectric Effect, Hall Effect Temperature and Thermal Properties of Material, Heat Transfer, Light, Dynamic Models of Sensor Elements. **Interface Electronic Circuits:** Input Characteristics of Interface Circuits, Amplifiers, Excitation Circuits, Analog to Digital Converters, Direct Digitization and Processing, Bridge Circuits, Data Transmission, Batteries for Low Power Sensors. **Sensors in Different Application Area:** Occupancy and Motion Detectors; Position, Displacement, and Level;Velocity and Acceleration; Force, Strain, and Tactile Sensors; Pressure Sensors, Temperature Sensors. **Sensor Materials and Technologies:** Materials, Surface Processing, Nano-Technology

E. TEXT BOOKS

T1. Handbook of Modern Sensors: Physical, Designs, and Applications, J. Fraden, AIP Press, Springer
T2. Sensors and Transducers, D. Patranabis, PHI Publication, New Delhi

F. REFERENCE BOOKS

R1: Mechatronics- Ganesh S. Hegde, Published by University Science Press (An imprint of Laxmi Publication Private Limited).

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	COURSE OUTCOME STATEMENT	CORRELATION WITH PROGRAM OUTCOMES									CORRELATION WITH PROGRAM SPECIFIC OUTCOMES				
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	Concept behind working of measurement systems and different types of sensors and transducers.	1	2	2	2	2	-	-	-	-	2	-	-	-	1
CO2	Sensor to measure various physical parameters used in Industry and normal measurement applications.	2	2	2	2	-	2	-	-	-	2	1	-	1	2
CO3	Working principle of resistive, inductive and capacitive transducers and their applications.	3	2	2	1	1	-	-	-	-	3	-	1	2	-
CO4	Understanding of thermocouples, piezoelectric and pyro-electric transducers and their applications.	1	2	2	1	-	1	-	-	-	2	-	-	1	1
CO5	Understanding of acoustic, optical sensors and other sensors and their applications.	2	2	1	1						2		1	-	2
CO6	Understanding of digital and proximity sensors and their applications.	2	1	2	2						2		2	2	-

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Discipline Specific Elective (DSE) Course
Internet of Things (Select any TWO)

Subject: Embedded System

Code: CSC24115
5 Credits | Semester IV
Total Hours Required –75 Total Tutorials Required – 15

A. Introduction: The objective of the course is to provide complete knowledge of Embedded Systems. Students will be able to provide various techniques of Embedded Systems which will help them to create programs, applications in Embedded Systems. The students will also develop an ability which can easily help them switch to any other relevant technology in future.

The main objectives of the course are as follows:

- To learn the concepts and architecture of embedded systems.
- To acquire the fundamental knowledge of the Embedded system.
- To learn the various operations performed by the Embedded system.
- Students will capable of designing embedded systems.

B. Course Outcomes: At the end of the course, students will be able to
[CO.1]. Understand the Embedded concepts and embedded system Architecture.
[CO.2]. Learn the architecture and programming of Microcontroller.
[CO.3]. Select a proper Microcontroller for an application.
[CO.4]. Understand the usage of the development and debugging tools.
[CO.5]. Learn and apply the knowledge of Memory systems and Peripherals

C. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Internal Examination	20
	Assignment	05
	Attendance	05
End Term Exam (Summative)	End Term Examination	70
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

Introduction to Embedded System: Embedded Vs General computing system, Classification of Embedded systems, Major applications and purpose of ES. Core of an Embedded System including all types of processor/controller, Memory, Sensors, Actuators, LED, 7 segment LED display, Opto coupler, Relay, Piezo buzzer, Push button switch, Communication Interface (onboard and external types), Embedded firmware, Other system components. **Characteristics and Quality Attributes of Embedded Systems:** Characteristics and Quality Attributes of Embedded Systems, Operational and non-operational quality attributes, Embedded Systems-Application and Domain specific, Hardware Software Co-Design and Program Modelling (excluding UML), Embedded firmware design and development **ARM -32 bit Microcontroller family:** Architecture of ARM Cortex M3 –General Purpose Registers, Stack Pointer, Link Register, Program Counter, Special Register,. Nested Vector Interrupt Controller. Interrupt behavior of ARM Cortex M3. Exceptions Programming. Advanced Programming Features. Memory Protection. Debug Architecture. **Embedded Firmware Design and Development:**Embedded Firmware Design Approaches, Embedded Firmware Development Languages **Real-Time Operating System (RTOS) based Embedded System Design**: Operating System Basics, Types of OS, Tasks, Process and Threads (Only POSIX Threads with an example program), Multiprocessing and Multitasking, Thread Preemption, Preemptive Task Scheduling, Threads, Processes and Scheduling: Putting them altogether, Task Communication, Task Synchronization, Device Drivers, How to Choose an RTOS?**The Embedded System Development Environment:** The Integrated Development Environment (IDE), Integration and testing of Embedded hardware and firmware, Embedded system Development Environment – Block diagram (excluding Keil), Disassembler/decompiler, simulator, emulator and debugging techniques **Embedded Hardware Design and Development :**EDA Tools, How to Use EDA Tool, Schematic Design – Place wire, Bus , port, junction, creating part numbers, Design Rules check, Bill of materials, Netlist creation , PCB Layout Design – Building blocks, Component placement, PCB track routing.

E. TEXT BOOKS

T1. Embedded Systems Architecture, Programming and Design, Raj Kamal

F. REFERENCE BOOKS

R1. Introduction to Embedded Systems, K. V. Shibu..
R2. Embedded System, N. S. Gopal Singh.

G. Course Articulation Matrix: (Mapping of COs withPOs)

CO	COURSE OUTCOME STATEMENT	CORRELATION WITH PROGRAM OUTCOMES									CORRELATION WITH PROGRAM SPECIFIC OUTCOMES				
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	Understand the Embedded concepts and embedded system Architecture	1	2	2	2	2	-	-	-	-	2	-	-	3	3
CO2	Learn the architecture and programming of Microcontroller.	2	2	2	2	-	2	-	-	-	2	1	-	3	3
CO3	Understand the usage of the development and debugging tools.	3	2	2	1	1	-	-	-	-	3	-	1	2	3
CO4	Understand the usage of the development and debugging tools.	1	2	2	1	-	1	-	-	-	2	-	2	3	2
CO5	Learn and apply the knowledge of Memory systems and Peripherals	1	2	3	2		1				1		2	2	-

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Discipline Specific Elective (DSE) Course
Internet of Things (Select any TWO)

Subject: Web Programming

Code: CSC24022
5 Credits | Semester IV
Total Hours Required –75 Total Tutorials Required – 15

A. Introduction: This course introduces the fundamental concept of Web Programming. The objective of the course is to provide complete knowledge of Web Programming Fundamentals. It willhelp the students getting started with web programming using HTML5, PHP and My SQL.They will learn how to build their own website, create dynamic content and user interface and integrating the front end and backend perspective of the application.

The main objectives of the course are as follows:

- To help the students getting started with web programming using HTML5, PHP and My SQL.
- To learn how to build own website.
- To create dynamic content and user interface.
- Embed objects in a web page.
- Integrating the front end and backend perspective of the application.

B. Course Outcomes: At the end of the course, students will be able to
[CO.1]. Create static HTML pages.
[CO.2]. Create well-structured and easily maintained CSS code to present HTML pages in different ways.
[CO.3]. Use JavaScript to add dynamic content to pages.
[CO.4]. Create dynamic web pages using PHP and My SQL.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Internal Examination	20
	Assignment	05
	Attendance	05
End Term Exam (Summative)	End Term Examination	70
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

Internet and the World Wide Web: Introduction to internet and its applications, E-mail, telnet, FTP, e-commerce, video conferencing, e-business. Internet service providers, World Wide Web (WWW): World Wide Web and its evolution, uniform resource locator (URL), Different browsers. Search engine, web saver – Apache, IIS, Proxy Server, HTTP protocol. **HTML5:** Introduction, Why HTML5? Style sheets, CSS formatting text using style sheets. **HTML5 Page layout and navigation:** Creating navigational aids: planning site organization, creating text-based and graphical navigation bar, creating division based layouts, HTML5 semantic layout. **HTML5 Tables, Forms and Media:** Creating tables, merging table cells, using tables for page layout, formatting tables. Creating user forms: Creating basic form, using check boxes and option buttons, creating lists, Incorporating sound and video in HTML5. **Java Script:** Introduction, Client-Side JavaScript, Server-Side JavaScript, JavaScript Objects, JavaScript Security Operators: Assignment Operators, Comparison Operators, Arithmetic Operators, Logical Operators, String Operators, Special Operators. Statements: Break, comment, continue, delete, do...while, export, for, for...in function, if...else, Core JavaScript (Properties and Methods of Each) : Array, Boolean, Date, Function, Math, Number, Object, String, regExp Document and its associated objects: document, Link, Area, Anchor, Image, Applet, Layer. **Events and Event Handlers:** General Information about Events, Defining EventHandlers, different events of JavaScript. **PHP:** Introduction of PHP and MySQL. Server-side scripting, PHP syntax and variables, comments, types, control structures, branching, looping, termination, functions, passing information with PHP, GET, POST, formatting form variables, super global arrays, strings and string functions, regular expressions, arrays, number handling, basic PHP errors/problems. **Advanced PHP and MySQL:** PHP/My SQL Functions, Integrating web forms and databases, Displaying queries in tables, Building Forms from queries, String and Regular Expressions, Sessions, Cookies and HTTP, E-Mail.

E. TEXT BOOKS

T1. Web Design The Complete Reference - Thomas Powell - Tata McGraw Hill
T2. PHP 5.1 for Beginners - Ivan Bayross, Sharanam Shah - SPD
T3. JavaScript 2.0: The Complete Reference - Thomas Powell and Fritz Schneider - Tata McGraw Hill

F. REFERENCE BOOKS

R1. HTML5 Step by Step – FaitheWempen - Microsoft Press
R2. PHP Project for Beginners - Sharanam Shah, Vaishali Shah - SPD

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	COURSE OUTCOME STATEMENT	CORRELATION WITH PROGRAM OUTCOMES									CORRELATION WITH PROGRAM SPECIFIC OUTCOMES				
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	Create static HTML pages.	1	2	2	2	2	-	-	-	-	2	-	-	2	-
CO2	Create well-structured and easily maintained CSS code to present HTML pages in different ways.	2	2	2	2	-	2	-	-	-	2	1	-	2	1
CO3	Use JavaScript to add dynamic content to pages.	3	2	2	1	1	-	-	-	-	3	-	1	3	-
CO4	Create dynamic web pages using PHP and My SQL.	1	2	2	1	-	1	-	-	-	2	-	-	2	-

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Discipline Specific Elective (DSE) Course
Artificial Intelligence (Select any TWO)

Subject: Introduction to RPA Tools

Code: CSC24166
5 Credits | Semester IV
Total Hours Required –75Total Tutorials Required – 15

A. Introduction: The objective of the course is to provide complete knowledge of RPA Tools. Students will be exposed to Robotics Process Automation techniques, which will help them to prepare various automation projects. The students will also develop an ability, which can easily help them switch to any other technology in future.

The main objectives of the course are as follows:

- To learn RPA tools fundamentals.
- Be exposed to Robotics Process Automation techniques.
- Be familiar with Uipath studio.
- Learn to prepare automation projects.

B. Course Outcomes: At the end of the course, students will be able to

[CO.1]. Understand the various concepts, terminologies of RPA systems.
[CO.2]. Understand the application areas of RPA
[CO.3]. Use various techniques of automation and control in Robotics
[CO.4]. Understand building blocks of RPA and characteristics.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Internal Examination	20
	Assignment	05
	Attendance	05
End Term Exam (Summative)	End Term Examination	70
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

Fundamentals of RPA: What is RPA? Historic Evaluation, Why RPA? Test automation v/s RPA, Pros & Cons of RPA, How RPA Works? RPA Implementation, Tools for RPA, Applications of RPA. **Uipath – Basics &UipathStudio:**Introduction, What is UiPath? Why UiPath? Products of UiPath, Starting UiPath Studio, Requirements for Installing UiPath Studio, Types of Projects, Important Concepts in UiPath Studio. **Uipath – understanding user interface components:** Components of UiPath User Interface - The Ribbon, The Quick Access Toolbar, The Universal Search Bar, The Designer Panel, The Activities Panel, The Library Panel, The Project Panel, The Properties Panel, The Outline Panel, The Output Panel, The Locals Panel, The Context Menu. **Ui path studio – keyboard shortcuts &customization:**Keyboard Shortcuts, File Management, Comments, Debugging, Recording, Workflow Execution, Selected Activity, Customization of Keyboard Shortcuts, Steps for Keyboard Shortcuts Customization, Example**. Uipathstudio – automation projects and their debugging:** Introduction, Working with Automation Projects in UiPath Studio, Steps for Creating an Automation project, What is Automation Debugging? , Functions of Debugging, Steps for Performing Automation Debugging.

E. TEXT BOOKS

T1. The Robotic Process Automation Handbook: A Guide to implementing RPA Systems 1st ed. Edition by Tom Taulli.

T2. Robotic Process Automation Tools, Process Automation and theirbenefits: Understanding RPA and Intelligent Automation, Srikanth Merianda, 1st Edition, Consulting Opportunity Holdings LLC, 2018

F. REFERENCE BOOKS

R1. Robotics Process and Cognitive Automation: The next Phase by Mary C.Lacity and Leslie P. Willcocks

R2. Robotic Process Automation: Guide To Building Software Robots,Automate Repetitive Tasks & Become an RPA Consultant, Richard Murdoch, Amazon Asia-Pacific Holdings Private Limited, 2018

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	COURSE OUTCOME STATEMENT	CORRELATION WITH PROGRAM OUTCOMES									CORRELATION WITH PROGRAM SPECIFIC OUTCOMES				
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	Understand the various concepts, terminologies of RPA systems.	1	2	2	2	2	-	-	-	-	2	-	-	3	3
CO2	Understand the application areas of RPA.	2	2	2	2	-	2	-	-	-	2	1	-	3	3
CO3	Use various techniques of automation and control in Robotics.	3	2	2	1	1	-	-	-	-	3	-	1	2	3
CO4	Understand building blocks of RPA and characteristics.	1	2	2	1	-	1	-	-	-	2	-	2	3	2

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Discipline Specific Elective (DSE) Course
Artificial Intelligence (Select any TWO)

Subject: Introduction to Process Automation

Code: CSC24167
5 Credits | Semester IV
Total Hours Required –75 Total Tutorials Required – 15

A. Introduction: The objective of the course is to provide complete knowledge of Industrial Process Automation. Students will be able to develop logical abilities, which will help them to create programs, applications using Process Automation. The students will also develop an ability, which can easily help them switch to any other automation technology in future.

The main objectives of the course are as follows:

- Learn P.A. tools fundamentals.
- Be exposed to Process Automation techniques.
- Be familiar with PLC.
- Learn to prepare automation projects

B. Course Outcomes: At the end of the course, students will be able to
[CO.1]. Understand the various concepts, terminologies of Process Automation.
[CO.2]. Understand the application areas of Process Automation.
[CO.3]. Use various techniques of automation and control of processes.
[CO.4]. Understand building blocks of Process Automation and it's characteristics.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Internal Examination	20
	Assignment	05
	Attendance	05
End Term Exam (Summative)	End Term Examination	70
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

Fundamentals of Process Automation: Structure & components of Process Automation systems. Architectural levels of Process controls. Actuators & sensors: Servomotors, Stepper motors, Process I/O systems. Local & remote I/O systems. **Controllers & its types:** Different types of controllers, Single loop and Multiloop controllers and their tunning, Direct controllers, Software implementation of MultiloopControllers.**Sequence Control**: Programmable Logic Controllers, Relay Ladder Logic, Programming.**Supervisory Controllers:** Functionally of Supervisory Control Level, Process Optimization, Recipe Management Material. Tracking. Man-machine interfaces. **ProcessOperation Management Systems:**Overview of process operation management systems, order, Inventory management, Process scheduling, Quality management

E. TEXT BOOKS

T1. Liptak B.G (ED)-Process Control H andbook,vol-2 Chilton book Co.

F. REFERENCE BOOKS

R1. Webb J.W-Programmable controllers: Principle and Applications, PHI New Delhi
R2. Parr A –Programmable Controllers :An Engineers' Guide, Newnes, Butterworth-HeinnemanLtd1993

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	COURSE OUTCOME STATEMENT	CORRELATION WITH PROGRAM OUTCOMES									CORRELATION WITH PROGRAM SPECIFIC OUTCOMES				
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	Understand the various concepts, terminologies of Process Automation.	1	2	2	2	2	-	-	-	-	2	-	-	3	3
CO2	Understand the application areas of Process Automation.	2	2	2	2	-	2	-	-	-	2	1	-	3	3
CO3	Use various techniques of automation and control of processes.	3	2	2	1	1	-	-	-	-	3	-	1	2	3
CO4	Understand building blocks of Process Automation and it's characteristics	1	2	2	1	-	1	-	-	-	2	-	2	3	2

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Discipline Specific Elective (DSE) Course
Artificial Intelligence (Select any TWO)

Subject: Web Programming

Code: CSC24022
5 Credits | Semester IV
Total Hours Required –75Total Tutorials Required – 15

A. Introduction: This course introduces the fundamental concept of Web Programming. The objective of the course is to provide complete knowledge of Web Programming Fundamentals. It willhelp the students getting started with web programming using HTML5, PHP and My SQL.They will learn how to build their own website, create dynamic content and user interface and integrating the front end and backend perspective of the application.

The main objectives of the course are as follows:

- To help the students getting started with web programming using HTML5, PHP and My SQL.
- To learn how to build own website.
- To create dynamic content and user interface.
- Embed objects in a web page.
- Integrating the front end and backend perspective of the application.

B. Course Outcomes: At the end of the course, students will be able to
[CO.1]. Create static HTML pages.
[CO.2]. Create well-structured and easily maintained CSS code to present HTML pages in different ways.
[CO.3]. Use JavaScript to add dynamic content to pages.
[CO.4]. Create dynamic web pages using PHP and My SQL.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Internal Examination	20
	Assignment	05
	Attendance	05
End Term Exam (Summative)	End Term Examination	70
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

Internet and the World Wide Web: Introduction to internet and its applications, E-mail, telnet, FTP, e-commerce, video conferencing, e-business. Internet service providers, World Wide Web (WWW): World Wide Web and its evolution, uniform resource locator (URL), Different browsers. Search engine, web saver – Apache, IIS, Proxy Server, HTTP protocol. **HTML5:** Introduction, Why HTML5? Style sheets, CSS formatting text using style sheets. **HTML5 Page layout and navigation:** Creating navigational aids: planning site organization, creating text-based and graphical navigation bar, creating division based layouts, HTML5 semantic layout. **HTML5 Tables, Forms and Media:** Creating tables, merging table cells, using tables for page layout, formatting tables. Creating user forms : Creating basic form, using check boxes and option buttons, creating lists, Incorporating sound and video in HTML5. **Java Script:** Introduction, Client-Side JavaScript, Server-Side JavaScript, JavaScript Objects, JavaScript Security Operators: Assignment Operators, Comparison Operators, Arithmetic Operators, Logical Operators, String Operators, Special Operators. Statements: Break, comment, continue, delete, do...while, export, for, for...in function, if...else, Core JavaScript (Properties and Methods of Each) : Array, Boolean, Date, Function, Math, Number, Object, String, regExp Document and its associated objects: document, Link, Area, Anchor, Image, Applet, Layer. **Events and Event Handlers :** General Information about Events, Defining EventHandlers, different events of JavaScript. **PHP:** Introduction of PHP and MySQL. Server-side scripting, PHP syntax and variables, comments, types, control structures, branching, looping, termination, functions, passing information with PHP, GET, POST, formatting form variables, super global arrays, strings and string functions, regular expressions, arrays, number handling, basic PHP errors/problems. **Advanced PHP and MySQL:** PHP/My SQL Functions, Integrating web forms and databases, Displaying queries in tables, Building Forms from queries, String and Regular Expressions, Sessions, Cookies and HTTP, E-Mail.

E. TEXT BOOKS

T1. Web Design The Complete Reference - Thomas Powell - Tata McGraw Hill
T2. PHP 5.1 for Beginners - Ivan Bayross, Sharanam Shah - SPD
T3. JavaScript 2.0: The Complete Reference - Thomas Powell and Fritz Schneider - Tata McGraw Hill

F. REFERENCE BOOKS

R1. HTML5 Step by Step – FaitheWempen - Microsoft Press
R2. PHP Project for Beginners - Sharanam Shah, Vaishali Shah - SPD

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	COURSE OUTCOME STATEMENT	CORRELATION WITH PROGRAM OUTCOMES									CORRELATION WITH PROGRAM SPECIFIC OUTCOMES				
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	Create static HTML pages.	1	2	2	2	2	-	-	-	-	2	-	-	2	-
CO2	Create well-structured and easily maintained CSS code to present HTML pages in different ways.	2	2	2	2	-	2	-	-	-	2	1	-	2	1
CO3	Use JavaScript to add dynamic content to pages.	3	2	2	1	1	-	-	-	-	3	-	1	3	-
CO4	Create dynamic web pages using PHP and My SQL.	1	2	2	1	-	1	-	-	-	2	-	-	2	-

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Discipline Specific Elective (DSE) Course
Data Science (Select any TWO)

Subject: R Programming Language Lab

Code: CSC24124
2 Credits | Semester IV
Total Hours Required –60 Total Tutorials Required – 12

A. Introduction: The objective of the course is to provide complete knowledge of R programming language. Students will be able to develop logical abilities, which will help them to create programs, applications. The students will also develop an ability, which can easily help them switch to any other language in future.

The main objectives of the course are as follows:

- Understanding and being able to use basic programming concepts
- Automate data analysis
- Working collaboratively and openly on code
- Knowing how to generate dynamic documents
- Being able to use a continuous test-driven development approach

B. Course Outcomes: At the end of the course, students will be able to
[CO.1]. Use and program in the programming language R
[CO.2]. Use R to solve statistical problems
[CO.3]. Implement and describe Monte Carlo the technology
[CO.4]. Minimize and maximize functions using R

C. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Internal Examination	10
	Assignment	2.5
	Attendance	2.5
End Term Exam (Summative)	End Term Examination	35
	Total	50
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

List of Practical	
1.	Write an R-Program to print Hello World
2.	Write an R-Program to take input from user.

3.	Write an R-Program to demonstrate working with operators (Arithmetic, Relational, Logical, Assignment operators).
4.	Write an R Program to Check if a Number is Odd or Even
5.	Write an R Program to check if the given Number is a Prime Number
6.	Write an R Program to Find the Factorial of a Number
7.	Write an R Program to Find the Factors of a Number
8.	Write an R Program to Find the Fibonacci sequence Using Recursive Function
9.	Write an R Program to Make a Simple Calculator
10.	Write an R Program to Find L.C.M of two numbers
11.	Write an R Program to create a Vector and to access elements in a Vector
12.	Write an R Program to create a Matrix and access rows and columns using functions colnames() and rownames() .
13.	Write an R Program to create a Matrix using cbind() and rbind() functions.
14.	Write an R Program to create a Matrix from a Vector using dim() function.
15.	Write an R Program to create a List and modify its components.
16.	Write an R Program to create a Data Frame.
17.	Write an R Program to access a Data Frame like a List.
18.	Write an R Program to access a Data Frame like a Matrix.
19.	Write an R Program to create a Factor.
20.	Write an R Program to Access and Modify Components of a Factor.
21.	Write an R Program to create an S3 Class and S3 Objects.
22.	Write an R Program to write an own generic function in S3 Class.
23.	Write an R Program to create a S4 Class and S4 Objects.
24.	Write an R Program to write an own generic function in S4 Class.
25.	Write an R Program to create Reference Class and modify its Methods.

E. TEXT BOOKS

T1.R Programming for Data Science by Roger D. Peng

T2. The Art of R Programming by Prashanthsingh, VivekMourya, Cengage Learning India.

F. REFERENCE BOOKS

R1. An Introduction to R, W. N. Venables, D. M. Smith, R Core Team, 2018.

R2.simpleR – Using R for Introductory Statistics, John Verzani, CRC Press, Taylor & Francis Group,2005

R3. Beginner's guide for Data Analysis using R Programming by Dr. Jeeva Jose

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	COURSE OUTCOME STATEMENT	CORRELATION WITH PROGRAM OUTCOMES									CORRELATION WITH PROGRAM SPECIFIC OUTCOMES				
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	Use and program in the programming language R	1	2	2	2	2	2	-	-	-	2	2	-	3	3
CO2	Use R to solve statistical problems	2	2	2	3	3	2	-	-	-	2	1	-	3	3
CO3	Implement and describe Monte Carlo the technology	3	2	2	1	1	-	-	-	-	3	-	1	2	3
CO4	Minimize and maximize functions using R	1	2	2	1	3	1	-	-	-	2	3	2	3	2

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Discipline Specific Elective (DSE) Course
Data Science (Select any TWO)

Subject: Python for Data Science Lab

Code: CSC24125
2 Credits | Semester IV
Total Hours Required –60 Total Tutorials Required – 12

A. Introduction: This course provides good knowledge of python for data science. The students will also learn to program and programming paradigms brought in by Python with a focus on File Handling and Regular Expressions. A major component of this course will be learning how to use python-based programming tools to apply these methods to real-life datasets.

B. Course Outcomes: At the end of the course, students will be able to

[CO.1]. Walk through algorithm
[CO.2]. Improve programming skills
[CO.3]. Appreciate Python Programming Paradigm
[CO.4]. Hands on Regular Expression
[CO.5]. Ability to Text Processing scripts

C. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Internal Examination	10
	Assignment	2.5
	Attendance	2.5
End Term Exam (Summative)	End Term Examination	35
	Total	50
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

List of Practical	
1.	Implement a sequential search
2.	Create a calculator program
3.	Explore string functions
4.	Implement Selection Sort
5.	Implement Stack
6.	Read and write into a file

7.	Demonstrate usage of basic regular expression
8.	Demonstrate use of advanced regular expressions for data validation.
9.	Demonstrate use of List
10.	Demonstrate use of Dictionaries
11.	Create Comma Separate Files (CSV), Load CSV files into internal Data Structure
12.	Write script to work like a SQL SELECT statement for internal Data Structure made in earlier exercise
13.	Write script to work like a SQL Inner Join for an internal Data Structure made in earlier exercise
14.	Demonstrate Exceptions in Python

E. TEXT BOOKS

T1. Programming in Python 3 - A Complete Introduction to the Python Language, Mark Summerfield, Addison-Wesley Reprint 2011

F. REFERENCE BOOKS

R1. Think Python, Version 2.0.17, Allen Downey, Green Tea Press, Needham, Massachusetts, 2012

Course Articulation Matrix: (Mapping of COs withPOs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES									CORRELATION WITH PROGRAM SPECIFICOUTCOMES				
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	Walk through algorithm	1	2	2	2	2	-	-	-	-	2	-	-	3	3
CO2	Improve programming skills	2	2	2	2	-	2	-	-	-	2	1	-	3	3
CO3	Appreciate Python Programming Paradigm	3	2	2	1	1	-	-	-	-	3	-	1	2	3
CO4	Hands on Regular Expression	1	2	2	1	-	1	-	-	-	2	-	-	3	2
CO5	Ability to Text Processing scripts	2	2	1	1	-	2	-	-	-	2	-	-	3	2

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Discipline Specific Elective (DSE) Course
Data Science (Select any TWO)

Subject: Web Programming Lab

Code: CSC24026
2 Credits | Semester IV
Total Hours Required –60 Total Tutorials Required – 12

A. Introduction: This course introduces the fundamental concept of Web Programming. The objective of the course is to provide complete knowledge of Web Programming Fundamentals. It willhelp the students getting started with web programming using HTML5, PHP and My SQL.They will learn how to build their own website, create dynamic content and user interface and integrating the front end and backend perspective of the application.

The main objectives of the course are as follows:

- To help the students getting started with web programming using HTML5, PHP and My SQL.
- To learn how to build own website.
- To create dynamic content and user interface.
- Embed objects in a web page.
- Integrating the front end and backend perspective of the application.

B. Course Outcomes: At the end of the course, students will be able to
[CO.1]. Create static HTML pages.
[CO.2]. Create well-structured and easily maintained CSS code to present HTML pages in different ways.
[CO.3]. Use JavaScript to add dynamic content to pages.
[CO.4]. Create dynamic web pages using PHP and My SQL.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Internal Examination	10
	Assignment	2.5
	Attendance	2.5
End Term Exam (Summative)	End Term Examination	35
	Total	50
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

List of Practical	
1.	**Use of Basic Tags**

a.	Design a web page using different text formatting tags.
b.	Design a web page with links to different pages and allow navigation betweenweb pages.
c.	Design a web page demonstrating all Style sheet types
2.	**Image maps, Tables, Forms and Media**
a.	Design a web page with Image maps.
b.	Design a web page demonstrating different semantics
c.	Design a web page with different tables. Design a web pages using table so that the content appears well placed.
d.	Design a web page with a form that uses all types of controls.
e.	Design a web page embedding with multimedia features.
3.	**Java Script**
a.	Using JavaScript design, a web page that prints factorial/Fibonacci series/anygiven series.
b.	Design a form and validate all the controls placed on the form using Java Script.
c.	Write a JavaScript program to display all the prime numbers between 1 and 100.
a.	Write a JavaScript program to accept a number from the user and display the sum of its digits.
d.	Write a program in JavaScript to accept a sentence from the user and display the number of words in it. (Do not use split () function).
e.	Write a java script program to design simple calculator.
4.	**Control and looping statements and Java Script references**
a.	Design a web page demonstrating different conditional statements.
b.	Design a web page demonstrating different looping statements.
c.	Design a web page demonstrating different Core JavaScript references (Array, Boolean, Date, Function, Math, Number, Object, String, regExp).
5.	**Basic PHP I**
a.	Write a PHP Program to accept a number from the user and print it factorial.
b.	Write a PHP program to accept a number from the user and print whether it is prime or not.
6.	**Basic PHP II**
a.	Write a PHP code to find the greater of 2 numbers. Accept the no. from the user.
b.	Write a PHP program to display the following Binary Pyramid: 1 0 1 1 0 1 0 1 0 1
7.	String Functions and arrays
a.	Write a PHP program to demonstrate different string functions.
b.	Write a PHP program to create one-dimensional array.

8.	PHP and Database
a.	Write a PHP code to create: • Create a database College Create a table Department (Dname, Dno, Number_Of_faculty)
b.	Write a PHP program to create a database named "College". Create a table named "Student" with following fields (sno, sname, percentage). Insert 3 records of your choice. Display the names of the students whose percentage is between 35 to 75in a tabular format.
c.	Design a PHP page for authenticating a user.
9.	Email
a.	Write a program to send email with attachment.
10.	Sessions and Cookies
a.	Write a program to demonstrate use of sessions and cookies.

E. TEXT BOOKS

T1. Web Design The Complete Reference - Thomas Powell - Tata McGraw Hill
T2. PHP 5.1 for Beginners - Ivan Bayross, Sharanam Shah - SPD
T3. JavaScript 2.0: The Complete Reference - Thomas Powell and Fritz Schneider - Tata McGraw Hill

F. REFERENCE BOOKS

R1. HTML5 Step by Step – FaitheWempen - Microsoft Press
R2. PHP Project for Beginners - Sharanam Shah, Vaishali Shah – SPD
R3. Murach's PHP and MySQL - Joel Murach, Ray Harris - SPD

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	COURSE OUTCOME STATEMENT	CORRELATION WITH PROGRAM OUTCOMES									CORRELATION WITH PROGRAM SPECIFIC OUTCOMES				
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	Create static HTML pages.	1	2	2	2	2	-	-	-	-	2	-	-	2	-
CO2	Create well-structured and easily maintained CSS code to present HTML pages in different ways.	2	2	2	2	-	2	-	-	-	2	1	-	2	1
CO3	Use JavaScript to add dynamic content to pages.	3	2	2	1	1	-	-	-	-	3	-	1	3	-
CO4	Create dynamic web pages using PHP and My SQL.	1	2	2	1	-	1	-	-	-	2	-	-	2	-

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Discipline Specific Elective (DSE) Course
Internet of Things (Select any TWO)

Subject: Sensor Technologies Lab

Code: CSC24117
2 Credits | Semester IV
Total Hours Required –60 Total Tutorials Required –12

A. Introduction: The course objective is to provide good knowledge of working of different types of sensors used in various application areas. The course also be provided with the knowledge of interfacing of electronic circuits with different sensors for it's applications in different fields.

B. Course Outcomes: At the end of the course, students will be able to

[CO.1]. Concept behind working of measurement systems and different types of sensors and transducers.
[CO.2]. Sensor to measure various physical parameters used in Industry and normal measurement applications.
[CO.3]. Working principle of resistive, inductive and capacitive transducers and their applications.
[CO.4]. Understanding of thermocouples, piezoelectric and pyro-electric transducers and their applications.
[CO.5]. Understanding of acoustic, optical sensors and other sensors and their applications.
[CO.6]. Understanding of digital and proximity sensors and their applications.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Internal Examination	10
	Assignment	2.5
	Attendance	2.5
End Term Exam (Summative)	End Term Examination	35
	Total	50
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

List of Practical	
1.	Characterization of strain gauge indicator and weight measurement using Load Cell.
2.	Measurement of Displacement using LVDT.

3.	Study of Encoder as displacement sensor.
4.	To plot the characteristics of a) J/K/R/S/T Thermocouples (any two types) b) Thermocouple simulator
5.	To plot the characteristics of a) RTD Pt100/Pt500/Pt1000 (any two) b) RTD simulator
6.	Measurement of Pressure using Bellows, Bourdon gauge, Diaphragm.
7.	Study of different types of Proximity switches.
8.	Study of Dead Weight Tester.
9.	Study of Vacuum Gauge Tester.
10.	Measurement of sound level.

E. TEXT BOOKS

T1. Handbook of Modern Sensors: Physical, Designs, and Applications, J. Fraden, AIP Press, Springer

T2. Sensors and Transducers, D. Patranabis, PHI Publication, New Delhi

F. REFERENCE BOOKS

R1: Mechatronics- Ganesh S. Hegde, Published by University Science Press (An imprint of Laxmi Publication Private Limited).

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	COURSE OUTCOME STATEMENT	CORRELATION WITH PROGRAM OUTCOMES									CORRELATION WITH PROGRAM SPECIFIC OUTCOMES				
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	Concept behind working of measurement systems and different types of sensors and transducers.	1	2	2	2	2	-	-	-	-	2	-	-	-	1
CO2	Sensor to measure various physical parameters used in Industry and normal measurement applications.	2	2	2	2	-	2	-	-	-	2	1	-	1	2
CO3	Working principle of resistive, inductive & capacitive transducers & their applications.	3	2	2	1	1	-	-	-	-	3	-	1	-	1
CO4	Understanding of thermocouples, piezoelectric and pyro-electric transducers and their applications.	1	2	2	1	-	1	-	-	-	2	-	-	-	2
CO5	Understanding of acoustic, optical sensors and other sensors and their applications.	2	2	1	1						2		1	1	2
CO6	Understanding of digital and proximity sensors and their applications.	2	1	2	2						2		2	-	2

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Discipline Specific Elective (DSE) Course
Internet of Things (Select any TWO)

Subject: Embedded System Lab

Code: CSC24118
2 Credits | Semester IV
Total Hours Required –60 Total Tutorials Required – 12

A. Introduction: The objective of the course is to provide complete knowledge of Embedded Systems. Students will be able to provide various techniques of Embedded Systems, which will help them to create programs, applications in Embedded Systems. The students will also develop an ability, which can easily help them switch to any other relevant technology in future.

The main objectives of the course are as follows:

- To learn the concepts and architecture of embedded systems.
- To acquire the fundamental knowledge of the Embedded system.
- To learn the various operations performed by the Embedded system.
- Students will capable of designing embedded systems.

B. Course Outcomes: At the end of the course, students will be able to
[CO.1]. Understand the Embedded concepts and embedded system Architecture.
[CO.2]. Learn the architecture and programming of Microcontroller.
[CO.3]. Select a proper Microcontroller for an application.
[CO.4]. Understand the usage of the development and debugging tools.
[CO.5]. Learn and apply the knowledge of Memory systems and Peripherals

C. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Internal Examination	10
	Assignment	2.5
	Attendance	2.5
End Term Exam (Summative)	End Term Examination	35
	Total	50
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

List of Practical	
	Experiments to be done using Embedded Microcontroller
1.	Display ―Hello World message using Internal UART.
2.	Interface and Control a DC Motor.
3.	Interface a Stepper motor and rotate it in clockwise and anti-clockwise direction.
4.	Interface a DAC and generate Triangular and Square waveforms.
5.	Interface a 4x4 keyboard and display the key code on an LCD.
6.	Using the Internal PWM module of ARM controller generate PWM and vary its duty cycle.
7.	Demonstrate the use of an external interrupt to toggle an LED On/Off.
8.	Display the Hex digits 0 to F on a 7-segment LED interface, with an appropriate delay in between.
9.	Interface a simple Switch and display its status through Relay, Buzzer and LED.
10.	Measure Ambient temperature using a sensor and SPI ADC IC.

E. TEXT BOOKS

T1. Embedded Systems Architecture, Programming and Design, Raj Kamal

F. REFERENCE BOOKS

R1. Introduction to Embedded Systems, K. V. Shibu..

R2. Embedded System, N. S. Gopal Singh.

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES									CORRELATION WITH PROGRAM SPECIFIC OUTCOMES				
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	Understand the Embedded concepts and embedded system Architecture	1	2	2	2	2	-	-	-	-	2	-	-	3	3
CO2	Learn the architecture and programming of Microcontroller.	2	2	2	2	-	2	-	-	-	2	1	-	3	3
CO3	Understand the usage of the development and debugging tools.	3	2	2	1	1	-	-	-	-	3	-	1	2	3
CO4	Understand the usage of the development and debugging tools.	1	2	2	1	-	1	-	-	-	2	-	2	3	2
CO5	Learn and apply the knowledge of Memory systems and Peripherals	1	2	3	2		1				1		2	2	-

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Discipline Specific Elective (DSE) Course
Internet of Things (Select any TWO)

Subject: Web Programming Lab

Code: CSC24026
2 Credits | Semester IV
Total Hours Required –60 Total Tutorials Required – 12

A. Introduction: This course introduces the fundamental concept of Web Programming. The objective of the course is to provide complete knowledge of Web Programming Fundamentals. It willhelp the students getting started with web programming using HTML5, PHP and My SQL.They will learn how to build their own website, create dynamic content and user interface and integrating the front end and backend perspective of the application.

The main objectives of the course are as follows:

- To help the students getting started with web programming using HTML5, PHP and My SQL.
- To learn how to build own website.
- To create dynamic content and user interface.
- Embed objects in a web page.
- Integrating the front end and backend perspective of the application.

B. Course Outcomes: At the end of the course, students will be able to
[CO.1]. Create static HTML pages.
[CO.2]. Create well-structured and easily maintained CSS code to present HTML pages in different ways.
[CO.3]. Use JavaScript to add dynamic content to pages.
[CO.4]. Create dynamic web pages using PHP and My SQL.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Internal Examination	10
	Assignment	2.5
	Attendance	2.5
End Term Exam (Summative)	End Term Examination	35
	Total	50
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

List of Practical	
1.	**Use of Basic Tags**

a.	Design a web page using different text formatting tags.
b.	Design a web page with links to different pages and allow navigation betweenweb pages.
c.	Design a web page demonstrating all Style sheet types
2.	**Image maps, Tables, Forms and Media**
a.	Design a web page with Image maps.
b.	Design a web page demonstrating different semantics
c.	Design a web page with different tables. Design a web pages using table so that the content appears well placed.
d.	Design a web page with a form that uses all types of controls.
e.	Design a web page embedding with multimedia features.
3.	**Java Script**
a.	Using JavaScript design, a web page that prints factorial/Fibonacci series/anygiven series.
b.	Design a form and validate all the controls placed on the form using Java Script.
c.	Write a JavaScript program to display all the prime numbers between 1 and 100.
a.	Write a JavaScript program to accept a number from the user and display the sum of its digits.
d.	Write a program in JavaScript to accept a sentence from the user and display the number of words in it. (Do not use split () function).
e.	Write a java script program to design simple calculator.
4.	**Control and looping statements and Java Script references**
a.	Design a web page demonstrating different conditional statements.
b.	Design a web page demonstrating different looping statements.
c.	Design a web page demonstrating different Core JavaScript references (Array, Boolean, Date, Function, Math, Number, Object, String, regExp).
5.	**Basic PHP I**
a.	Write a PHP Program to accept a number from the user and print it factorial.
b.	Write a PHP program to accept a number from the user and print whether it is prime or not.
6.	**Basic PHP II**
a.	Write a PHP code to find the greater of 2 numbers. Accept the no. from the user.
b.	Write a PHP program to display the following Binary Pyramid: 1 0 1 1 0 1 0 1 0 1
7.	String Functions and arrays
a.	Write a PHP program to demonstrate different string functions.
b.	Write a PHP program to create one-dimensional array.

8.	PHP and Database
a.	Write a PHP code to create: • Create a database College • Create a table Department (Dname, Dno, Number_Of_faculty)
b.	Write a PHP program to create a database named "College". Create a table named "Student" with following fields (sno, sname, percentage). Insert 3 records of your choice. Display the names of the students whose percentage is between 35 to 75in a tabular format.
c.	Design a PHP page for authenticating a user.
9.	Email
a.	Write a program to send email with attachment.
10.	Sessions and Cookies
a.	Write a program to demonstrate use of sessions and cookies.

E. TEXT BOOKS

T1. Web Design The Complete Reference - Thomas Powell - Tata McGraw Hill

T2. PHP 5.1 for Beginners - Ivan Bayross, Sharanam Shah - SPD

T3. JavaScript 2.0: The Complete Reference - Thomas Powell and Fritz Schneider - Tata McGraw Hill

F. REFERENCE BOOKS

R1. HTML5 Step by Step – FaitheWempen - Microsoft Press

R2. PHP Project for Beginners - Sharanam Shah, Vaishali Shah – SPD

R3. Murach's PHP and MySQL - Joel Murach, Ray Harris - SP

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	COURSE OUTCOME STATEMENT	CORRELATION WITH PROGRAM OUTCOMES									CORRELATION WITH PROGRAM SPECIFIC OUTCOMES				
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	Create static HTML pages.	1	2	2	2	2	-	-	-	-	2	-	-	2	-
CO2	Create well-structured and easily maintained CSS code to present HTML pages in different ways.	2	2	2	2	-	2	-	-	-	2	1	-	2	1
CO3	Use JavaScript to add dynamic content to pages.	3	2	2	1	1	-	-	-	-	3	-	1	3	-
CO4	Create dynamic web pages using PHP and My SQL.	1	2	2	1	-	1	-	-	-	2	-	-	2	-

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Discipline Specific Elective (DSE) Course
Artificial Intelligence (Select any TWO)

Subject: Introduction to RPA Tools Lab

Code: CSC24194
2 Credits | Semester IV
Total Hours Required –60 Total Tutorials Required – 12

A. Introduction: The objective of the course is to provide complete knowledge of RPA Tools. Students will be exposed to Robotics Process Automation techniques, which will help them to prepare various automation projects. The students will also develop an ability, which can easily help them switch to any other technology in future.

The main objectives of the course are as follows:

- To learn RPA tools fundamentals.
- Be exposed to Robotics Process Automation techniques.
- Be familiar with Uipath studio.
- Learn to prepare automation projects.

B. Course Outcomes: At the end of the course, students will be able to

[CO.1]. Understand the various concepts, terminologies of RPA systems.
[CO.2]. Understand the application areas of RPA
[CO.3]. Use various techniques of automation and control in Robotics
[CO.4]. Understand building blocks of RPA and characteristics.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Internal Examination	10
	Assignment	2.5
	Attendance	2.5
End Term Exam (Summative)	End Term Examination	35
	Total	50
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

Practical No	Details
1	Open, log in, and toggle between different applications and systems.
2	Copy and paste data from spreadsheets to core systems.
3	Move data from core systems to spreadsheets.
4	Move information from Core System 1 to Core System 2.
5	Pull data from invoices into a core system.
6	Open an email and move its data into a core system.
7	Move files and folders from desktops to servers.
8	Scrape information from the internet and websites.
9	Calculate data automatically to create reports.

E. TEXT BOOKS

T1. The Robotic Process Automation Handbook: A Guide to implementing RPA Systems 1st ed. Edition by Tom Taulli.

F. REFERENCE BOOKS

R1. Robotics Process and Cognitive Automation: The next Phase By Mary C. Lacity and Leslie P. Willcocks

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	COURSE OUTCOME STATEMENT	CORRELATION WITH PROGRAM OUTCOMES									CORRELATION WITH PROGRAM SPECIFIC OUTCOMES				
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	Understand the various concepts, terminologies of RPA systems.	1	2	2	2	2	-	-	-	-	2	-	-	3	3
CO2	Understand the application areas of RPA.	2	2	2	2	-	2	-	-	-	2	1	-	3	3
CO3	Use various techniques of automation and control in Robotics.	3	2	2	1	1	-	-	-	-	3	-	1	2	3
CO4	Understand building blocks of RPA and characteristics.	1	2	2	1	-	1	-	-	-	2	-	2	3	2

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Discipline Specific Elective (DSE) Course
Artificial Intelligence (Select any TWO)

Subject: Introduction to Process Automation Lab

Code: CSC24195
2 Credits | Semester IV
Total Hours Required –60 Total Tutorials Required – 12

A. Introduction: The objective of the course is to provide complete knowledge of Industrial Process Automation. Students will be able to develop logical abilities, which will help them to create programs, applications using Process Automation. The students will also develop an ability, which can easily help them switch to any other automation technology in future.

The main objectives of the course are as follows:

- Learn P.A. tools fundamentals.
- Be exposed to Process Automation techniques.
- Be familiar with PLC.
- Learn to prepare automation projects

B. Course Outcomes: At the end of the course, students will be able to
[CO.1]. Understand the various concepts, terminologies of Process Automation.
[CO.2]. Understand the application areas of Process Automation.
[CO.3]. Use various techniques of automation and control of processes.
[CO.4]. Understand building blocks of Process Automation and its characteristics.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Internal Examination	10
	Assignment	2.5
	Attendance	2.5
End Term Exam (Summative)	End Term Examination	35
	Total	50
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

Practical No	Details
1	Study of PLC kit, practicing of basic programs.
2	Write the ladder diagram to test digital logic gates (two, three and four inputs)
3	Write the ladder diagram for three variable Boolean expressions and test the output. Example: Y= (Ā+B+C)+(BC) and Z=(ĀB+C)+(B+C).
4	Write the ladder diagram to verify Demorgan's theorem.
5	Write the ladder diagram for DOL starter and test the output
6	Writing the ladder diagram and execute the Stair case light application
7	Writing the ladder diagram and execute the Water level controller application
8	Writing the ladder diagram and execute the Conveyer control application
9	Writing the ladder diagram and execute the Lift control application
10	Writing the ladder diagram and execute the Speed control of ac servo motor

E. TEXT BOOKS

T1. Liptak B.G (ED)-Process Control H andbook,vol-2 Chilton book Co.

F. REFERENCE BOOKS

R1. Webb J.W-Programmable controllers: Principle and Applications, PHI New Delhi
R2. Parr A –Programmable Controllers :An Engineers' Guide, Newnes, Butterworth-HeinnemanLtd1993

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	COURSE OUTCOME STATEMENT	CORRELATION WITH PROGRAM OUTCOMES									CORRELATION WITH PROGRAM SPECIFIC OUTCOMES				
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	Understand the various concepts, terminologies of ProcessAutomation.	1	2	2	2	2	-	-	-	-	2	-	-	3	3
CO2	Understand the application areas of Process Automation.	2	2	2	2	-	2	-	-	-	2	1	-	3	3
CO3	Use various techniques of automation and control of processes.	3	2	2	1	1	-	-	-	-	3	-	1	2	3
CO4	Understand building blocks of Process Automation and it's characteristics	1	2	2	1	-	1	-	-	-	2	-	2	3	2

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Discipline Specific Elective (DSE) Course
Artificial Intelligence (Select any TWO)

Subject: Web Programming Lab

Code: CSC24026
2 Credits | Semester IV
Total Hours Required –60 Total Tutorials Required – 12

A. Introduction: This course introduces the fundamental concept of Web Programming. The objective of the course is to provide complete knowledge of Web Programming Fundamentals. It willhelp the students getting started with web programming using HTML5, PHP and My SQL.They will learn how to build their own website, create dynamic content and user interface and integrating the front end and backend perspective of the application.

The main objectives of the course are as follows:

- To help the students getting started with web programming using HTML5, PHP and My SQL.
- To learn how to build own website.
- To create dynamic content and user interface.
- Embed objects in a web page.
- Integrating the front end and backend perspective of the application.

B. Course Outcomes: At the end of the course, students will be able to
[CO.1]. Create static HTML pages.
[CO.2]. Create well-structured and easily maintained CSS code to present HTML pages in different ways.
[CO.3]. Use JavaScript to add dynamic content to pages.
[CO.4]. Create dynamic web pages using PHP and My SQL.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Internal Examination	10
	Assignment	2.5
	Attendance	2.5
End Term Exam (Summative)	End Term Examination	35
	Total	50
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

List of Practical	
1.	**Use of Basic Tags**

a.	Design a web page using different text formatting tags.
b.	Design a web page with links to different pages and allow navigation betweenweb pages.
c.	Design a web page demonstrating all Style sheet types
2.	**Image maps, Tables, Forms and Media**
a.	Design a web page with Image maps.
b.	Design a web page demonstrating different semantics
c.	Design a web page with different tables. Design a web pages using table so that the content appears well placed.
d.	Design a web page with a form that uses all types of controls.
e.	Design a web page embedding with multimedia features.
3.	**Java Script**
a.	Using JavaScript design, a web page that prints factorial/Fibonacci series/anygiven series.
b.	Design a form and validate all the controls placed on the form using Java Script.
c.	Write a JavaScript program to display all the prime numbers between 1 and 100.
a.	Write a JavaScript program to accept a number from the user and display the sum of its digits.
d.	Write a program in JavaScript to accept a sentence from the user and display the number of words in it. (Do not use split () function).
e.	Write a java script program to design simple calculator.
4.	**Control and looping statements and Java Script references**
a.	Design a web page demonstrating different conditional statements.
b.	Design a web page demonstrating different looping statements.
c.	Design a web page demonstrating different Core JavaScript references (Array, Boolean, Date, Function, Math, Number, Object, String, regExp).
5.	**Basic PHP I**
a.	Write a PHP Program to accept a number from the user and print it factorial.
b.	Write a PHP program to accept a number from the user and print whether it is prime or not.
6.	**Basic PHP II**
a.	Write a PHP code to find the greater of 2 numbers. Accept the no. from the user.
b.	Write a PHP program to display the following Binary Pyramid: 1 0 1 1 0 1 0 1 0 1
7.	String Functions and arrays
a.	Write a PHP program to demonstrate different string functions.
b.	Write a PHP program to create one-dimensional array.
8.	PHP and Database
a.	Write a PHP code to create: • Create a database College Create a table Department (Dname, Dno, Number_Of_faculty)

b.	Write a PHP program to create a database named "College". Create a table named "Student" with following fields (sno, sname, percentage). Insert 3 records of your choice. Display the names of the students whose percentage is between 35 to 75in a tabular format.
c.	Design a PHP page for authenticating a user.
9.	Email
a.	Write a program to send email with attachment.
10.	Sessions and Cookies
a.	Write a program to demonstrate use of sessions and cookies.

E. TEXT BOOKS

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T2. PHP 5.1 for Beginners - Ivan Bayross, Sharanam Shah - SPD

T3. JavaScript 2.0: The Complete Reference - Thomas Powell and Fritz Schneider - Tata McGraw Hill

F. REFERENCE BOOKS

R1. HTML5 Step by Step – FaitheWempen - Microsoft Press

R2. PHP Project for Beginners - Sharanam Shah, Vaishali Shah – SPD

R3. Murach's PHP and MySQL - Joel Murach, Ray Harris - SPD

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	COURSE OUTCOME STATEMENT	CORRELATION WITH PROGRAM OUTCOMES									CORRELATION WITH PROGRAM SPECIFIC OUTCOMES				
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	Create static HTML pages.	1	2	2	2	2	-	-	-	-	2	-	-	2	-
CO2	Create well-structured and easily maintained CSS code to present HTML pages in different ways.	2	2	2	2	-	2	-	-	-	2	1	-	2	1
CO3	Use JavaScript to add dynamic content to pages.	3	2	2	1	1	-	-	-	-	3	-	1	3	-
CO4	Create dynamic web pages using PHP and My SQL.	1	2	2	1	-	1	-	-	-	2	-	-	2	-

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

ARKA JAIN University
Jharkhand

Syllabus of

Bachelor of Computer Applications

Semester-V

ARKAJAIN University, Jharkhand
School of Engineering & Information Technology
Department of Computer Science & Information Technology
Faculty – BCA
Scheme of Study (w.e.f Batch 2020)

SEMESTER -I

Sl.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Introduction to Computer Science	Core	5	5	100	70	20	5	5
2	Programming In C	Core	5	5	100	70	20	5	5
3	Discrete Mathematics	GS	5	5	100	70	20	5	5
4	Business Communication	AECC	5	5	100	70	20	5	5
	Practical								
5	Computer Science Lab	Core	2	4	50	35	10	2.5	2.5
6	Programming In C Lab	Core	2	4	50	35	10	2.5	2.5
	Total		**24**	**28**	**500**	**350**	**100**	**25**	**25**

SEMESTER –II

Sl.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Data Structure through C	Core	5	5	100	70	20	5	5
2	Object Oriented Programming with C++	Core	5	5	100	70	20	5	5
3	Operating System	Core	5	5	100	70	20	5	5
4	Numerical & Statistical Methods	GS	5	5	100	70	20	5	5
5	Environmental Science	AECC	5	5	100	70	20	5	5
	Practical								
6	Data Structure through C Lab	Core	2	4	50	35	10	2.5	2.5
7	Object Oriented Programming with C++ Lab	Core	2	4	50	35	10	2.5	2.5
	Total		**28**	**32**	**600**	**420**	**120**	**30**	**30**

SEMESTER –III

Sl.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Programming with Java	Core	5	5	100	70	20	5	5
2	Design and Analysis of Algorithms	Core	5	5	100	70	20	5	5
3	Database Management System	Core	5	5	100	70	20	5	5
4	Data Communication & Networking	Core	5	5	100	70	20	5	5
5	Python Programming	SECC	4	4	100	70	20	5	5
	Practical								
6	Programming with Java Lab	Core	2	4	50	35	10	2.5	2.5
7	Database Management System Lab	Core	2	4	50	35	10	2.5	2.5
8	Python Programming Lab	SECC	2	4	50	35	10	2.5	2.5
	TOTAL		**30**	**36**	**650**	**455**	**130**	**32.5**	**32.5**

SEMESTER –IV

Sl.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Introduction to Data Science	Core	5	5	100	70	20	5	5
2	Internet of Things	Core	5	5	100	70	20	5	5
3	Data Science - Elective I IOT - Elective I AI - Elective I	DSE	5	5	100	70	20	5	5
4	Data Science - Elective II IOT - Elective II AI - Elective II	DSE	5	5	100	70	20	5	5
	Practical								
5	Data Science - Elective I IOT - Elective I AI - Elective I	**DSE**	2	4	50	35	10	2.5	2.5
6	Data Science - Elective II IOT - Elective II AI - Elective II	DSE	2	4	50	35	10	2.5	2.5
	TOTAL		**24**	**28**	**500**	**350**	**100**	**25**	**25**

SEMESTER –V

Sl.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Enterprise Java	Core	5	5	100	70	20	5	5
2	Machine Learning	Core	5	5	100	70	20	5	5
3	Mobile Application Development	SECC	4	4	100	70	20	5	5
4	Data Science - Elective III IOT - Elective III AI - Elective III	DSE	5	5	100	70	20	5	5
5	Data Science - Elective IV IOT - Elective IV AI - Elective IV	DSE	5	5	100	70	20	5	5
	Practical								
6	Enterprise Java Lab	Core	2	4	50	35	10	2.5	2.5
7	Machine Learning Lab	Core	2	4	50	35	10	2.5	2.5
8	Mobile Application Development Lab	SECC	2	4	50	35	10	2.5	2.5
	TOTAL		**30**	**36**	**650**	**455**	**130**	**32.5**	**32.5**

SEMESTER –VI

Sl. No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Software Engineering	Core	5	5	100	70	20	5	5
2	Data Science - Elective V IOT - Elective V AI - Elective V	DSE	5	5	100	70	20	5	5
3	Data Science - Elective VI IOT - Elective VI AI - Elective VI	DSE	5	5	100	70	20	5	5
	Practical								
4	Project	DSE	5	5	100	70	30	0	0
5	Data Science - Elective V IOT - Elective V AI - Elective V	DSE	2	4	50	35	10	2.5	2.5
6	Data Science - Elective VI IOT - Elective VI AI - Elective VI	DSE	2	4	50	35	10	2.5	2.5
	TOTAL		**24**	**28**	**500**	**350**	**110**	**20**	**20**

Discipline Specific Elective (DSE) Courses

Elective I & II	Elective I & II	Elective I & II
Data Science (Select any Two)	**IOT (Select any Two)**	**AI (Select any Two)**
R Programming Language	Sensor Technologies	Introduction to RPA Tools
Python for Data Science	Embedded System	Introduction to Process Automation
Web Programming	Web Programming	Web Programming
Practical		
R Programming Language Lab	Sensor Technologies Lab	Introduction to RPA Tools Lab
Python for Data Science Lab	Embedded System Lab	Introduction to Process Automation Lab
Web Programming Lab	Web Programming Lab	Web Programming Lab

Elective III & IV	Elective III & IV	Elective III & IV
Data Science (Select any Two)	**IOT (Select any Two)**	**AI (Select any Two)**
Design and Analysis of Experiments	Artificial Intelligence	Six Sigma and Lean Methods
Probabilistic Graphical Models	Digital Image Processing	Digital Image Processing
Exploratory Data Analysis and Data Visualization Techniques	Cloud Computing	Business Intelligence

Elective V & VI	Elective V & VI	Elective V & VI
Data Science (Select any Two)	**IOT (Select any Two)**	**AI (Select any Two)**
Big Data Analytics	Embedded C with Adruino	Cloud Deployment And Management
NoSQL Databases	Digital Signal Processing	Natural Language Processing
Time Series Analysis	Artificial Neural Networks	Artificial Neural Networks
Practical		
Big Data Analytics Lab	Embedded C with Adruino Lab	Cloud Deployment And Management Lab
NoSQL Databases Lab	Digital Signal Processing Lab	Natural Language Processing Lab
Time Series Analysis Lab	Artificial Neural Networks Lab	Artificial Neural Networks Lab

Distribution of Credit across 6 semesters:

Sl. No	Type of Paper	No. of Paper	Total Credit
1	Core Paper	22	86
2	Ability Enhancement Compulsory Paper	2	10
3	Generic Paper	2	9
4	Discipline Specific Elective	11	43
5	Skill Enhancement	4	12
	Total	41	160

***CIA – Continuous Internal Assessment – Based on Projects / Assignment during the semester**
GS-Generic Subject | AECC -Ability Enhancement Compulsory Course
SECC -Skill Enhancement Compulsory Course | DSE - Discipline Specific Elective

ARKAJAINUniversity, Jharkhand
School of Engineering & Information Technology
Department of Computer Science & Information Technology
PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES
BCA – Semester–V

PROGRAM OUTCOMES

After completing this undergraduate program, a learner:

[PO.1]. Apply knowledge of Mathematics and science in solving computational problems

[PO.2]. Understand the Computing concepts and their applications using the acquired board based knowledge.

[PO.3]. Design, set up and conduct practical.

[PO.4]. Use the techniques, skills, and modern Software tools for software development.

[PO.5]. Identify and analyze software application problems in multiple aspect including coding, testing and implementation in industrial applications.

[PO.6]. Design, develop and verify software systems to meet desired needs within realistic constraints ensuring quality, reliability, security in addition to satisfying economical, ethical, social and environmental constraints.

[PO.7]. Apply Enterprise level application software for design of diverse software products.

[PO.8]. Communicate effectively in diverse groups and exhibit leadership qualities.

[PO.9]. Understanding of professional and ethical responsibility.

PROGRAM SPECIFIC OUTCOMES (COMMON ACROSS ALL SPECIALIZATIONS)

[PSO.1]. Prepare professionally trained in the areas of programming, databases, software engineering, web designing and networking and other application areas to acquire knowledge in various domain-based prospects.

[PSO.2]. Encourage to communicate effectively and to improve their competency skills to solve real time problems.

[PSO.3]. Understand to employ modern computer languages and applications for their successful career, to create platforms to become an entrepreneur and a relish for higher studies.

PROGRAM SPECIFIC OUTCOMES (DATA SCIENCE)

[PSO.4]. Ability to apply the knowledge of computing tools and techniques in the field of Data science for solving real world problems encountered in the Software Industries.

[PSO.5]. Ability to identify the challenges in Data analytics with respect to IT Industry and pursue quality research in this field with social relevance.

PROGRAM SPECIFIC OUTCOMES (INTERNET OF THINGS)

[PSO.4]. An ability to apply pattern recognition, machine learning, and artificial intelligent techniques including statistical data analysis and quantitative modelling techniques to solve real world problems from various domains such as healthcare, social computing, economics, etc.

[PSO.5]. An ability to recognize and analyze problems related to AI and ML applications along with their ethical implications.

PROGRAM SPECIFIC OUTCOMES (ARTIFICIAL INTELLIGENCE)

[PSO.4]. An ability to recognize and analyze problems related to artificial intelligence and machine learning applications along with their ethical implications

[PSO.5]. An ability to apply intelligent computer systems to a variety of applications.

Subject: Enterprise Java

Code: CSC25034
5 Credits | Semester V
Total Hours Required –75 Total Tutorials Required – 15

A. Introduction: This course introduces the fundamental concept of Enterprise Java. The objective is to equip the students with the advanced feature of Enterprise Java which would enable them to handle complex programs relating to managing data and processes over the network. The major objective of this course is to provide a sound foundation to the students on the concepts, precepts and practices, in a field that is of immense concern to the industry and business.

The main objectives of the course are as follows:

- Understand enterprise foundation fundamentals.
- Distributed enterprise communication
- Various tools and technologies of the EE architecture.
- Able to build their own robust applications.

B. Course Outcomes: At the end of the course, students will be able to

[CO.1]. Identify advance concepts of Java programming with database connectivity.
[CO.2]. Design and develop platform independent applications using a variety of component-based frameworks.
[CO.3]. Able to implement the concepts of JSP, JPA, JNDI, Hibernate, XML & EJB for building enterprise applications.
[CO.4]. To learn how to use Java APIs.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Internal Examination	20
	Assignment	05
	Attendance	05
End Term Exam (Summative)	End Term Examination	70
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

Understanding Java EE: What is an Enterprise Application? What is java enterprise edition? Java EE Technologies, Java EE evolution, Glassfish server Java EE Architecture, **Server and Containers:** Types of System Architecture, Java EE Server, Java EE Containers. **Introduction to Java Servlets:**The Need for Dynamic Content, Java Servlet Technology, Servlet API and Lifecycle: Java Servlet API, the Servlet Skeleton, the Servlet Life Cycle.**Working With Servlets:**Getting Started, Using Annotations Instead of Deployment Descriptor. **Working with Databases:**JDBC Architecture, Accessing Database, the Servlet GUI and Database Example.**Request Dispatcher:** Request dispatcher Interface, Methods of

Request dispatcher, Request dispatcher Application. **COOKIES:** Introduction, Kinds of Cookies, Creating Cookies Using Servlet, Dynamically Changing the Colors of a Page, **SESSION:**Introduction, Life cycle Of Http Session, Session Tracking with Servlet API, **Working with Files:** Uploading Files, Creating an Upload File Application, Downloading Files, Creating a Download FileApplication. Working with Non-Blocking I/O: Creating a Non- Blocking Read Application, Creating the Web Application, Creating Java Class, Creating Servlets, Retrieving the File, Creating index.jsp, **Introduction to Java Server Pages:** Why use Java Server Pages? Disadvantages of JSP, JSP v\s Servlets, Life Cycle of a JSP Page, How does a JSP function? How does JSP execute? About Java Server Pages **Getting Started With Java Server Pages:** Comments, JSP Document, JSP Elements. **Action Elements:** Including other Files, Forwarding JSP Page to Another Page, PassingParameters for other Actions, Loading a Java bean. Implicit Objects, Scope And **EL Expressions:** Implicit Objects, Character-Quoting Conventions, Unified Expression Language [UnifiedEL], Expression Language. **Java Server Pages Standard Tag Libraries:** What is wrong in using JSP Scriptlet Tags? How JSTL Fixes JSP Scriptlet's Shortcomings? Disadvantages of JSTL, Tag Libraries. **Introduction to Enterprise Java Beans:**Enterprise Bean Architecture, Benefits of Enterprise Bean, Types of Enterprise Bean, Accessing Enterprise Beans, Enterprise Bean Application, Packaging Enterprise Beans **Working with Session Beans:** Types of Session Beans, Remote and LocalInterfaces, Accessing Interfaces, Life cycle of Enterprise Beans, Packaging Enterprise Beans. **Working with Message Driven Beans:** Life cycle of a MessageDriven Bean, Uses of Message Driven Beans.**Interceptors:** Request And Interceptor, Defining An Interceptor, AroundInvokeMethod, Applying Interceptor, Adding An Interceptor To An Enterprise Bean, Build and Run the WebApplication. **Java Naming and Directory Interface:** Basic Lookup, JNDI Namespace in Java EE, Resources and JNDI, Datasource Resource Definition in Java EE.**Persistence, Object/Relational Mapping and JPA:**Introduction, Persistence in Java, Current Standards in Java,Object/Relational Mapping, Introduction to Java Persistence API: The Java Persistence API, JPA, ORM, Database and the Application, Architecture of JPA, JPA Specifications.Writing JPA Application: Application Requirement Specifications, Software Requirements, the ApplicationDevelopment Approach, Creating Database And Tables in MySQL, Creating a Web Application, Adding the Required Library Files, Creating a Java bean Class, Creating Persistence Unit [Persistence. Xml], Creating JSPS, the JPA Application Structure, Running the JPA Application. **Introduction to Hibernate:**Introduction of Hibernate, Database and the Components of Hibernate, Architecture of Hibernate **Writing Hibernate Application:** Application Requirement Specifications, Software Requirements, The Application Development Approach, Creating Database and Tables in MySQL, Creating a Web Application, Adding The Required Library Files, Creating a Java bean Class, Creating Hibernate Configuration File, Adding a Mapping Class, Creating JSPS, Running The Hibernate Application.

E. TEXT BOOKS

T1. Java EE 7 For Beginners, Sharanam Shah, Vaishali Shah, SPD
T2. Java EE 8 Cookbook: Build reliable applications with the most robust and mature technology for enterprise development, Elder Moraes, Packt

F. REFERENCE BOOKS

R1. Advanced Java Programming, Uttam Kumar Roy, Oxford Press

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	COURSE OUTCOME STATEMENT	CORRELATION WITH PROGRAM OUTCOMES									CORRELATION WITH PROGRAM SPECIFIC OUTCOMES				
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	Identify advance concepts of Java programming with database connectivity.	1	2	2	2	2	-	-	-	-	2	-	-	2	-
CO2	Design and develop platform independent applications using a variety of component-based frameworks.	2	2	2	2	-	2	-	-	-	2	1	-	2	1
CO3	Able to implement the concepts of JSP, JPA, JNDI, Hibernate, XML & EJB for building enterprise applications.	3	2	2	1	1	-	-	-	-	3	-	1	3	-
CO4	To learn how to use Java APIs.	1	2	2	1	-	1	-	-	-	2	-	-	2	-

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Machine Learning with R

Code: CSC24123
5 Credits | Semester V
Total Hours Required –75 Total Tutorials Required – 15

A. Introduction: The objective of the course is to provide complete knowledge of machine learning. Students will be able to provide various algorithms of Machine Learning, which will help them to prepare data and create programs, applications in Machine Learning. The students will also develop an ability, which can easily help them switch to any other relevant technology in future.

The main objectives of the course are as follows:

- To impart the concepts and algorithm of Machine Learning.
- To acquire the fundamental knowledge of the Machine Learning.
- Students will capable of designing various Machine Learning Algorithm.
- Students will capable to prepare data, and use different techniques using R.

B. Course Outcomes: At the end of the course, students will be able to

[CO.1]. Understand the Machine Learning concepts.
[CO.2]. Learn various algorithm and programming of machine learning.
[CO.3]. Apply the knowledge various concepts of machine learning.
[CO.4]. Understand the usage of R programming
[CO.5]. Implement different machine learning algorithm techniques using R.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Internal Examination	20
	Assignment	05
	Attendance	05
End Term Exam (Summative)	End Term Examination	70
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

Introduction to Machine Learning: Introduction to Machine Learning, The origins of MachineLearning, Uses and abuses of machine learning, How machine learn, Machine learning in practice, Machine learning with R.**Managing& Understanding Data:** R data structures, Managing data with R, Exploring and understanding data, Exploring the structure of data,Exploring numeric variables, categorical variable- relationship between variables.**Classification using Nearest**

Neighbors: Understanding nearest neighbour classification, The k-NN algorithm, Example, Probabilistic Learning, Classification Using Naïve Bayes, Basic concepts of Bayesianmethods, The Naïve Bayes algorithm.**Forecasting Numeric Data-Regression Methods:** Understanding Regression, Learning, Example, Understanding regression trees and model trees.Black box methods, Neural networks and Support Vector Machines, Understanding neural networks, example, modelling strength of concrete with ANNs.**Association Rules, Clustering with K-means, Model Performance** Understanding association rules- Example, Understanding clustering- Example, Evaluating Model Performance- Measuring performance forclassification in R

E. TEXT BOOKS

T1. Pattern Recognition and Machine Learning, Christopher Bishop, Springer, 2006.
T2. Machine Learning: A Probabilistic Perspective, Kevin P. Murphy, MIT Press, 2012.
T3. Introduction to Machine Learning, EthemAlpaydin, Prentice Hall of India, 2005.
T4. The Elements of Statistical Learning (2nd ed)., Hastie, Tibshirani, Friedman, Springer, 2008.
T5.Machine Learning –An Algorithmic Perspective, Stephen Marsland, CRC Press, 2009.

F. REFERENCE BOOKS

R1. Machine Learning, Tom Mitchell, McGraw-Hill, 1997
R2. Machine Learning with R, Second Edition, 2015, Brett Lantz

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	COURSE OUTCOME STATEMENT	CORRELATION WITH PROGRAM OUTCOMES									CORRELATION WITH PROGRAM SPECIFIC OUTCOMES				
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	Understand the Machine Learning concepts	1	2	2	2	2	-	-	-	-	2	-	-	3	3
CO2	Learn various algorithm and programming of machine learning.	2	3	3	2	-	2	-	-	-	2	1	-	3	3
CO3	Apply the knowledge of various concepts of machine learning	3	3	2		1	-	-	-	-	3	-	1	2	3
CO4	Understand the usage of R programming	1	2	2	3	-	2	-	-	-	2	-	2	3	2
CO5	Implement different machine learning algorithm techniques using R.	2	2	1	3		1				1		2	2	-

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Mobile Application Development

Code: CSC24025
4 Credits | Semester V
Total Hours Required –60 Total Tutorials Required – 12

A. Introduction: The objective of the course is to provide complete knowledge of developing applications for modern Smartphone operating systems. This course is dedicated to Google's Android and covers Rapid application development techniques, as well as setup of the development environment, real world testing, and deployment

The main objectives of the course are as follows:

- To provide a practical approach to Android mobile application development and knowledge about Windows application
- To make students understand, how to develop and deploy an application to the app market.

B. Course Outcomes: At the end of the course, students will be able to

[CO.1]. Understand and demonstrate Android activities life cycle
[CO.2]. Build their own Android applications.
[CO.3]. Explain the differences between Android and other mobile development environments.
[CO.4]. Secure, tune, package and deploy Applications.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Internal Examination	20
	Assignment	05
	Attendance	05
End Term Exam (Summative)	End Term Examination	70
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

INTRODUCTION & USER INTERFACE AND DESIGNING WITH VIEWS Brief History of mobile technologies, Different mobile technologies, Introduction to Android Get to know the required tools, Creating your first Android application, Anatomy of android Application. Understanding Activities, linking Activities using intents, fragments, Calling Built-in Applications using Intents, Displaying Notifications Understanding the components of a screen, adapting to display orientation, managing changes to screen orientation Utilizing the Action Bar, Creating the user Interface programmatically, Listening for UI Notifications Using Basic Views, Using Picker views, Using List views to display lists,

Understanding specialized fragments **DESIGNING USER INTERFACE & DISPLAYING WITH VIEWS, DATA PERSISTENCE** Designing User interface Designing by declaration, creating the opening screen, using alternate resources implementing an about box, applying a theme, adding a menu, adding settings, debugging with log messages, debugging with debugger Using Image Views to display pictures, using menus with views, some additional views Saving and loading user preferences , persisting Data Files **STORING LOCAL DATA & CONTENT PROVIDERS** Reading/writing local data Accessing the Internal File system, Accessing SD card Creating and using Databases.Sharing Data in Android using content provider, creating your own content providers using content providers **USING SQLITE & PREPARING AND PUBLISHING** Introducing SQLite, In and Out of SQLite Hello Database, Data Binding, using content provider implementing content provider Preparing app for publishing, Deploying APK files, uploading in **MESSAGING , LOCATION BASED SERVICES AND NETWORKING & INTRODUCTION TO WINDOWS PHONE PROGRAMMING** SMS Messaging, Sending E-mail Displaying Maps, Getting Location Data, Monitoring a Location Vision and architecture- A different kind of phone Windows phone architecture, Building and delivering apps Getting started with "Hello World".

E. TEXT BOOKS

T1. Beginning Android 4 - Grant Allen - Apress
T2. Android - A programmer's Guide - Jerome (J.F) DiMarzio - TataMcGraw Hill
T3. Programming Windows Phone - CharlesPetzold - Microsoft Press

F. REFERENCE BOOKS

R1.Android: Introducing Google's Mobile Development Platform - Ed Burnette, Hello - Pragmatic. Bookshelf
R2. Windows Phone 8 Development Internals - Andrew Whitechapel, Sean McKenna – Microsoft Press

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	COURSE OUTCOME STATEMENT	CORRELATION WITH PROGRAM OUTCOMES									CORRELATION WITH PROGRAM SPECIFIC OUTCOMES				
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	Understand and demonstrate Android activities life cycle	1	3	3	2	1	2	2	-	-	2	-	1	1	1
CO2	Build their own Android applications.	1	2	2	2	2	2	-	-	-	2	1	-	1	2
CO3	Explain the differences between Android and other mobile development environments.	2	2	2	2	1	2	-	-	-	3	-	1	1	2
CO4	Secure, tune, package and deploy Applications.	1	2	2	2	2	1	1	-	-	2	2	1	1	1

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Discipline Specific Elective (DSE) Course
Data Science (Select any TWO)

Elective III & IV

Subject: Design and Analysis of Experiments

Code: CSC25132
5 Credits | Semester V
Total Hours Required –75 Total Tutorials Required – 15

A. Introduction: The objective of the course is to provide complete knowledge of Design and Analysis of Experiments. It will help to examine the essential nature of a process and discuss its advantages to those who conduct the experiments as well as those to whom the results are reported.

The objective of the course is to:

- Design experiments, carry them out, and analyze the data they yield.
- Discuss various designs and their respective differences, advantages, and disadvantages
- Discuss factorial and fractional factorial designs

B. Course Outcomes: At the end of the course, students will be able to
[CO.1]. Describe how to design experiments, carry them out, and analyze the data they yield.
[CO.2]. Understand the process of designing an experiment including factorial and fractional factorial designs.
[CO.3]. Examine factorial design to allow cost reduction, increases efficiency of experimentation, and reveals the essential nature of a process.
[CO.4]. Investigate the logic of hypothesis testing, including analysis of variance and the detailed analysis of experimental data.

C. Assessment Plan:

Criteria	**Description**	**Maximum Marks**
Internal Assessment (Summative)	Internal Examination	20
	Assignment	05
	Attendance	05
End Term Exam (Summative)	End Term Examination	70
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

FUNDAMENTALS OF EXPERIMENTATION: Role of experimentation in rapid scientific progress,

historical perspective of experimental approaches. Steps in experimentation, principles of experimentation.**SIMPLE COMPARATIVE EXPERIMENTS:** Basic concepts of probability & statistics, comparison of two means and two variances. Comparison of multiple (more than two) means and ANOVA.**EXPERIMENTAL DESIGNS:** Factorial designs, fractional factorial designs, orthogonal arrays, standard orthogonal arrays and interaction tables, modifying orthogonal arrays, selection of suitable orthogonal array design, analysis of experimental data. **RESPONSE SURFACE METHODOLOGY:** Concept, linear model, steepest ascent, Second order model, regression. **TAGUCHI'S PARAMETER DESIGN:** Concept of robustness, noise factor, objective function & S/N ratios, Inner array & outer array design, data analysis.

E. TEXT BOOKS

T1.Design and Analysis of Experiments, Montgomery DC, 7th Edition, John Wiley & Sons, NY, 2008.

T2.Introduction to Design and Analysis of Experiments, G.W. Cobb, Wiley Publishers

F. REFERENCE BOOKS

R1. Taguchi techniques for Quality Engineering, Ross P J , McGraw-Hill Book Company, NY, 2008

G.Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES									CORRELATION WITH PROGRAM SPECIFIC OUTCOMES				
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	Describe how to design experiments, carry them out, and analyze the data they yield.	1	2	2	2	2	2	-	-	-	2	2	-	3	3
CO2	Understand the process of designing an experiment including factorial and fractional factorial designs	2	2	2	3	3	2	-	-	-	2	1	-	3	3
CO3	Examine factorial design to allow cost reduction, increases efficiency of experimentation, and reveals the essential nature of a process.	3	2	2	1	1	-	-	-	-	3	-	1	2	3
CO4	Investigate the logic of hypothesis testing, including analysis of variance and the detailed analysis of experimental data	1	2	2	1	3	1	-	-	-	2	3	2	3	2

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Discipline Specific Elective (DSE) Course
Data Science (Select any TWO)

Subject: Probabilistic Graphical Models

Code: CSC25131
5 Credits | Semester V
Total Hours Required –75 Total Tutorials Required – 15

A. Introduction: The course provides comprehensive introduction to probabilistic graphical models. Probabilistic graphical models are used to model stochasticity (uncertainty) in the world. The course will cover two classes of graphical models: Bayesian belief networks (also called directed graphical models) and Markov Random Fields (undirected models). The course will focus on recent advances in inferences and learning with graphical models

B. Course Outcomes: At the end of the course, students will be able to
[CO.1]. Model problems using graphical models
[CO.2]. Design inference algorithms
[CO.3]. Learn the structure of the graphical model from data.
[CO.4]. Understand the advances in inferences using graphical models

C. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Internal Examination	20
	Assignment	05
	Attendance	05
End Term Exam (Summative)	End Term Examination	70
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

INTRODUCTION: Fundamentals of Probability Theory - Views of Probability, Random Variables and Joint Distributions, Conditional Probability, Conditional Independence, Expectation and Variance. Probability Distributions - Conjugate Priors, Introduction to Exponential Family. Fundamentals of Graph Theory - Paths, Cliques, Subgraphs, Cycles and Loops. **GRAPHICAL MODELS:** Introduction, Directed Models (Bayesian Network), Undirected Models (Markov Random Fields), Dynamic Models (Hidden Markov Model &Kalman Filters) and Factor Graph. Conditional Independence (Bayes Ball Theorem and D-separation), Markov Blanket, Factorization (Hammersley-Clifford Theorem), Equivalence (I-Maps

&Perfect Maps). Factor Graphs - Representation, Relation to Bayesian Network and Markov Random Field.**INFERENCE IN GRAPHICAL MODELS:** Exact Inference - Variable Elimination, Elimination Orderings, Relation to Dynamic Programming, Dealing with Evidence, Forward-Backward Algorithm, Viterbi Algorithm; Junction Tree Algorithm; Belief Propagation (Sum Product). Approximate Inference - Variational Methods (Mean Field, Kikuchi & Bethe Approximation), Expectation Propagation, Gaussian Belief Propagation. MAP Inference - Max-Product, Graph Cuts, Linear Programming Relaxations to MAP (Tree-Reweighted Belief Propagation, MPLP); Sampling - Markov Chain Monte Carlo, Metropolis Hastings, Gibbs (Collapsing & Blocking), Particle filtering. **LEARNING IN GRAPHICAL MODELS:** Parameter Estimation - Expectation Maximization, Maximum Likelihood Estimation, Maximum Entropy, Pseudolikelihood, Bayesian Estimation, Conditional Likelihood, Structured Prediction; Learning with Approximate Inference; Learning with Latent Variables; Structure Learning, Structure Search, L1 priors.**DECISION MAKING:** Markov Decision Processes - Dynamic programming methods, Structured state and action spaces, Learning algorithms, Generalization and function approximation. Partially Observable Markov Decision Processes - Exact solution methods, Approximate methods

E. TEXT BOOKS

T1. Probabilistic Graphical Models: Principles and Techniques, Koller, D. and Friedman, N. (2009). , MIT Press.

F. REFERENCE BOOKS

R1. Bayesian Networks and Decision Graphs. Information Science and Statistics. , Jensen, F. V. and Nielsen, T. D. (2002). , Springer, 2nd edition.

R2. Machine Learning: A Probabilistic Perspective. , Kevin P. Murphy (2013) 4th Printing. MIT Press.

R3. Bayesian Reasoning and Machine Learning. , Barber, D. (2011). , Cambridge University Press, 1st edition.

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	COURSE OUTCOME STATEMENT	CORRELATION WITH PROGRAM OUTCOMES									CORRELATION WITH PROGRAM SPECIFIC OUTCOMES				
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	Model problems using graphical models	3	2	`1	2	2	-	-	1	-	2	-	-	1	-
CO2	Design inference algorithms	2	3	2	2	-	1	-	1	-	2	1	-	2	-
CO3	Learn the structure of the graphical model from data.	3	2	2	1	1	-	-	-	-	3	-	1	3	-
CO4	Understand the advances in inferences using graphical models	1	2	1	-	-	3	-	-	3	-	-	1	1	-

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Discipline Specific Elective (DSE) Course
Data Science (Select any TWO)

Subject: Exploratory Data Analysis and Data Visualisation Techniques

Code: CSC25129
5 Credits | Semester V
Total Hours Required –75 Total Tutorials Required – 15

A. Introduction: The objective of the course is to provide complete knowledge of Experiments, Visualisation Techniques. Students will be able to develop logical abilities, which will help them to create designs, applications. The students will also develop an ability, which can easily help them switch to any other language in future.

The main objectives of the course are as follows:

- Thorough study exploratory data analysis and data visualisation techniques.
- Exploratory Data Analysis is an approach to data analysis that employs a variety of techniques,
- Discuss various designs and their respective differences, advantages, and disadvantages
- To open-mindedly explore the data. Exploratory Data Analysis allows the data scientist to discover patterns, to spot anomalies, to test hypotheses and to check assumptions with the help of summary statistics and graphical representations.
- Being able to use a continuous test-driven development approach

B. Course Outcomes: At the end of the course, students will be able to
[CO.1]. Choose and apply the most suitable techniques for exploratory data analysis
[CO.2]. Map out the hidden underlying structure of the data
[CO.3]. Detect anomalies and missing data
[CO.4]. Demonstrate strong skills in using visualization techniques for analysis and communication.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Internal Examination	20
	Assignment	05
	Attendance	05
End Term Exam (Summative)	End Term Examination	70
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

INTRODUCTION: EDA Introduction, What is EDA? EDA vs Classical & Bayesian ,EDA vs Summary, EDA Goals ,The role of Graphics, AN EDA/Graphical Example ,General Problem Categories.**EDA**

ASSUMPTIONS: Underlying Assumptions, Importance Techniques for Testing Assumptions ,Interpretation of 4-Plot, Consequences. **EDA TECHNIQUES**: Introduction, Analysis Questions, Graphical Techniques,AlphabeticalGraphical Techniques: By Problem Category, Quantitative Techniques,Probability Distributions. **EDA CASE STUDIES:** Case Studies Introduction,Case Studies : Normal random numbers, Uniform random numbers, Random walk, Josephson Junction Cryothermometry, Beam Deflections, FilterTransmittance,Standard Resistor, Heat Flow Meter, Airplane Glass Failure Tie,Ceramic Strength**. DATA VISUALIZATION:** Introduction to R,RStudio,Data cleaning and aggregation ,Design principles for charts and graphs, ggplot2 and Tableau tools for creating data visualizations, The process creating visualizations and selecting the appropriate visual display, Designing effective digital presentations, Visualization as exploration, Visualizing categorical data,Visualizing time series data, Visualizing multiple variables,Visualizing geospatial data, Dashboard design, Web-based visualizations, Interactive visualizations and motion.

E. TEXT BOOKS

T1. Exploratory Data Analysis with R, Roger D. Peng
T2. Interactive Data Visualization for the Web, Scott Murray
T3. Making sense of Data: A practical Guide to Exploratory Data Analysis and Data Mining, Glenn J. Myatt,John Wiley Publishers, 2007.

F. REFERENCE BOOKS

R1. Engineering Statistics Handbook
R2. Advanced Analytics with R and Tableau, Jen Strirrup, Packt Publications

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	COURSE OUTCOME STATEMENT	CORRELATION WITH PROGRAM OUTCOMES									CORRELATION WITH PROGRAM SPECIFIC OUTCOMES				
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	Choose and apply the most suitable techniques for exploratory data analysis.	1	2	2	2	2	2	-	-	-	2	2	-	3	3
CO2	Map out the hidden underlying structure of the data	2	2	2	3	3	2	-	-	-	2	1	-	3	3
CO3	Detect anomalies and missing data	3	2	2	1	1	-	-	-	-	3	-	1	2	3
CO4	Demonstrate strong skills in using visualization techniques for analysis and communication	1	2	2	1	3	1	-	-	-	2	3	2	3	2

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Discipline Specific Elective (DSE) Course
Internet of Things (Select any TWO)

Subject: Artificial Intelligence

Code: CSC25032
5 Credits | Semester V
Total Hours Required –75 Total Tutorials Required – 15

A. Introduction: The basic objective of AI (also called heuristic programming) is to enable computers to perform such intellectual tasks as decision making, problem solving, perception, understanding human communication.

The main objectives of the course are as follows:

- To acquaint the student with basic concepts of Artificial Intelligence.
- To aware the student about Theory and practical techniques of artificial intelligence.
- This course would provide emphasis to the principles and applications of Artificial Intelligence.

B. Course Outcomes: At the end of the course, students will be able to
[CO.1]. Understand what Artificial Intelligence mean and the foundations of it.
[CO.2]. Understand those elements constituting problems and learn tosolve it by various uninformed and informed (heuristics based) searching techniques
[CO.3]. Understand the formal method for representing the knowledge and the process of inference to derive representations of the knowledge to deduce what to do.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Internal Examination	20
	Assignment	05
	Attendance	05
End Term Exam (Summative)	End Term Examination	70
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

History of AI, Introduction Agents of AI, Structure of AI, Nature of Environment, Good Behavior, Solving problem, Example problem, Searching for solution, Problem solving agents, Uniform search, Informed search, Heuristic search, local search algorithm, Online search, BFS, Searching with partial observations, Unknown Environment, **Adversarial Search:** Games, optimal decisions in games, alpha-beta pruning, Stochastic games, partially observable games, state-of-the-are game programs, **Logical**

Agents: Knowledge base agents, The Wumpus world, **Logic** - propositional logic, propositional theorem proving, effective propositional model checking, agents based on propositional logic.**First Order Logic:** Syntax and semantics, using First Order Logic, Knowledge engineering in First Order Logic. **Inference in First Order Logic:** propositional vs. First Order, unification and lifting, Forward and backward chaining, resolution. **Planning:** Definition of Classical Planning, Algorithms for planning as state space search, planning graphs, other classical planning approaches, analysis of planning approaches, Time, Schedules and resources, hierarchical planning, Planning and Acting in Nondeterministic Domains, multiagent planning, **Knowledge Representation:** Categories and Objects, events, mental events and objects, reasoning systems for categories, reasoning with default information, Internet shopping world

E. TEXT BOOKS

T1. Artificial Intelligence, Elaine Rich, Kevin Knight, S.B. Nair, Tata McGraw Hill.

T2. Artificial Intelligence and Soft Computing for BeginnersAnandita Das Shroff Publication.

F. REFERENCE BOOKS

R1. "Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications", S. Rajsekaran& G.A. VijayalakshmiPai, Prentice Hall of India.

R2. "Neural Networks" Kumar Satish Tata McGraw Hill

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	COURSE OUTCOME STATEMENT	CORRELATION WITH PROGRAM OUTCOMES									CORRELATION WITH PROGRAM SPECIFIC OUTCOMES				
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	Understand what Artificial Intelligence mean and the foundations of it.	3	2	`1	2	2	-	-	1	-	2	-	-	1	3
CO2	Understand those elements constituting problems and learn tosolve it by various uninformed and informed (heuristics based) searching techniques	2	3	2	2	-	1	-	1	-	2	1	-	2	-
CO3	Understand the formal method for representing the knowledge and the process of inference to derive representations of the knowledge to deduce what to do.	3	2	2	1	1	-	-	-	-	3	-	1	2	1

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Discipline Specific Elective (DSE) Course
Internet of Things (Select any TWO)

Subject: Digital Image Processing

Code: CSC25144
5 Credits | Semester V
Total Hours Required –75 Total Tutorials Required – 15

A. Introduction: The objective of the course is to provide complete knowledge of Digital Image Processing. Students will be able to develop various concepts of Digital Image Processing, which will help them to create programs, applications using Digital Image Processing. The students will also develop an ability, which can easily help them switch to any other relevant technology in future.

The main objectives of the course are as follows:

- Learn digital image fundamentals.
- Be exposed to simple image processing techniques.
- Be familiar with image compression and segmentation techniques.
- Learn to represent image in form of features.

B. Course Outcomes: At the end of the course, students will be able to
[CO.1]. Understand the various concepts, terminologies of digital image processing.
[CO.2]. Understand the application areas of digital image processing
[CO.3]. Realize the revolution of Image Processing in Digital era.
[CO.4]. Use various techniques of image processing.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Internal Examination	20
	Assignment	05
	Attendance	05
End Term Exam (Summative)	End Term Examination	70
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

Digital image fundamentals: Introduction – Origin – Steps in Digital Image Processing – Components – Elements of Visual Perception – Image Sensing and Acquisition – Image Sampling and Quantization – Relationships between pixels – color models. **Image enhancement**: Spatial

Domain: Gray level transformations – Histogram processing – Basics of Spatial Filtering–Smoothing and Sharpening Spatial Filtering – Frequency Domain: Introduction to Fourier Transform – Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters.**Image restoration and segmentation:** Noise models – Mean Filters – Order Statistics – Adaptive filters – Band reject Filters – Band pass Filters – Notch Filters – Optimum Notch Filtering – Inverse Filtering – Wiener filtering Segmentation: Detection of Discontinuities–Edge Linking and Boundary detection – Region based segmentation- Morphological processing- erosion and dilation.**The Image, its Mathematical and Physical Background:** Linearity, The Dirac Distribution and Convolution, Linear Integral Transforms - Images as Linear Systems, Introduction to Linear Integral Transforms, 1D Fourier Transform, 2D Fourier Transform.**Image Data Compression:** Image Data Properties, Discrete Image Transforms in Image Data Compression

E. TEXT BOOKS

T1. Rafael C. Gonzales, Richard E. Woods, "Digital Image Processing", Third Edition, Pearson Education, 2010

F. REFERENCE BOOKS

R1. Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, "Digital Image Processing Using MATLAB", Third Edition Tata Mc Graw Hill Pvt. Ltd., 2011.

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	COURSE OUTCOME STATEMENT	CORRELATION WITH PROGRAM OUTCOMES									CORRELATION WITH PROGRAM SPECIFIC OUTCOMES				
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	Understand the various concepts, terminologies of digital image processing	1	2	2	2	2	-	-	-	-	2	-	-	3	3
CO2	Understand the application areas of digital image processing.	2	2	2	2	-	2	-	-	-	2	1	-	3	3
CO3	Realize the revolution of Image Processing in Digital era.	3	2	2	1	1	-	-	-	-	3	-	1	2	3
CO4	Use various techniques of image processing	1	2	2	1	-	1	-	-	-	2	-	2	3	2

. **1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

Discipline Specific Elective (DSE) Course
Internet of Things (Select any TWO)

Subject: Cloud Computing

Code: CSC26045
5 Credits | Semester V
Total Hours Required –75 Total Tutorials Required – 15

A. Introduction: This course covers a series of current cloud computing technologies, including technologies for Infrastructure as a Service, Platform as a Service, Software as a Service, and Physical Systems as a Service. For different layers of the cloud technologies, practical solutions such as Google, Amazon, Microsoft, SalesForce.com.

B. Course Outcomes: At the end of the course, students will be able to
[CO.1]. Understand the fundamental principles of distributed computing
[CO.2]. Understand the importance of virtualization in distributed computing and how this has enabled the development of Cloud Computing
[CO.3]. Understand the business models that underlie Cloud Computing.
[CO.4]. Understand concepts of IAAS, SASS, PAAS

C. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Internal Examination	20
	Assignment	05
	Attendance	05
End Term Exam (Summative)	End Term Examination	70
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

Introduction: The vision of cloud computing, The cloud computing reference model, Characteristics and benefits, Challenges aheadDistributed systems, Virtualization, Building cloud computing environments, Application development, Infrastructure and system development, Computing platforms and technologies. Principles of Parallel and Distributed Computing: Parallel vs. distributed computing, Elements of parallel computing, Hardware architectures for parallel processing Approaches to parallel programming, Laws of caution.**Virtualization:** Introduction, Characteristics of virtualized environments, Taxonomy of virtualization techniques, Virtualization and cloud computing, Pros and cons of virtualization, Cloud Computing Architecture: Introduction - The cloud reference model - Types of clouds - Economics of the

cloud. **Concurrent Computing:** Anatomy of the Aneka container - Introducing parallelism for single-machine computation. Programming applications with threads - Multithreading with aneka - Programming applications with aneka threads. Cloud computing economics: cloud infrastructure - Economics of private clouds - Software productivity in the cloud - Economies of scale: public vs. private clouds**.** **Multi-tenant software:** Multi-entity support - Multi-schema approach - Multi-tenancy using cloud data stores - Data access control for enterprise applications. **Data in the cloud:** Relational databases - Cloud file systems: GFS and HDFS - BigTable, HBase - Cloud data stores: Datastore and SimpleDB. **Cloud Platforms in Industry:** Amazon web services: Compute services - Storage services - Communication services - Additional services. Google AppEngine: Architecture and core concepts - Application life cycle - Cost model – Observations. Microsoft azure: Azure core concepts - SQL azure - Windows azure platform appliance

E. TEXT BOOKS

T1. Mastering Cloud Computing - Foundations and Applications Programming, RajkumarBuyya, Christian Vecchiola and S. ThamaraiSelvi, MK publications

T2. "Enterprise Cloud Computing: Technology, Architecture, Applications", Gautam Shroff, Cambridge University Press

F. REFERENCE BOOKS

R1. "Architecting the Cloud: Design Decisions for Cloud Computing Service Models (SaaS, PaaS, and IaaS)", Michael J.Kavis, John Wiley & Sons Inc.

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	COURSE OUTCOME STATEMENT	CORRELATION WITH PROGRAM OUTCOMES									CORRELATION WITH PROGRAM SPECIFIC OUTCOMES				
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	Understand the fundamental principles of distributed computing.	1	2	2	2	2	-	-	-	-	2	-	-	2	-
CO2	Understand the importance of virtualization in distributed computing and how this has enabled the development of Cloud Computing.	2	2	2	2	-	2	-	-	-	2	1	-	2	1
CO3	Understand the business models that underlie Cloud Computing.	3	2	2	1	1	-	-	-	-	3	-	1	3	-
CO4	Understand concepts of IAAS, SASS, PAAS	1	2	2	1	-	1	-	-	-	2	-	-	2	-

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Discipline Specific Elective (DSE) Course
Artificial Intelligence (Select any TWO)

Subject: Six Sigma and Lean Methods

Code: CSC25145
5 Credits | Semester V
Total Hours Required –75 Total Tutorials Required – 15

A. A. Introduction: This course covers the application of lean principles to manufacturing, service and government processes in order to improve productivity, increase value and eliminate waste as well as the use of the Six Sigma problem solving methodology to reduce variation and improve quality. Students will gain experience with the tools and analysis methods used in both approaches. The topics covered include: methods for creating Lean processes, proven lean problem-solving methodologies, managing a lean transformation, implementing a Six Sigma initiative, and executing the five phases of the Six Sigma DMAIC process, and communicating results to stakeholders and decision-makers.

The main objectives of the course are as follows:

- Discuss how to create and sustain a culture that focuses on the delivery of value to the customer by utilizing continuous process improvement and variance reduction strategies.
- Discuss the differences and similarities between Lean and Six Sigma, how they complement one another and how they can be used together for greater benefit.
- Teach them to manage a lean transformation, implementing a Six Sigma initiative.
- Executing the five phases of the Six Sigma DMAIC process.

B. Course Outcomes: At the end of the course, students will be able to

[CO.1]. Understand the Lean and Six Sigma approaches to quality and productivity improvement and master the skills need to contribute to the success of a Lean, Six Sigma or LSS initiative.
[CO.2]. Explain the project selection process and set goals for a Six Sigma or LSS project.
[CO.3]. Explain the goals of each phase of the Six Sigma DMAIC process and create a plan for managing and executing a Six Sigma improvement project.
[CO.4]. Clearly and concisely communicate project plans and results of studies to stakeholders and decision makers.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Internal Examination	20
	Assignment	05
	Attendance	05
End Term Exam (Summative)	End Term Examination	70
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

Define Phase:The Basics of Six Sigma: Meanings of Six Sigma, General History of Six Sigma & Continuous Improvement, Deliverables of a Lean Six Sigma Project, The Problem Solving Strategy Y = f(x),Voice of the Customer, Business and Employee, Six Sigma Roles & Responsibilities, **The Fundamentals of Six Sigma:** Defining a Process, Critical to Quality Characteristics (CTQ's),Cost of Poor Quality (COPQ),Pareto Analysis (80:20 rule),**Basic Six Sigma Metrics:** including DPU, DPMO, FTY, RTY Cycle Time, deriving these metrics and these metrics, Selecting Lean Six Sigma Projects: Building a Business Case & Project Charter,Developing Project Metrics, Financial Evaluation & Benefits Capture, The Lean Enterprise: Understanding Lean,The History of Lean, Lean & Six Sigma, The Seven Elements of Waste: Overproduction, Correction, Inventory, Motion, over processing, Conveyance, Waiting.5S: Straighten, Shine, Standardize, Self-Discipline, Sort**Measure Phase: Process Definition:** Cause & Effect / Fishbone Diagrams, Process Mapping, SIPOC, Value Stream Map, X-Y Diagram, Failure Modes & Effects Analysis (FMEA) **Measurement System Analysis:** Basic Statistics, Descriptive Statistics, Normal Distributions & Normality, Graphical Analysis Measurement System Analysis: Precision & Accuracy, Bias, Linearity & Stability Gage Repeatability & Reproducibility, Variable & Attribute MSA **Process Capability:** Capability Analysis, Concept of Stability,Attribute& Discrete Capability, Monitoring Techniques.**Analyze Phase: Patterns of Variation:** Multi-Vari Analysis, Classes of Distributions.**Inferential Statistics:** Understanding Inference, Sampling Techniques & Uses, Central Limit Theorem Hypothesis **Testing:** General Concepts & Goals of Hypothesis Testing, Significance; Practical vs. Statistical, Risk; Alpha & Beta, Types of Hypothesis Test Hypothesis Testing with Normal Data: 1 & 2 sample t-tests, 1 sample variance**. One Way ANOVA:** Including Tests of Equal Variance, Normality Testing and Sample Size calculation, performing tests and interpreting results. Hypothesis Testing with Non-Normal Data: Mann-Whitney,Kruskal-Wallis, Mood's Median, Friedman, 1 Sample Sign, 1 Sample Wilcoxon, One and Two-Sample Proportion. **Chi-Squared (Contingency Tables):** Including Tests of Equal Variance, Normality Testing and Sample Size calculation, performing tests and interpreting results.**Improve Phase : Simple Linear Regression:** Correlation, Regression Equations Residuals Analysis Multiple Regression Analysis: Non- Linear Regression, Multiple Linear Regression Confidence & Prediction Intervals Residuals Analysis, Data Transformation, Box Cox Control Phase.**Lean Controls:** Control Methods for 5S, Kanban, Poka-Yoke (Mistake Proofing) Statistical Process Control (SPC): Data Collection for SPC, I-MR Chart, Xbar-R Chart, U Chart, P Chart, NP Chart, X-S chart, CumSum Chart, EWMA Chart, Control Chart Anatomy **Six Sigma Control Plans:** Cost Benefit Analysis, Elements of the Control Plan, Elements of the Response Plan.

E. TEXT BOOKS

T1. Donna Summers (2011), Lean Six Sigma: Process Improvement Tools and Techniques. Published by Pearson.

T2. Peter S. Pande, Robert P. Neuman and Roland R. Cavanagh (2002), The Six Sigma Way Team Fieldbook: An Implementation Guide for Process Improvement Teams. Published by McGraw- Hill Education.

F. REFERENCE BOOKS

R1. Certified Six Sigma Green Belt Handbook 2nd Edition
R2. The Six Sigma Handbook: The complete Guide for Greenbelts, Blackbelts, and Managers at all Levels.

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	COURSE OUTCOME STATEMENT	CORRELATION WITH PROGRAM OUTCOMES									CORRELATION WITH PROGRAM SPECIFIC OUTCOMES				
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	CO1. Understand the Lean and Six Sigma approaches to quality and productivity improvement and master the skills need to contribute to the success of a Lean, Six Sigma or LSS initiative.	**3**	**2**	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**2**	**-**
CO2	Explain the project selection process and set goals for a Six Sigma or LSS project.	**2**	**2**	**3**	**2**	**-**	**2**	**-**	**-**	**-**	**2**	**1**	**-**	**2**	**1**
CO3	Explain the goals of each phase of the Six Sigma DMAIC process and create a plan for managing and executing a Six Sigma improvement project.	**3**	**2**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**3**	**-**	**1**	**3**	**-**
CO4	Clearly and concisely communicate project plans and results of studies to stakeholders and decision makers.	**1**	**3**	**2**	**1**	**-**	**1**	**-**	**-**	**-**	**2**	**-**	**-**	**2**	**-**

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Discipline Specific Elective (DSE) Course
Artificial Intelligence (Select any TWO)

Subject: Digital Image Processing

Code: CSC26044
5 Credits | Semester V
Total Hours Required –75 Total Tutorials Required – 15

A. Introduction: The objective of the course is to provide complete knowledge of Digital Image Processing. Students will be able to develop various concepts of Digital Image Processing, which will help them to create programs, applications using Digital Image Processing. The students will also develop an ability, which can easily help them switch to any other relevant technology in future.

The main objectives of the course are as follows:

- Learn digital image fundamentals.
- Be exposed to simple image processing techniques.
- Be familiar with image compression and segmentation techniques.
- Learn to represent image in form of features.

B. Course Outcomes: At the end of the course, students will be able to
[CO.1]. Understand the various concepts, terminologies of digital image processing.
[CO.2]. Understand the application areas of digital image processing
[CO.3]. Realize the revolution of Image Processing in Digital era.
[CO.4]. Use various techniques of image processing.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Internal Examination	20
	Assignment	05
	Attendance	05
End Term Exam (Summative)	End Term Examination	70
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

Digital image fundamentals: Introduction – Origin – Steps in Digital Image Processing – Components – Elements of Visual Perception – Image Sensing and Acquisition – Image Sampling and Quantization – Relationships between pixels – color models. **Image enhancement**: Spatial

Domain: Gray level transformations – Histogram processing – Basics of Spatial Filtering–Smoothing and Sharpening Spatial Filtering – Frequency Domain: Introduction to Fourier Transform – Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters.**Image restoration and segmentation:** Noise models – Mean Filters – Order Statistics – Adaptive filters – Band reject Filters – Band pass Filters – Notch Filters – Optimum Notch Filtering – Inverse Filtering – Wiener filtering Segmentation: Detection of Discontinuities–Edge Linking and Boundary detection – Region based segmentation- Morphological processing- erosion and dilation.**The Image, its Mathematical and Physical Background:** Linearity, The Dirac Distribution and Convolution, Linear Integral Transforms - Images as Linear Systems, Introduction to Linear Integral Transforms, 1D Fourier Transform, 2D Fourier Transform.**Image Data Compression:** Image Data Properties, Discrete Image Transforms in Image Data Compression

E. TEXT BOOKS

T1. Rafael C. Gonzales, Richard E. Woods, "Digital Image Processing", Third Edition, Pearson Education, 2010

F. REFERENCE BOOKS

R1. Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, "Digital Image Processing Using MATLAB", Third Edition Tata Mc Graw Hill Pvt. Ltd., 2011.

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	COURSE OUTCOME STATEMENT	CORRELATION WITH PROGRAM OUTCOMES									CORRELATION WITH PROGRAM SPECIFIC OUTCOMES				
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	Understand the various concepts, terminologies of digital image processing	1	2	2	2	2	-	-	-	-	2	-	-	3	3
CO2	Understand the application areas of digital image processing.	2	2	2	2	-	2	-	-	-	2	1	-	3	3
CO3	Realize the revolution of Image Processing in Digital era.	3	2	2	1	1	-	-	-	-	3	-	1	2	3
CO4	Use various techniques of image processing	1	2	2	1	-	1	-	-	-	2	-	2	3	2

. **1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

Discipline Specific Elective (DSE) Course

Artificial Intelligence (Select any TWO)

Subject: Business Intelligence

Code: CSC26044
5 Credits | Semester V
Total Hours Required –75 Total Tutorials Required – 15

A. A. Introduction: The objective of the course is to provide complete knowledge of Business Intelligence. Students will be able to develop logical abilities, which will help them to create programs, applications. The students will also develop an ability, which can easily help them switch to any other language in future.

The main objectives of the course are as follows:

- toprovide students with comprehensive and in-depth knowledge of Business Intelligence (BI) principles and techniques by introducing the relationship between managerial and technological perspectives.
- to expose students to the frontiers of BI-intensive BIG data computing and information systems, while providing a sufficiently strong foundation to encourage further research.

B. Course Outcomes: At the end of the course, students will be able to

[CO.1]. Explain the foundations, definitions, and capabilities of DSS, data analytics and BI.
[CO.2]. List the definitions, concepts, and architectures of data warehousing.
[CO.3]. Demonstrate the impact of business reporting, information visualization, and dashboards.
[CO.4]. Outline the definitions, concepts, and enabling technologies of Business Intelligence.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Internal Examination	20
	Assignment	05
	Attendance	05
End Term Exam (Summative)	End Term Examination	70
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

Business Intelligence: Effective and timely decisions, Data, information and knowledge, The role of mathematical models, Business intelligence architectures, Ethics and business intelligence, Decision support systems: Definition of system, Representation of the decision-making process, Evolution of information systems, Definition of decision, support system, Development of a decision support system. **Mathematical models for decision making**: Structure of mathematical models, Development of a model, Classes of models, Data mining: Definition of data mining, Representation of input data , Data mining process, Analysis methodologies ,Data preparation: Data validation, Data transformation, Data reduction.**Classification**: Classification problems, Evaluation of classification models, Bayesian methods, Logistic regression, neural networks, Support vector machines, Clustering: Clustering methods, Partition methods, Hierarchical methods, Evaluation of clustering models.**Business intelligence applications:** Marketing models: Relational marketing, Sales force management, Logistic and production models: Supply chain optimization, Optimization models for logistics planning, Revenue management systems. Data envelopment analysis: Efficiency measures, Efficient frontier, The CCR model, Identification of good operating practices. Knowledge Management: Introduction to Knowledge Management, Organizational Learning and Transformation, Knowledge Management Activities ,Approaches to Knowledge Management, Information Technology (IT) In Knowledge Management, Knowledge Management Systems Implementation, Roles of People in Knowledge Management, Artificial Intelligence and Expert Systems: Concepts and Definitions of Artificial Intelligence, Artificial Intelligence Versus Natural Intelligence, Basic Concepts of Expert Systems, Applications of Expert Systems, Structure of Expert Systems, Knowledge Engineering, Development of Expert Systems.

E. TEXT BOOKS

T1. Business Intelligence: Data Mining and Optimization for Decision Making, Carlo Vercellis, Wiley
T2. Decision support and Business Intelligence Systems, Efraim Turban, Ramesh Sharda, DursunDelen, Pearson

F. REFERENCE BOOKS

R1. Fundamental of Business Intelligence, Grossmann W, Rinderle-Ma, Springer

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	COURSE OUTCOME STATEMENT	CORRELATION WITH PROGRAM OUTCOMES									CORRELATION WITH PROGRAM SPECIFIC OUTCOMES				
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	Explain the foundations, definitions, and capabilities of DSS, data analytics and BI	1	2	2	2	2	2	-	-	-	2	2	-	3	3
CO2	List the definitions, concepts, and architectures of data warehousing	2	2	2	3	3	2	-	-	-	2	1	-	3	3
CO3	Demonstrate the impact of business reporting, information visualization, and dashboards	3	2	2	1	1	-	-	-	-	3	-	1	2	3
CO4	Outline the definitions, concepts, and enabling technologies of Business Intelligence	1	2	2	1	3	1	-	-	-	2	3	2	3	2

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Enterprise Java Lab

Code: CSC25040
2 Credits | Semester V
Total Hours Required – 60 Total Tutorials Required – 12

B. A. Introduction: This course introduces the fundamental concept of Enterprise Java. The objective is to equip the students with the advanced feature of Enterprise Java which would enable them to handle complex programs relating to managing data and processes over the network. The major objective of this course is to provide a sound foundation to the students on the concepts, precepts and practices, in a field that is of immense concern to the industry and business.

The main objectives of the course are as follows:

- Understand enterprise foundation fundamentals.
- Distributed enterprise communication
- Various tools and technologies of the EE architecture.
- Able to build their own robust applications.

B. Course Outcomes: At the end of the course, students will be able to
[CO.1]. Identify advance concepts of Java programming with database connectivity.
[CO.2]. Design and develop platform independent applications using a variety of component-based frameworks.
[CO.3]. Able to implement the concepts of JSP, JPA, JNDI, Hibernate, XML & EJB for building enterprise applications.
[CO.4]. To learn how to use Java APIs.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Internal Examination	10
	Assignment	2.5
	Attendance	2.5
End Term Exam (Summative)	End Term Examination	35
	Total	50
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

List of Practical
1. Implement the following Simple Servlet applications.

a. Create a simple calculator application using servlet.
b. Create a servlet for a login page. If the username and password are correct then it says message “Hello <username>” else a message “login failed”
c. Create a registration servlet in Java using JDBC. Accept the details such as Username, Password, Email, and Country from the user using HTML Form and store the registration details in the database.
2. Implement the following Servlet applications with Cookies and Sessions.
a. Using Request Dispatcher Interface create a Servlet which will validate the password entered by the user, if the user has entered "Servlet" as password, then he will beforwarded to Welcome Servlet else the user will stay on the index.html page and an error message will be displayed.
b. Create a servlet that uses Cookies to store the number of times a user has visited servlet.
c. Create a servlet demonstrating the use of session creation and destruction. Also check whether the user has visited this page first time or has visited earlier also using sessions.
3. Implement the Servlet IO and File applications.
a. Create a Servlet application to upload and download a file.
b. Develop Simple Servlet Question Answer Application using Database.
c. Create simple Servlet application to demonstrate Non-Blocking Read Operation.
4. Implement the following JSP applications.
a. Develop a simple JSP application to display values obtained from the use of intrinsic objects of various types.
b. Develop a simple JSP application to pass values from one page to another with validations. (Name-txt, age-txt, hobbies-checkbox, email-txt, gender-radio button).
c. Create a registration and login JSP application to register and authenticate the user based on username and password using JDBC.
5. Implement the following JSP JSTL and EL Applications.
a. Create an html page with fields, eno, name, age, desg, salary. Now on submit this datatoaJSPpagewhichwillupdatetheemployeetableofdatabasewithmatchingeno.
b. Create a JSP page to demonstrate the use of Expression language.
c. Create a JSP application to demonstrate the use of JSTL.
6. Implement the following EJB Applications.
a. Create a Currency Converter application using EJB.
b. Develop a Simple Room Reservation System Application Using EJB.
c. Develop simple shopping cart application using EJB [Stateful Session Bean].

7. Implement the following EJB applications with different types of Beans.
a. Develop simple EJB application to demonstrate Servlet Hit count using Singleton Session Beans.
b. Develop simple visitor Statistics application using Message Driven Bean [Stateless Session Bean].
c. Develop simple Marks Entry Application to demonstrate accessing Database using EJB.
8. Implement the following JPA applications.
a. Develop a simple Inventory Application Using JPA.
b. Develop a Guestbook Application Using JPA.
c. Create simple JPA application to store and retrieve Book details.
9. Implement the following JPA applications with ORM and Hibernate.
a. Develop a JPA Application to demonstrate use of ORM associations.
b. Develop a Hibernate application to store Feedback of Website Visitor in MySQL Database.
c. Develop a Hibernate application to store and retrieve employee details in MySQL Database.
10. Implement the following Hibernate applications.
a. Develop an application to demonstrate Hibernate One- To -One Mapping Using Annotation.
b. Develop Hibernate application to enter and retrieve course details with ORM Mapping.
c. Develop a five page web application site using any two or three Java EE Technologies.

E. TEXT BOOKS

T1. Java EE 7 For Beginners, Sharanam Shah, Vaishali Shah, SPD

T2. Java EE 8 Cookbook: Build reliable applications with the most robust and mature technology for enterprise development, Elder Moraes, Packt

F. REFERENCE BOOKS

R1. Advanced Java Programming, Uttam Kumar Roy, Oxford Press

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	COURSE OUTCOME STATEMENT	CORRELATION WITH PROGRAM OUTCOMES									CORRELATION WITH PROGRAM SPECIFIC OUTCOMES				
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	Identify advance concepts of Java programming with database connectivity.	**1**	**2**	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**2**	**-**
CO2	Design and develop platform independent applications using a variety of component-based frameworks.	**2**	**2**	**2**	**2**	**-**	**2**	**-**	**-**	**-**	**2**	**1**	**-**	**2**	**1**
CO3	Able to implement the concepts of JSP, JPA, JNDI, Hibernate, XML & EJB for building enterprise applications.	**3**	**2**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**3**	**-**	**1**	**3**	**-**
CO4	To learn how to use Java APIs.	**1**	**2**	**2**	**1**	**-**	**1**	**-**	**-**	**-**	**2**	**-**	**-**	**2**	**-**

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Machine Learning with R Lab

Code: CSC24126
2 Credits | Semester V
Total Hours Required –60 Total Tutorials Required – 12

A. Introduction: The objective of the course is to provide complete knowledge of machine learning. Students will be able to provide various algorithms of Machine Learning which will help them to prepare data and create programs, applications in Machine Learning. The students will also develop an ability which can easily help them switch to any other relevant technology in future.

The main objectives of the course are as follows:

- To impart the concepts and algorithm of Machine Learning.
- To acquire the fundamental knowledge of the Machine Learning.
- Students will capable of designing various Machine Learning Algorithm.
- Students will capable to prepare data, and use different techniques using R.

B. Course Outcomes: At the end of the course, students will be able to

[CO.1]. Understand the Machine Learning concepts.
[CO.2]. Learn various algorithm and programming of machine learning.
[CO.3]. Apply the knowledge various concepts of machine learning.
[CO.4]. Understand the usage of R programming
[CO.5]. Implement different machine learning algorithm techniques using R.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Internal Examination	10
	Assignment	2.5
	Attendance	2.5
End Term Exam (Summative)	End Term Examination	35
	Total	50
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

1. Write an R program to create a simple bar plot of five subjects marks.

2. Write a R program to create an array of two 3x3 matrices each with 3 rows and 3 columns from two given two vectors. Print the second row of the second matrix of the array and the element in the 3rd row and 3rd column of the 1st matrix.

3. Write a R program to extract 3rd and 5th rows with 1st and 3rd columns from a given data frame

4. Write a R program to create a data frame using two given vectors and display the duplicated elements and unique rows of the said data frame.

5. Write a R program to rotate a given matrix 90 degree clockwise rotation.

6. Create the vector (x1 + 2x2 − x3, x2 + 2x3 − x4, . . . , xn−2 + 2xn−1 − xn)

7. Write a R program to find Sum, Mean and Product of a Vector, ignore element like NA or NaN.

8. Write a R program to create a list of dataframes and access each of those data frames from the list.

9. Reading the data into R and apply Simple statistics on it with required graphs.

10. Take any dataset and perform following operations on it.

- Basic row manipulations o Advanced row selection o Basic column operations
- Permanently changing the column order
- Adding and removing new columns
- Adding new columns; Advanced
- Counting observations
- Working with keys and subsetting
- Selecting existing columns and reshaping
- Getting counts for grouped data

E. TEXT BOOKS

T1. Pattern Recognition and Machine Learning , Christopher Bishop, Springer, 2006.
T2. Machine Learning: A Probabilistic Perspective, Kevin P. Murphy, MIT Press, 2012.
T3. Introduction to Machine Learning, EthemAlpaydin, Prentice Hall of India, 2005.
T4. The Elements of Statistical Learning (2nd ed)., Hastie, Tibshirani, Friedman, Springer, 2008.
T5. Machine Learning –An Algorithmic Perspective, Stephen Marsland, CRC Press, 2009.

F. REFERENCE BOOKS

R1. Machine Learning, Tom Mitchell, McGraw-Hill, 1997
R2. Machine Learning with R, Second Edition, 2015, Brett Lantz

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	COURSE OUTCOME STATEMENT	CORRELATION WITH PROGRAM OUTCOMES									CORRELATION WITH PROGRAM SPECIFIC OUTCOMES				
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	Understand the Machine Learning concepts	1	2	2	2	2	-	-	-	-	2	-	-	3	3
CO2	Learn various algorithm and programming of machine learning.	2	3	3	2	-	2	-	-	-	2	1	-	3	3
CO3	Apply the knowledge of various concepts of machine learning.	3	3	2		1	-	-	-	-	3	-	1	2	3
CO4	Understand the usage of R programming	1	2	2	3	-	2	-	-	-	2	-	2	3	2
CO5	Implement different machine learning algorithm techniques using R.	2	2	1	3		1				1		2	2	-

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Mobile Application Development Lab

Code: CSC24028
2 Credits | Semester V
Total Hours Required –60 Total Tutorials Required – 12

A. Introduction: The objective of the course is to provide complete knowledge of developing applications for modern Smartphone operating systems. This course is dedicated to Google's Android and covers Rapid application development techniques, as well as setup of the development environment, real world testing, and deployment

The main objectives of the course are as follows:

- To provide a practical approach to Android mobile application development and knowledge about Windows application
- To make students understand, how to develop and deploy an application to the app market.

B. Course Outcomes: At the end of the course, students will be able to

[CO.1]. Understand and demonstrate Android activities life cycle
[CO.2]. Build their own Android applications.
[CO.3]. Explain the differences between Android and other mobile development environments.
[CO.4]. Secure, tune, package and deploy Applications.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Internal Examination	10
	Assignment	2.5
	Attendance	2.5
End Term Exam (Summative)	End Term Examination	35
	Total	50
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

List of programs	
1	Creating “Hello world” Application.
2	Creating an Application that displays message based on the screen orientation.
3	Create an application that displays custom designed Opening Screen.
4	Play an audio, based on the user event.

5	Create an UI with all views.
6	Create menu in Application.
7	Read/ write the Local data.
8	Create / Read / Write data with database (SQLite).
9	Create an application to send SMS.
10	Create an application to send an e-mail.
11	Display Map based on the Current/given location.
12	Learn to deploy android Applications.

E. TEXT BOOKS

T1. Beginning Android 4 - Grant Allen - Apress

T2. Android - A programmer's Guide - Jerome (J.F) DiMarzio -TataMcGraw Hill

T3. Programming Windows Phone - CharlesPetzold - Microsoft Press

F. REFERENCE BOOKS

R1. Android: Introducing Google's Mobile Development Platform - Ed Burnette, Hello - Pragmatic. Bookshelf

R2. Windows Phone 8 Development Internals - Andrew Whitechapel, Sean McKenna - Microsoft Press

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	COURSE OUTCOME STATEMENT	CORRELATION WITH PROGRAM OUTCOMES									CORRELATION WITH PROGRAM SPECIFIC OUTCOMES				
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	Understand and demonstrate Android activities life cycle	1	3	3	2	1	2	2	-	-	2	-	1	1	1
CO2	Build their own Android applications.	1	2	2	2	2	2	-	-	-	2	1	-	1	2
CO3	Explain the differences between Android and other mobile development environments.	2	2	2	2	1	2	-	-	-	3	-	1	1	2
CO4	Secure, tune, package and deploy Applications.	1	2	2	2	2	1	1	-	-	2	2	1	1	1

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

ARKA JAIN University
Jharkhand

Syllabus of
Bachelor of Computer Applications
Semester-VI

ARKAJAIN University, Jharkhand
School of Engineering & Information Technology
Department of Computer Science & Information Technology
Faculty – BCA
Scheme of Study (w.e.f Batch 2020)

SEMESTER -I

Sl.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Introduction to Computer Science	Core	5	5	100	70	20	5	5
2	Programming In C	Core	5	5	100	70	20	5	5
3	Discrete Mathematics	GS	5	5	100	70	20	5	5
4	Business Communication	AECC	5	5	100	70	20	5	5
	Practical								
5	Computer Science Lab	Core	2	4	50	35	10	2.5	2.5
6	Programming In C Lab	Core	2	4	50	35	10	2.5	2.5
	Total		**24**	**28**	**500**	**350**	**100**	**25**	**25**

SEMESTER –II

Sl.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Data Structure through C	Core	5	5	100	70	20	5	5
2	Object Oriented Programming with C++	Core	5	5	100	70	20	5	5
3	Operating System	Core	5	5	100	70	20	5	5
4	Numerical & Statistical Methods	GS	5	5	100	70	20	5	5
5	Environmental Science	AECC	5	5	100	70	20	5	5
	Practical								
6	Data Structure through C Lab	Core	2	4	50	35	10	2.5	2.5
7	Object Oriented Programming with C++ Lab	Core	2	4	50	35	10	2.5	2.5
	Total		**28**	**32**	**600**	**420**	**120**	**30**	**30**

SEMESTER –III

Sl.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Programming with Java	Core	5	5	100	70	20	5	5
2	Design and Analysis of Algorithms	Core	5	5	100	70	20	5	5
3	Database Management System	Core	5	5	100	70	20	5	5
4	Data Communication & Networking	Core	5	5	100	70	20	5	5
5	Python Programming	SECC	4	4	100	70	20	5	5
	Practical								
6	Programming with Java Lab	Core	2	4	50	35	10	2.5	2.5
7	Database Management System Lab	Core	2	4	50	35	10	2.5	2.5
8	Python Programming Lab	SECC	2	4	50	35	10	2.5	2.5
	TOTAL		**30**	**36**	**650**	**455**	**130**	**32.5**	**32.5**

SEMESTER –IV

Sl.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Introduction to Data Science	Core	5	5	100	70	20	5	5
2	Internet of Things	Core	5	5	100	70	20	5	5
3	Data Science - Elective I IOT - Elective I AI - Elective I	DSE	5	5	100	70	20	5	5
4	Data Science - Elective II IOT - Elective II AI - Elective II	DSE	5	5	100	70	20	5	5
	Practical								
5	Data Science - Elective I IOT - Elective I AI - Elective I	**DSE**	2	4	50	35	10	2.5	2.5
6	Data Science - Elective II IOT - Elective II AI - Elective II	DSE	2	4	50	35	10	2.5	2.5
	TOTAL		**24**	**28**	**500**	**350**	**100**	**25**	**25**

SEMESTER –V

Sl.No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Enterprise Java	Core	5	5	100	70	20	5	5
2	Machine Learning	Core	5	5	100	70	20	5	5
3	Mobile Application Development	SECC	4	4	100	70	20	5	5
4	Data Science - Elective III IOT - Elective III AI - Elective III	DSE	5	5	100	70	20	5	5
5	Data Science - Elective IV IOT - Elective IV AI - Elective IV	DSE	5	5	100	70	20	5	5
	Practical								
6	Enterprise Java Lab	Core	2	4	50	35	10	2.5	2.5
7	Machine Learning Lab	Core	2	4	50	35	10	2.5	2.5
8	Mobile Application Development Lab	SECC	2	4	50	35	10	2.5	2.5
	TOTAL		**30**	**36**	**650**	**455**	**130**	**32.5**	**32.5**

SEMESTER –VI

Sl. No	Name of the Subject	Type of Paper	Credit	Contact Hours Per Week	Total Marks	End Term Theory/ Practical Exam	Mid Term Theory/ Practical Exam	CIA *	Attendance
1	Software Engineering	Core	5	5	100	70	20	5	5
2	Data Science - Elective V IOT - Elective V AI - Elective V	DSE	5	5	100	70	20	5	5
3	Data Science - Elective VI IOT - Elective VI AI - Elective VI	DSE	5	5	100	70	20	5	5
	Practical								
4	Project	DSE	5	5	100	70	30	0	0
5	Data Science - Elective V IOT - Elective V AI - Elective V	DSE	2	4	50	35	10	2.5	2.5
6	Data Science - Elective VI IOT - Elective VI AI - Elective VI	DSE	2	4	50	35	10	2.5	2.5
	TOTAL		**24**	**28**	**500**	**350**	**110**	**20**	**20**

Discipline Specific Elective (DSE) Courses

Elective I & II	Elective I & II	Elective I & II
Data Science (Select any Two)	**IOT (Select any Two)**	**AI (Select any Two)**
R Programming Language	Sensor Technologies	Introduction to RPA Tools
Python for Data Science	Embedded System	Introduction to Process Automation
Web Programming	Web Programming	Web Programming
Practical		
R Programming Language Lab	Sensor Technologies Lab	Introduction to RPA Tools Lab
Python for Data Science Lab	Embedded System Lab	Introduction to Process Automation Lab
Web Programming Lab	Web Programming Lab	Web Programming Lab

Elective III & IV	Elective III & IV	Elective III & IV
Data Science (Select any Two)	**IOT (Select any Two)**	**AI (Select any Two)**
Design and Analysis of Experiments	Artificial Intelligence	Six Sigma and Lean Methods
Probabilistic Graphical Models	Digital Image Processing	Digital Image Processing
Exploratory Data Analysis and Data Visualization Techniques	Cloud Computing	Business Intelligence

Elective V & VI	Elective V & VI	Elective V & VI
Data Science (Select any Two)	**IOT (Select any Two)**	**AI (Select any Two)**
Big Data Analytics	Embedded C with Adruino	Cloud Deployment And Management
NoSQL Databases	Digital Signal Processing	Natural Language Processing
Time Series Analysis	Artificial Neural Networks	Artificial Neural Networks
Practical		
Big Data Analytics Lab	Embedded C with Adruino Lab	Cloud Deployment And Management Lab
NoSQL Databases Lab	Digital Signal Processing Lab	Natural Language Processing Lab
Time Series Analysis Lab	Artificial Neural Networks Lab	Artificial Neural Networks Lab

Distribution of Credit across 6 semesters:

Sl. No	Type of Paper	No. of Paper	Total Credit
1	Core Paper	22	86
2	Ability Enhancement Compulsory Paper	2	10
3	Generic Paper	2	9
4	Discipline Specific Elective	11	43
5	Skill Enhancement	4	12
	Total	41	160

***CIA – Continuous Internal Assessment – Based on Projects / Assignment during the semester**
GS-Generic Subject | AECC -Ability Enhancement Compulsory Course
SECC -Skill Enhancement Compulsory Course | DSE - Discipline Specific Elective

ARKAJAINUniversity, Jharkhand
School of Engineering & Information Technology
Department of Computer Science & Information Technology
PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES
BCA – Semester–VI

PROGRAM OUTCOMES

After completing this undergraduate program, a learner:

[PO.1]. Apply knowledge of Mathematics and science in solving computational problems

[PO.2]. Understand the Computing concepts and their applications using the acquired board based knowledge.

[PO.3]. Design, set up and conduct practical.

[PO.4]. Use the techniques, skills, and modern Software tools for software development.

[PO.5]. Identify and analyze software application problems in multiple aspect including coding, testing and implementation in industrial applications.

[PO.6]. Design, develop and verify software systems to meet desired needs within realistic constraints ensuring quality, reliability, security in addition to satisfying economical, ethical, social and environmental constraints.

[PO.7]. Apply Enterprise level application software for design of diverse software products.

[PO.8]. Communicate effectively in diverse groups and exhibit leadership qualities.

[PO.9]. Understanding of professional and ethical responsibility.

PROGRAM SPECIFIC OUTCOMES (COMMON ACROSS ALL SPECIALIZATIONS)

[PSO.1]. Prepare professionally trained in the areas of programming, databases, software engineering, web designing and networking and other application areas to acquire knowledge in various domain-based prospects.

[PSO.2]. Encourage to communicate effectively and to improve their competency skills to solve real time problems.

[PSO.3]. Understand to employ modern computer languages and applications for their successful career, to create platforms to become an entrepreneur and a relish for higher studies.

PROGRAM SPECIFIC OUTCOMES (DATA SCIENCE)

[PSO.4]. Ability to apply the knowledge of computing tools and techniques in the field of Data science for solving real world problems encountered in the Software Industries.

[PSO.5]. Ability to identify the challenges in Data analytics with respect to IT Industry and pursue quality research in this field with social relevance.

PROGRAM SPECIFIC OUTCOMES (INTERNET OF THINGS)

[PSO.4]. An ability to apply pattern recognition, machine learning, and artificial intelligent techniques including statistical data analysis and quantitative modelling techniques to solve real world problems from various domains such as healthcare, social computing, economics, etc.

[PSO.5]. An ability to recognize and analyze problems related to AI and ML applications along with their ethical implications.

PROGRAM SPECIFIC OUTCOMES (ARTIFICIAL INTELLIGENCE)

[PSO.4]. An ability to recognize and analyze problems related to artificial intelligence and machine learning applications along with their ethical implications

[PSO.5]. An ability to apply intelligent computer systems to a variety of applications.

Subject: Software Engineering

Code: CSC24024
5 Credits | Semester VI
Total Hours Required –75 Total Tutorials Required – 15

A. Introduction: This course helps students to understand the software development process and design. It also helps the students to understand about the different stages of software development, various process models and software engineering principles.

The main objectives of the course are as follows:

- Get knowledge about the basic concept of Software Development.
- To provide students with an in depth understanding of Software Engineering Principles.
- To prepare the students to develop the skills necessary to handle software project.
- To make the students aware of the importance of software engineering principles in designing software project.
- To Provide students about the technical systems and management of software development Process.
- To make students familiar with cost estimation and testing measurement in software development process.

B. Course Outcomes: At the end of the course, students will be able to

[CO.1]. Understand the importance of the stages in the software development life cycle.
[CO.2]. Understand the various process model.
[CO.3]. Understand the UML notation.
[CO.4]. Be able to design software by applying the software engineering principles.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Internal Examination	20
	Assignment	05
	Attendance	05
End Term Exam (Summative)	End Term Examination	70
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

Introduction to Software Development Process: Software Engineering, Software development Cycle, Requirement analysis, software design coding, testing, Maintenance etc. Software Requirements: Functional &non-Functional requirements, user requirements, system requirements, Documentation of the software requirements Software Process: Process and Project, components software Processes. Software Development Process Models: Waterfall Models, Prototyping, Iterative Development, RAD Model **Software Development and its Systems:** Socio-technical system:Essential characteristics of socio technical systems, Emergent system properties, Systems Engineering, Components of system such as

organization, people and computers.**Critical System**: Types of critical system, A simple safety critical system, availability and Reliability, Safety and Security of Software systems.**Requirements Engineering Processes :** Feasibility study, Requirements elicitation and analysis, Requirements Validations,**System Models:** Models and its types ,Context Model, Behavioural Models, Data Models , Object Models, Structured Models.**Software Designs and Management:** Architectural Design **:** Architectural Design Decisions, System Organisation , Modular Decomposition Styles ,Control Styles , Reference Architectures , UML Model. **User Interface Design** : Need of UI design, Design issues, The UI design Process, User analysis, User Interface Prototyping, Interface Evaluation, **Project Management :** Software Project Management ,Management activities, Project Planning , Risk Management Quality Management : Process and Product Quality, Quality assurance and Standards, Quality Planning, Quality Control, Software Measurement and Metrics **Concept of Software Models Verification:** Verification and Validation : Planning Verification and Validation, Software Inspections, Automated Statics Analysis, **Verification and Formal Methods Software Testing** : System Testing , Component Testing , Test Case Design, **Test Automation Software Measurement** :Size –Oriented Metrics, Function-Oriented Metrics , COCOMO Model Software Cost Estimation: Software Productivity, Estimation Techniques, Project Duration and Staffing

E. TEXT BOOKS

T1. Software Engineering, Ian Sommerville, Addison Wesley

F. REFERENCE BOOKS

R1. Software Engineering A Practitioner's Approach, S. Roger Pressman, Tata McGraw Hill
R2. Software Engineering, K K Aggarwal & Yogesh Singh, New Age International Publishers
R3. Fundamentals of Software Engineering, Rajib Mall, Eastern Economy Edition

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	COURSE OUTCOME STATEMENT	CORRELATION WITH PROGRAM OUTCOMES									CORRELATION WITH PROGRAM SPECIFIC OUTCOMES				
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	Understand the importance of the stages in the software development life cycle	3	1	2	2	2	-	-	-	-	2	-	-	3	-
CO2	Understand the various process model	2	3	2	3	-	2	-	-	-	2	1	-	2	1
CO3	Understand the UML notation	3	2	3	1	1	-	-	-	-	3	-	1	2	-
CO4	Be able to design software by applying the software engineering principles	1	2		3	-	1	-	-	-	2	-	-	1	2

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Discipline Specific Elective (DSE) Course
Data Science (Select any TWO)

Subject: Big Data Analytics

Code: CSC24116
5 Credits | Semester VI
Total Hours Required –75 Total Tutorials Required – 15

A. Introduction: This course introduces the fundamental concept of big data analytics. The objective of the course is to provide complete knowledge of big data analytics. Students will be able to develop the concepts of big data analytics with the concept of hadoop framework. The students will also develop an ability which can easily help them to handle big data concept by using the different components of hadoop framework.

The main objectives of the course are as follows:

- Introduce the concepts of big data analytics to the students.
- Introduces the big data framework, its characteristics and use cases associated with it.
- Students will be familiar with the concept of big data handling concept mechanisms concept with the help of hadoop framework.
- A concise introduction to Hadoop framework will prepare students to handle industry scenarios of big data analytics.
- Learn the basic concept of big data analytics process.

B. Course Outcomes: At the end of the course, students will be able to
[CO.1]. Understand the concept & characteristics of big data.
[CO.2]. Explore Hadoop framework and its components. Use HDFS and Map Reduce to analyze . . various industry use cases of big data analytics.
[CO.3]. Understand the YARN Infrastructure.
[CO.4]. Learning different Sorting, Shuffling algorithm of mapreduce& understand the concept of big data streaming.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Internal Examination	20
	Assignment	05
	Attendance	05
End Term Exam (Summative)	End Term Examination	70
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination.	

	The allowance of 25% includes all types of leaves including medical leaves.

D. SYLLABUS

Introduction to Big Data, Characteristics and its Use Case: Introduction, Why Big data, What is big Importance of Big Data, Evolution of Big Data, Market Trends, Sources of Data Explosion, Types of Data, Need of Big Data, Big Data and its sources, Characteristics of Big Data, Difference between Traditional IT Approach and Big Data Technology, Capabilities of Big Data, Handling Limitations of Big Data, Technologies Supporting Big Data, Big Data Use Cases.**Introduction to Hadoop :** Introduction, Why Hadoop, What is Hadoop, History and Milestone of Hadoop, Core Components of Hadoop, Difference between Regular File System and HDFS, Common Hadoop Shell Commands, Hadoop Configuration.**Hadoop Distributed File System (HDFS) :** Concepts and Architecture, Data Flow (File Read, File Write), Fault Tolerance, Java Base APIDifferent Daemons in Hadoop cluster (NameNode, Secondary NameNode, Job Tracker, Task Tracker and DataNode, Loading a dataset into the HDFS.**Introduction to YARN and MapReduce :** What is YARN, YARN Infrastructure, Introduction of MapReduce, Analogy of MapReduce, MapReduce Architecture,Example of MapReduce, Sorting, Shuffling, Reducing, Combiner, Creating MapReduce program by using Eclipse **Introduction to Big Data Streaming :** Real time Big Data Streaming, Big data streaming framework, Data streaming process, Tools for big data streaming, Industry use cases for big data streaming

E. TEXT BOOKS

T1. Big Data and Analytics, Seema Acharya, SubhashiniChellappan, Wiley Publication

F. REFERENCE BOOKS

R1. Big Data, Black Book: Covers Hadoop 2, MapReduce, Hive, YARN, Pig, R andDataVisualization (2016), DT Editorial Services, Dream tech press

R2. Hadoop: The Definitive Guide, Tom White, O'Reilly Media

R3. Hadoop in Action, Chuck Lam, Manning

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	COURSE OUTCOME STATEMENT	CORRELATION WITH PROGRAM OUTCOMES									CORRELATION WITH PROGRAM SPECIFIC OUTCOMES				
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	Understand the concept & characteristics of big data.	**3**	**2**	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**2**	**-**
CO2	Explore Hadoop framework and its components. Use HDFS and Map Reduce to analyze various industry use cases of big data analytics	**2**	**2**	**3**	**2**	**-**	**2**	**-**	**-**	**-**	**2**	**1**	**-**	**2**	**1**
CO3	Understand the YARN Infrastructure	**3**	**2**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**3**	**-**	**1**	**3**	**-**
CO4	Learning different Sorting, Shuffling algorithm of mapreduce& understand the concept of big data streaming.	**1**	**3**	**2**	**1**	**-**	**1**	**-**	**-**	**-**	**2**	**-**	**-**	**2**	**-**

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Discipline Specific Elective (DSE) Course
Data Science (Select any TWO)

Subject: NoSQL Databases

Code: CSC25128
5 Credits | Semester VI
Total Hours Required –75 Total Tutorials Required – 15

A. Introduction: The objective of the course is to provide complete knowledge of NoSQL. Students will be able to develop non-relational database logical that is collection and document. This will help to manage huge amount of data in a flexible way.

The course objective is to:

- Get knowledge about the basic concept of non-relational DBMS.
- Work with query unstructured database
- Define, compare and use the four types of NoSQL Databases (Document-oriented, KeyValue Pairs, Column-oriented and Graph).
- Demonstrate an understanding of the detailed architecture, define objects, load data, query data and performance tune Column-oriented NoSQL databases.
- Explain the detailed architecture, define objects, load data, query data and performance tune Document-orients NoSQL databases.

B. Course Outcomes: At the end of the course, students will be able to

[CO.1]. Analyze the Data model of storing and retrieving Data.
[CO.2]. Use of Collection and Document
[CO.3]. Demonstrate the concepts Transactions Spanning different Operations
[CO.4]. Analyze the need of NoSQL Key/Value databases inModern web development

C. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Internal Examination	20
	Assignment	05
	Attendance	05
End Term Exam (Summative)	End Term Examination	70
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

Introduction: Introduction and History of NoSQL Databases,Features of NoSQL,Different types of NoSQL Database Comparison of relational databases to new NoSQL stores - MongoDB, Cassandra, HBASE, Neo4j. Application and Challenges - NoSQL approach .Key-Value and Document Data Models .Column-Family Stores, Aggregate-Oriented Databases. **DATA MODELS:** Replication and sharding, MapReduce on databases. , Distribution .Models, Single Server, Sharding.Master-Slave Replication .Peer-to-Peer Replication .Combining Sharding and Replication. NoSQL Key/Value databases using MongoDB. Document Databases – Introduction, Features, Query Features. Suitable Use Cases - Content Management Systems, Blogging. Platforms, Web Analytics or Real-Time Analytics, E-Commerce Applications. Complex Transactions Spanning Different Operations, Queries against Varying Aggregate Structure.**COLUMN- ORIENTED NOSQL DATABASES USING APACHE: HBASE -** Column-oriented NoSQL databases using Apache HBASE, Column oriented NoSQL databases using Apache Cassandra. Architecture of HBASE, Column-Family Data Store – Introduction, Features, Query Features, Suitable Use Cases - Content Management Systems. **NOSQL KEY/VALUE DATABASES USING RIAK -** NoSQL Key/Value databases using Riak, Key-Value Databases, Key-Value Store - Introduction, Features, Structure of Data, Storing Session Information, User Profiles, Preferences, Shopping Cart Data. Relationships among Data, Multi-operation Transactions, Query by Data, Operations by Sets.**GRAPH NOSQL DATABASES USING NEO4 -** Graph NoSQL databases using Neo4. NoSQL database development tools and programming languages. Graph Databases – Introduction, Features, Connected Data, Routing, Dispatch, and Location-Based Services, Recommendation Engines.

E. TEXT BOOKS

T1. NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, P. J. Sadalage and M. Fowler, Pearson Education, Inc. 2012.

T2. NoSQL For Dummies, 2015 John Wiley & Sons, Pearson Education

T3. Professional NoSQL, Shashank Tiwari, Wrox

F. REFERENCE BOOKS

R1. HBase: The Definitive Guide, Lars George,.O'Reilley, 2011

R2. Cassandra: The Definitive Guide, Eben Hewitt, O'Reilley, 2010

R3. MongoDB: The Definitive Guide, Kristina Chodorow, Cengage Learning

R4. Programming Hive, E. Capriolo, D. Wampler, and J. Rutherglen O'Reilley, 2012

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	COURSE OUTCOME STATEMENT	CORRELATION WITH PROGRAM OUTCOMES									CORRELATION WITH PROGRAM SPECIFIC OUTCOMES				
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	Analyze the Data model of storing and retrieving Data.	1	2	2	2	2	2	-	-	-	2	2	-	3	3
CO2	Use of Collection and Document	2	2	2	3	3	2	-	-	-	2	1	-	3	3
CO3	Demonstrate the concepts Transactions Spanning Different Operations	3	2	2	1	1	-	-	-	-	3	-	1	2	3
CO4	Analyze the need of NoSQL Key/Value databases in Modern web development	1	2	2	1	3	1	-	-	-	2	3	2	3	2

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Discipline Specific Elective (DSE) Course
Data Science (Select any TWO)

Subject: Time Series Analysis

Code: CSC26152
5 Credits | Semester VI
Total Hours Required –75 Total Tutorials Required – 15

A. Introduction: This course introduces the concept of Time Series Analysis. The course provides a survey of the theory and application of time series methods in econometrics. Topics covered will include univariate stationary and non-stationary models, vector auto regressions, frequency domain methods, models for estimation and inference in persistent time series, and structural breaks.

The main objectives of the course are as follows:

- To understand the basic concepts of time series analysis.
- To understand the elementary time series models and model evaluation techniques.
- To understand the integration process of non-stationary data set.
- To understand the importance of ARMA and ARIMA models for forecasting.
- To understand the basic concepts and estimation procedure for VAR models.
- To understand the method to select the appropriate number of order of variables.
- To understand the ARCH and GARCH models.

B. Course Outcomes: At the end of the course, students will be able to

[CO.1]. Understand the different elementary models related to time series analysis.
[CO.2]. Apply different model evaluation technique to identify better model to forecast.
[CO.3]. Understand the importance of stationarity in building time series models.
[CO.4]. Understand the use of Granger Causality and JohensenCointegration method.
[CO.5]. Apply VAR model to the dynamic behaviour of financial time series conditions.
[CO.6]. Select the order of Vector Auto Regression model for better forecast of time series data.
[CO.7]. Build the model using ARCH and GARCH technique for non-constant variance data

C. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Internal Examination	20
	Assignment	05
	Attendance	05
End Term Exam (Summative)	End Term Examination	70

	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

Introduction to Time Series: Definition, Examples, Components of time series, Trend, Seasonal, Cyclic and Irregular Variations, **Determination of trend:** Method of moving average, method of least squares, **Determination of seasonality:** Ratio to trend method, Ratio to moving average method, **Exponential Smoothing:** Simple exponential Smoothing, Holt Winter's Smoothing Procedure, Stationarity, Auto covariance, Autocorrelation functions and its properties, Partial Autocorrelation function, Test for stationarity, Test for randomness, Spectral density Function.**Models of Time series:** Autoregressive (AR) models, Moving average (MA) models, Properties such as stationarity, invertibility, ACF, PACF, Spectral density function, **Box-Jenkins analysis of time series:** Model identification using ACF and PACF, Estimation of parameters of AR, MA and ARMA models by method of MLE and method of least squares, fitting of the models, residual analysis and diagnostic checking.**Autoregressive integrated moving average (ARIMA) models:** Definition and elementary properties, Non Linear Time Series Models, ARCH and GARCH Models: definition and basic properties, Multivariate Time Series Models: Introduction, Stationary Multivariate Time Series, Vector Autoregressive Models, Vector ARMA Models, Co-integration

E. TEXT BOOKS

T1. C. Chatfield: The Analysis of Time Series - An Introduction Chapman and Hall.
T2. G.E.P. Box, G.M. Jenkins and G.C. Reinsel: Time Series Analysis, Forecasting and Control, John Wiley & Sons Publications.

F. REFERENCE BOOKS

R1. P.J. Brockwell .and R.A. Davis: Time Series: Theory and Methods, Springer Verlag.

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	COURSE OUTCOME STATEMENT	CORRELATION WITH PROGRAM OUTCOMES									CORRELATION WITH PROGRAM SPECIFIC OUTCOMES				
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	Understand the different elementary models related to time series analysis.	1	2	2	2	2	-	-	-	-	2	-	-	2	-
CO2	Apply different model evaluation technique to identify better model to forecast.	2	2	2	2	-	2	-	-	-	2	1	-	2	1
CO3	Understand the importance of stationarity in building time series models.	3	2	2	1	1	-	-	-	-	3	-	1	3	-
CO4	Understand the use of Granger Causality and JohensenCointegration method.	1	2	2	1	-	1	-	-	-	2	-	-	2	-
CO5	Apply VAR model to the dynamic behaviour of financial time series conditions.	2	-	2	-	1	1	-	-	-	1	2	-	1	2
CO6	Select the order of Vector Auto Regression model for better forecast of time series data.	3	2	1	-	2	1	-	-	-	-	2	1	-	2
CO7	Build the model using ARCH and GARCH technique for non-constant variance data	2	-	1	2	-	2	-	-	-	2	2	-	2	2

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Discipline Specific Elective (DSE) Course

Internet of Things (Select any TWO)

Subject: Embedded C with Arduino

Code: CSC26156
5 Credits | Semester VI
Total Hours Required –75 Total Tutorials Required – 15

A. Introduction: The objective of the course is to provide complete knowledge of ARDUINO & Embedded system with the help of language C. Students will be able to know the about various technologies developed & currently used in this field. They will be able to make various kinds of hardware/software projects on this topic.

1. The course will cover programming the Arduino using C code and accessing the pins on the board via the software to control external devices. The students will get firm career growth in electronics domain.
2. Develop an understanding of the technologies behind the embedded computing systems.
3. To introduce students to the design issues of embedded systems.
4. Enable students to analyse and develop software programs for embedded systems

B. Course Outcomes: At the end of the course, students will be able to

[CO.1]. Understand hardware and software design requirements of embedded systems.
[CO.2]. Analyze the embedded systems' specification and develop software programs.
[CO.3]. Evaluate the requirements of programming Embedded Systems, related software architectures and tool chain for Embedded Systems.
[CO.4]. Specialize in Embedded system design using Arduino.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Internal Examination	20
	Assignment	05
	Attendance	05
End Term Exam (Summative)	End Term Examination	70
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

ARDUINO – BASICS: Introduction, Program Structure, Data Types, Arduino Variables & Constants, Arduino Operators, Arduino Control, Switch Case Statement, Conditional Operator, Arduino Loops, Arduino Strings, Arduino – Arrays. **ARDUINO – FUNCTION LIBRARIES:** Arduino – I/O Functions Pins Configured as INPUT Pull-up Resistors, Pins Configured as OUTPUT, Arduino – Advanced I/O Function, Arduino – Character Functions, Arduino – Math Library, Library Macros, Library Functions, Arduino – Trigonometric Functions. **ARDUINO – ADVANCED:** Arduino – Due & Zero, Pulse Width Modulation - Basic Principle of PWM, Arduino Random Numbers - randomSeed (seed), random( ),Bits, Bytes. Arduino – Interrupts, Arduino Communication - Parallel Communication, Serial Communication Modules , Types of Serial Communications, Arduino – Inter Integrated Circuit, Board I2C Pins, Arduino I2C, Master Transmitter / Slave Receiver, Master Receiver / Slave Transmitter, Arduino – Serial Peripheral Interface, Board SPI Pins, SPI as MASTER, SPI as SLAVE. **DATA ANALYTICS FOR IOT:** An Introduction to Data Analytics for IoT, Machine Learning, Big Data Analytics Tools and Technology, Edge Streaming Analytics, Network Analytics, Securing IoT, Formal Risk Analysis Structures: OCTAVE and FAIR, Formal Risk Analysis Structures: OCTAVE and FAIR, The Phased Application of Security in an Operational Environment, The Phased Application of Security in an Operational Environment.**PHYSICAL DEVICES AND ENDPOINTS:** RaspberryPi: Introduction to Raspberry Pi, About the Raspberry Pi Board: Hardware Layout, Operating Systems on Raspberry Pi, Configuring Raspberry Pi, Programming Raspberry Pi with Python, Wireless Temperature Monitoring System Using Pi, DS18B20 Temperature Sensor, Connecting Raspberry Pi via SSH, Accessing Temperature from DS18B20 sensors, Remote access to RaspberryPi, Smart and Connected Cities, An IoT Strategy for Smarter Cities, Smart City IoT Architecture, Smart City Security Architecture, SmartCity Use-Case Examples.

E. TEXT BOOKS

T1. C Programming for Arduino, Julien Bayle, Packt Publishing

F. REFERENCE BOOKS

R1. Beginning C for Arduino, 2nd Edition, Jack Purdum, Apress

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	COURSE OUTCOME STATEMENT	CORRELATION WITH PROGRAM OUTCOMES									CORRELATION WITH PROGRAM SPECIFIC OUTCOMES				
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	Understand hardware and software design requirements of embedded systems.	**1**	**2**	**2**	**3**	**2**	**1**	**-**	**-**	**-**	**2**	**1**	**-**	**1**	**1**
CO2	Analyze the embedded systems' specification and develop software programs.	**1**	**2**	**2**	**3**	**2**	**2**	**-**	**-**	**-**	**2**	**1**	**-**	**2**	**1**
CO3	Evaluate the requirements of programming Embedded Systems, related software architectures and tool chain for Embedded Systems.	**1**	**2**	**2**	**3**	**2**	**2**	**-**	**-**	**-**	**3**	**2**	**1**	**1**	**2**
CO4	**S**pecialize in Embedded system design using Arduino.	**1**	**2**	**2**	**3**	**2**	**3**	**-**	**-**	**-**	**2**	**3**	**2**	**2**	**2**

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Discipline Specific Elective (DSE) Course
Internet of Things (Select any TWO)

Subject: Digital Signal Processing

Code: CSC26157
5 Credits | Semester VI
Total Hours Required –75 Total Tutorials Required – 15

A. Introduction: The purpose of this course is to provide an understanding of Digital Signal Processing. The topics include: Introduction to digital signal processing and application, discrete time signals and systems; Analysis of LTI systems; Structures of discrete time systems; Filter designing techniques; DFT and FFT; Architecture of DSP Processors, and Multi-rate Signal Processing and applications.

The main objectives of the course are as follows:

- To learn the concepts and architecture of DSP.
- To acquire the fundamental knowledge of the DSP.
- To learn the various operations performed by the Digital signal Processor.
- Students will capable of designing DSP kit.

B. Course Outcomes: At the end of the course, students will be able to
[CO.1]. Analyze digital and analog signals and systems.
[**CO.2].** Change sampling rate of the signal.
[**CO.3].** Conceptualize the need of adaptive filters in communication applications.
[CO.4]. Understand the key Architectural features of Digital Signal Processor.
[CO.5]. Apply digital signal processing algorithms to various areas.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Internal Examination	20
	Assignment	05
	Attendance	05
End Term Exam (Summative)	End Term Examination	70
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

Introduction to DSP, Frequency Domain analysis: Overview: Signals, systems and signal processing, classification of signals, elements of digital signal processing system, concept of frequency in continuous and discrete time signals, Periodic Sampling, Frequency domain representation of sampling, Reconstructions of band limited signals from its samples. Discrete-Time Signals and Systems (Frequency Domain analysis): Z-transform & Inverse z-transform, Linear convolution and its properties, Linear Constant Coefficient Difference equations, Frequency domain representation of Discrete-Time Signals & Systems, Representation of sequences by discrete time Fourier Transform, (DTFT), Properties of discrete time Fourier Transform, and correlation of signals, Fourier Transform Theorems. **Analysis of Linear Time Invariant System:** Analysis of LTI systems in time domain and stability considerations. Frequency response of LTI system, System functions for systems with linear constant-coefficient Difference equations, Freq. response of rational system functions relationship between magnitude & phase, All pass systems, inverse systems, Minimum/Maximum phase systems, systems with linear phase. **Structures for Discrete Time Systems:** Structures for Discrete Time Systems: Block Diagram and signal flow diagram representations of Linear Constant-Coefficient Difference equations, Basic Structures of IIR Systems, lattice and lattice-ladder structures, Transposed forms, Direct and cascade form, Structures for FIR Systems, Linear Phase FIR structure, Effects of Co-efficient quantization. **Filter Design Techniques:** Design of Discrete-Time IIR filters from Continuous-Time filters Approximation by derivatives, Impulse invariance and Bilinear Transformation methods, Design of FIR filters by windowing techniques. **Discrete-Fourier Transform & Fast Fourier Transform:** Discrete-Fourier Transform & Fast Fourier Transform: Representation of Periodic sequences: The discrete Fourier Series and its Properties Fourier Transform of Periodic Signals, Sampling the Fourier Transform, The Discrete-Fourier Transform, Properties of DFT, Linear Convolution using DFT. FFT-Efficient Computation of DFT, Goertzel Algorithm, radix2 Decimation-in-Time and Decimation in-Frequency FFT Algorithms.

E. TEXT BOOKS

T1. Digital Signal Processing: Principles, Algorithm & Application, 4th edition, Proakis, Manolakis, Pearson

T2. Discrete Time Signal Processing: Oppeheim, Schafer, Buck Pearson education publication, 2nd Edition, 2003.

T3. Digital Signal Processing fundamentals and Applications, Li Tan , Jean Jiang, Academic Press,2nd edition,2013

T4. Digital Signal Processing – A computer based Approach, S.K.Mitra, Tata McGraw Hill,3rd edition,2006

F. REFERENCE BOOKS

R1. Fundamentals of digital Signal Processing –Lonnie c.Ludeman, Wiley

R2. Digital Signal processing-A Practical Approach, second edition, Emmanuel I. feacher, and BarrieW. Jervis, Pearson Education

R3. Digital Signal Processing, S.Salivahanan, A.Vallavaraj, C.Gnapriya TMH

R4. Digital Signal Processors, Architecture, programming and applications by B. Venkatramani, M Bhaskar, Mc-Graw Hill

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	COURSE OUTCOME STATEMENT	CORRELATION WITH PROGRAM OUTCOMES									CORRELATION WITH PROGRAM SPECIFIC OUTCOMES				
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	Analyze digital and analog signals and systems.	1	2	2	2	2	-	-	-	-	2	-	-	3	3
CO2	Change sampling rate of the signal.	2	2	2	2	-	2	-	-	-	2	1	-	3	3
CO3	Conceptualize the need of adaptive filters in communication applications	3	2	2	1	1	-	-	-	-	3	-	1	2	3
CO4	Understand the key Architectural features of Digital Signal Processor.	1	2	2	1	-	1	-	-	-	2	-	2	3	2
CO5	Apply digital signal processing algorithms to various areas	1	2	1	1	-	-	-	-	-	2	1	1	-	-

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Discipline Specific Elective (DSE) Course
Internet of Things (Select any TWO)

Subject: Artificial Neural Networks

Code: CSC26158
5 Credits | Semester VI
Total Hours Required –75 Total Tutorials Required – 15

A. Introduction: The objective of the course is to provide complete knowledge of **Artificial Neural Network**(**ANN**) **uses** the processing of the brain as a basis to develop algorithms that **can** be **used** to model complex patterns and prediction problems. ... In our brain, there **are** billions of cells called neurons, which processes information in the form of electric signals.

The main objectives of the course are as follows:

- To introduce concepts of artificial neural networks and principles of leaning and regression
- To learn various types of neural networks and their working principles
- To understand role of neural network in various applications and apply it to multi- class classification etc.

B. Course Outcomes: At the end of the course, students will be able to
[CO.1]. Understand basic concepts of neural networks.
[CO.2]. Use neural networks to perform classification for single class and multiclass problems.
[CO.3]. Learn and apply the concept of self-organizing maps.
[CO.4]. To be able to formalize the problem, to solve it by using a neural network

C. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Internal Examination	20
	Assignment	05
	Attendance	05
End Term Exam (Summative)	End Term Examination	70
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

NEURAL NETWORK BASICS Classical AI and Neural Networks, characteristics of neural networks, Historical perspective The biological inspiration, models of artificial neuron & activation functions Artificial Neuron Model and Linear Regression, Nonlinear Activation Units and Training of artificial

neural networks, **LEARNING MECHANISMS** Learning Mechanisms: Gradient Descent Algorithm Learning Mechanisms-Hebbian, Competitive, Boltzmann , Universal function approximation. **SINGLE LAYER AND MULTI LAYER PERCEPTRONS** Representation of perceptron, Linear separability, Perceptron Learning, Single-Layer Perceptions , Unconstrained Optimization Gauss-Newton's Method, Linear Least Squares Filters, Least Mean Squares Algorithm , Perceptron Convergence Theorem Back Propagation Algorithm, Practical Consideration in Back Propagation Algorithm Training of single layer and multi-layer, back propagation training algorithm Applications of back propagation, Solution of Non-Linearly Separable Problems Using MLP, Heuristics For Back-Propagation, Multi- Class Classification Using Multi-layered Perceptrons, Associative Memory Networks:- Associative Memory Model, Conditions for perfect Recall in Associative memory, **RADIAL BASIS FUNCTION NETWORKS**Introduction,Separability and Interpolation, Learning Mechanisms in RBF Comparison Between MLP and RBF Introduction to Principal Components and Analysis, Dimensionality reduction Using PCA Hebbian- Based Principal Component Analysis **SELF ORGANIZING MAPS** Self Organizing Maps :Introduction to Self Organizing Maps, Cooperative and Adaptive Processes in SOM, Vector-Quantization Using SOM, Competitive learning, Mexican Hat networks.

E. TEXT BOOKS

T1. Neural Networks, fuzzy Logic, and Genetic Algorithms, Rajasekaran&VijayalakhmiPai, Pearson 2011

T2. Principles of Soft Computing, Sivanandam, Deepa, Wiley, 2014

F. REFERENCE BOOKS

R1. Neural Networks – A Classroom Approach, Satish Kumar, Tata McGraw Hill, 2010

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	COURSE OUTCOME STATEMENT	CORRELATION WITH PROGRAM OUTCOMES									CORRELATION WITH PROGRAM SPECIFIC OUTCOMES				
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	Understand basic concepts of neural networks.	2	3	3	2	1	2	2	-	-	2	-	1	2	2
CO2	Use neural networks to perform classification for single class and multiclass problems.	2	3	2	2	2	2	-	-	-	2	1	-	1	2
CO3	Learn and apply the concept of self-organizing maps.	2	2	2	2	1	2	-	-	-	3	-	1	-	2
CO4	To be able to formalize the problem, to solve it by using a neural network	3	2	2	2	2	1	1	-	-	2	2	1	1	2

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Discipline Specific Elective (DSE) Course
Artificial Intelligence (Select any TWO)

Subject: Cloud Deployment and Management

Code: CSC26162
5 Credits | Semester VI
Total Hours Required –75 Total Tutorials Required – 15

A. Introduction: Objective of this course is to provide students with a practical and theoretical knowledge of Cloud Computing and their Application implementation.

The main objectives of the course are as follows:

- To define Cloud Computing
- To provide an in-depth and comprehensive knowledge of the Cloud Computing fundamental issues, technologies, applications and implementations.
- To expose the students to the frontier areas of Cloud Computing
- To motivate students to do programming and experiment with the various cloud computing environments
- To shed light on the Security issues in Cloud Computing
- To introduce about the Cloud Standards

B. Course Outcomes: At the end of the course, students will be able to

[CO.1]. Analyze the components of cloud computing showing how business agility in an organization can be created
[CO.2]. Evaluate the deployment of web services from cloud architecture
[CO.3]. Critique the consistency of services deployed from a cloud architecture
[CO.4]. Compare and contrast the economic benefits delivered by various cloud models based on application requirements, economic constraints, and business requirements.
[CO.5]. Critically analyze case studies to derive the best practice model to apply when developing and deploying cloud-based applications

C. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Internal Examination	20
	Assignment	05
	Attendance	05
End Term Exam (Summative)	End Term Examination	70
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

OVERVIEW OF COMPUTING PARADIGM: Overview of Cloud Computing Paradigm, Recent trends in Computing, Grid Computing, Cluster Computing, Distributed Computing, Utility Computing, Cloud Computing Evolution of cloud computing, Business driver for adopting cloud computing. Introduction to Cloud Computing, History of Cloud Computing, Cloud service providers. Pros and Cons of Cloud Computing, Benefits of Cloud Computing, Cloud computing vs. Cluster computing vs. Grid computing.**CLOUD COMPUTING ARCHITECTURE:**Cloud computing stack, Comparison with traditional computing architecture (client/server), Services provided at various levels, How Cloud Computing Works, Role of Networks in Cloud computing, protocols used, Role of Web services, Service Models (XaaS), Infrastructure as a Service(IaaS), Platform as a Service(PaaS),Software as a Service(SaaS), Deployment Models, Public cloud, Private cloud, Hybrid cloud Community cloud, **SERVICE MANAGEMENT IN CLOUD COMPUTING** Service Level Agreements(SLAs), Billing & Accounting, Comparing Scaling Hardware: Traditional vs. Cloud, Economics of scaling: Benefitting enormously, Managing Data, Looking at Data, Scalability & Cloud Services, Database & Data Stores in Cloud, Large Scale Data Processing, Reliability, availability and security of services deployed from the cloud. Performance and scalability of services, tools and technologies used to manage cloud services deployment, Cloud Economics: Cloud Computing infrastructures available for implementing cloud based services. Economics of choosing a Cloud platform for an organization, based on application requirements, economic constraints and business needs (e.g Amazon, Microsoft and Google, Salesforce.com, Ubuntu and Redhat), **APPLICATION DEVELOPMENT AND CLOUD IT MODEL:** Service creation environments to develop cloud based applications, Development environments for service development; Amazon, Azure, Google App, Analysis of Case Studies when deciding to adopt cloud computing architecture. How to decide if the cloud is right for your requirements. Cloud based service, applications and development platform deployment so as to improve the total cost of ownership (TCO), **CLOUD SECURITY AND CASE STUDY** Infrastructure Security, Network level security, Host level security, Application level security, Data security and Storage: Data privacy and security Issues, Jurisdictional issues raised by Data location, Identity & Access Management, Access Control, Trust, Reputation, Risk, Authentication in cloud computing, Client access in cloud, Cloud contracting Model, Commercial and business considerations, Case Study on Open Source & Commercial Clouds : Eucalyptus, Microsoft Azure, Amazon EC2, etc.

E. TEXT BOOKS

T1. Gautam Shroff, "Enterprise Cloud Computing Technology Architecture Applications", Cambridge University Press

T2. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing, A Practical Approach" McGraw-Hill Osborne Media

F. REFERENCE BOOKS

R1. Dimitris N. Chorafas, "Cloud Computing Strategies" CRC Press

R2. Cloud Computing Bible, Barrie Sosinsky, Wiley-India

R3. Cloud Computing: Principles and Paradigms, Editors: Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Wiley

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	COURSE OUTCOME STATEMENT	CORRELATION WITH PROGRAM OUTCOMES									CORRELATION WITH PROGRAM SPECIFIC OUTCOMES				
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	Analyze the components of cloud computing showing how business agility in an organization can be created	3	3	3	2	1	2	2	-	-	2	-	1	1	2
CO2	Evaluate the deployment of web services from cloud architecture	3	2	2	2	2	2	-	-	-	2	1	-	1	2
CO3	Critique the consistency of services deployed from a cloud architecture	3	2	2	2	1	2	-	-	-	3	-	1	1	2
CO4	Compare and contrast the economic benefits delivered by various cloud models based on application requirements, economic constraints, and business requirements.	3	2	2	2	2	1	1	-	-	2	2	1	1	2
CO5	Critically analyze case studies to derive the best practice model to apply when developing and deploying cloud based applications	3	2	3	2	1	2	1	-	-	2	3	2	1	2

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Discipline Specific Elective (DSE) Course
Artificial Intelligence (Select any TWO)

Subject: Natural Language Processing

Code: CSC26163
5 Credits | Semester VI
Total Hours Required –75 Total Tutorials Required – 15

A. Introduction: The objective of the course is to provide complete knowledge of Natural Language Processing. Students will be able to develop logical abilities, which will help them to create programs, applications. The students will also develop an ability, which can easily help them switch to any other language in future.

The main objectives of the course are as follows

- Teach students the leading trends and systems in natural language processing.
- Make them understand the concepts of morphology, syntax, semantics and pragmatics of the language and that they are able to give the appropriate examples that will illustrate various concepts.
- Teach them to recognize the significance of pragmatics for natural language understanding.
- Enable students to be capable to describe the application based on natural language processing and to show the points of syntactic, semantic and pragmatic processing.

B. Course Outcomes: At the end of the course, students will be able to

[CO.1]. How key concepts from NLP are used to describe and analyze language
[CO.2]. POS tagging and context free grammar for English language
[CO.3]. Understanding semantics and pragmatics of English language for processing
[CO.4]. Writing programs to carry out natural language processing

C. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Internal Examination	20
	Assignment	05
	Attendance	05
End Term Exam (Summative)	End Term Examination	70
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

Introduction: Human languages, models, ambiguity Introduction to Natural Language Processing, Linguistic Background,Phases in Natural Language understanding, Spoken Language input and output Technologies,Written text input, Mathematical Methods, Statistical Modelling and Classification, Regular Expressions and Automata: Regular Expressions, Finite-State Automata, Regular Languages and FSA, **Grammars for Natural Language Processing:** Parsing with context free grammars: Parsing as Search, Basic Top down Parser, Problems with basic top-down-parsers, the early Algorithm, Finite state parsing, Semantic Analysis: Syntax driven semantic analysis, Attachment of Fragment of English, Integrating semantic analysis with early parser. Robust Semantic Analysis. Semantic and Logic Form, Ambiguity Resolution, Semantic Interpretation, **Information Retrieval Architecture:** Indexing , Storage Compression Techniques, Retrieval Approaches, Evaluation, **N-grams:** N-grams, smoothing, entropy, HMM, ME, SVM, CRF, Regular expressions, Finite State Automata word recognition, lexicon **Search Engines:** Commercial Search Engine features, Comparison, Document Processing, NLP Based Information Retrieval, Information Extraction, **Text Mining:** Categorization, Extraction Based Categorization, Clustering, Hierarchical Clustering, Document Clustering and Routing, **Finding and Organizing Answers from Text Search:** Use of Categories and Clusters forOrganizing Retrieval Results, Text Categorization and Efficient Summarization Using Lexical Chains, Pattern Extraction, Generic Issues: Multilingually, Multilingual Information Retrieval and Speech Processing, Text and Images, Modality Integration, Transmission and Storages,**Applications:** Speech coding, Evaluation of Systems, Human Factors and Acceptability, Machine Translation, transfer Metaphor, Interlingua and statistical Approaches, Discourse Processing, Dialog and Conversational agents, Surface Realization and Discourse Planning, Discourse- Reference resolution, constraints on co-reference, algorithm for pronoun resolution, text coherence, discourse structure.

E. TEXT BOOKS

T1. Speech and Language processing, Daniel Jurafsky and James H Martin,2000, Printice Hall
T2. Foundations of Statistical Natural Language Processing, Christopher D Manning Hinrichschutze, MITPress,1999

F. REFERENCE BOOKS

R1. Survey of the State of the art in Human Language Technology, Ron Cole, J. Martin, et.al, Cambridge University Press
R2. Survey of Text Mining, Clustering, Classifications and Retrieval, Michael W. Berry, Springer Verog,2003
R3. Natural language understanding, James Allen, Benjamin/Cummings Publishing Co.

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	COURSE OUTCOME STATEMENT	CORRELATION WITH PROGRAM OUTCOMES									CORRELATION WITH PROGRAM SPECIFIC OUTCOMES				
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	How key concepts from NLP are used to describe and analyze language	3	2	2	2	2	-	-	-	-	2	-	-	2	-
CO2	POS tagging and context free grammar for English language	2	2	3	2	-	2	-	-	-	2	1	-	2	1
CO3	Understanding semantics and pragmatics of English language for processing	3	2	2	1	1	-	-	-	-	3	-	1	3	-
CO4	Writing programs to carry out natural language processing	1	3	2	1	-	1	-	-	-	2	-	-	2	-

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Discipline Specific Elective (DSE) Course
Artificial Intelligence (Select any TWO)

Subject: Artificial Neural Networks

Code: CSC26158
5 Credits | Semester VI
Total Hours Required –75 Total Tutorials Required – 15

A. Introduction: The objective of the course is to provide complete knowledge of **Artificial Neural Network**(**ANN**) **uses** the processing of the brain as a basis to develop algorithms that **can** be **used** to model complex patterns and prediction problems. ... In our brain, there **are** billions of cells called neurons, which processes information in the form of electric signals.

The main objectives of the course are as follows:

- To introduce concepts of artificial neural networks and principles of leaning and regression
- To learn various types of neural networks and their working principles
- To understand role of neural network in various applications and apply it to multi- class classification etc.

B. Course Outcomes: At the end of the course, students will be able to
[CO.1]. Understand basic concepts of neural networks.
[CO.2]. Use neural networks to perform classification for single class and multiclass problems.
[CO.3]. Learn and apply the concept of self-organizing maps.
[CO.4]. To be able to formalize the problem, to solve it by using a neural network

C. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Internal Examination	20
	Assignment	05
	Attendance	05
End Term Exam (Summative)	End Term Examination	70
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

NEURAL NETWORK BASICS Classical AI and Neural Networks, characteristics of neural networks, Historical perspective The biological inspiration, models of artificial neuron & activation functions Artificial Neuron Model and Linear Regression, Nonlinear Activation Units and Training of artificial neural networks, **LEARNING MECHANISMS** Learning Mechanisms: Gradient Descent Algorithm

Learning Mechanisms-Hebbian, Competitive, Boltzmann , Universal function approximation. **SINGLE LAYER AND MULTI LAYER PERCEPTRONS** Representation of perceptron, Linear separability, Perceptron Learning, Single-Layer Perceptions , Unconstrained Optimization Gauss-Newton's Method, Linear Least Squares Filters, Least Mean Squares Algorithm , Perceptron Convergence Theorem Back Propagation Algorithm, Practical Consideration in Back Propagation Algorithm Training of single layer and multi-layer, back propagation training algorithm Applications of back propagation, Solution of Non-Linearly Separable Problems Using MLP, Heuristics For Back-Propagation, Multi- Class Classification Using Multi-layered Perceptrons, Associative Memory Networks:- Associative Memory Model, Conditions for perfect Recall in Associative memory, **RADIAL BASIS FUNCTION NETWORKS**Introduction,Separability and Interpolation, Learning Mechanisms in RBF Comparison Between MLP and RBF Introduction to Principal Components and Analysis, Dimensionality reduction Using PCA Hebbian- Based Principal Component Analysis **SELF ORGANIZING MAPS** Self Organizing Maps :Introduction to Self Organizing Maps, Cooperative and Adaptive Processes in SOM, Vector-Quantization Using SOM, Competitive learning, Mexican Hat networks.

E. TEXT BOOKS

T1. Neural Networks, fuzzy Logic, and Genetic Algorithms, Rajasekaran&VijayalakhmiPai, Pearson 2011

T2. Principles of Soft Computing, Sivanandam, Deepa, Wiley, 2014

F. REFERENCE BOOKS

R1. Neural Networks – A Classroom Approach, Satish Kumar, Tata McGraw Hill, 2010

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	COURSE OUTCOME STATEMENT	CORRELATION WITH PROGRAM OUTCOMES									CORRELATION WITH PROGRAM SPECIFIC OUTCOMES				
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	Understand basic concepts of neural networks.	2	3	3	2	1	2	2	-	-	2	-	1	2	2
CO2	Use neural networks to perform classification for single class and multiclass problems.	2	3	2	2	2	2	-	-	-	2	1	-	1	2
CO3	Learn and apply the concept of self-organizing maps.	2	2	2	2	1	2	-	-	-	3	-	1	-	2
CO4	To be able to formalize the problem, to solve it by using a neural network	3	2	2	2	2	1	1	-	-	2	2	1	1	2

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Discipline Specific Elective (DSE) Course
Data Science (Select any TWO)

Subject: Big Data Analytics Lab

Code: CSC26153
2 Credits | Semester VI
Total Hours Required –60 Total Tutorials Required – 12

A. Introduction: The objective of the course is to provide complete knowledge of big data analytics. Students will be able to develop the concepts of big data analytics to the students. The students will also develop an ability which can easily help them to handle industry scenarios of big data analytics.

The main objectives of the course are as follows:

- Introduce the concepts of big data analytics to the students.
- Introduces the big data framework, its characteristics and use cases associated with it.
- Students will be familiar with the concept of big data handling concept mechanisms concept with the help of hadoop framework.
- A concise introduction to Hadoop framework will prepare students to handle industry scenarios of big data analytics.
- Learn the basic concept of big data analytics process.

B. Course Outcomes: At the end of the course, students will be able to
[CO.1]. Understand the concept & characteristics of big data.
[CO.2]. Explore Hadoop framework and its components. Use HDFS and Map Reduce to analyze various industry use cases of big data analytics.
[CO.3]. Understand the YARN Infrastructure.
[CO.4]. Learning different Sorting, Shuffling algorithm of MapReduce& understand the concept of big data streaming.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Internal Examination	10
	Assignment	2.5
	Attendance	2.5
End Term Exam (Summative)	End Term Examination	35
	Total	50
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

List of Practicals
1. Install and configure Hadoop, set working directory and various processes.
2. Implement basic commands in Hadoop to manipulate big data.
a. **Ls**
b. **Mkdir**
c. **Touchz**
d. **copyFromLocal or put**
e. **cat**
f. **copyToLocal or get**
g. **moveFromLocal**
h. **cp**
i. **mv**
j. **rmr**
k. **du**
l. **dus**
m. **stat**
n. **setrep**
3. Create a directory in HDFS at given path.
4. List the contents of a directory.
5. See the contents of a file in Hadoop.
6. Copy a file from source to destination.
7. Copy a file from local file system to HDFS.
8. Display last few lines of a file.
9. Display the aggregate length of a file.
10. Write a MapReduce program for wordcount.
11. Set up Hadoop cluster configuration.
12. Implement HDFS and explore its characteristics
13. Explore the properties of YARN.
14. Import data from MySQL into HDFS.
15. Import data from MS Excel into HDFS.
16. Import data from MS Excel into HDFS.

17. Implement nested MapReduce.
18. Create a scenario based on real time domain.
19. Remove a file/directory in HDFS

E. TEXT BOOKS

T1. Big Data and Analytics, Seema Acharya, SubhashiniChellappan, Wiley Publication

F. REFERENCE BOOKS

R1. Big Data, Black Book: Covers Hadoop 2, MapReduce, Hive, YARN, Pig, R and Data Visualization (2016), DT Editorial Services, Dream tech press

R2. Hadoop: The Definitive Guide, Tom White, O'Reilly Media

R3. Hadoop in Action, Chuck Lam, Manning

G. Course Articulation Matrix: (Mapping of COs withPOs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES									CORRELATION WITH PROGRAM SPECIFICOUTCOMES				
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	Understand the concept & characteristics of big data.	3	2	2	2	2	-	-	-	-	2	-	-	2	-
CO2	Explore Hadoop framework and its components. Use HDFS and Map Reduce to analyze various industry use cases of big data analytics	2	2	3	2	-	2	-	-	-	2	1	-	2	1
CO3	Understand the YARN Infrastructure	3	2	2	1	1	-	-	-	-	3	-	1	3	-
CO4	Learning different Sorting, Shuffling algorithm of MapReduce& understand the concept of big data streaming.	1	3	2	1	-	1	-	-	-	2	-	-	2	-

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Discipline Specific Elective (DSE) Course
Data Science (Select any TWO)

Subject: NoSQL Databases Lab

Code: CSC26154
2 Credits | Semester VI
Total Hours Required –60 Total Tutorials Required – 12

A. Introduction: The objective of the course is to provide complete knowledge of NoSQL. Students will be able to develop non-relational database logical that is collection and document. This will help to manage huge amount of data in a flexible way.

The course objective is to:

- Get knowledge about the basic concept of non-relational DBMS.
- Work with query unstructured database
- Define, compare and use the four types of NoSQL Databases (Document-oriented, KeyValue Pairs, Column-oriented and Graph).
- Demonstrate an understanding of the detailed architecture, define objects, load data, query data and performance tune Column-oriented NoSQL databases.
- Explain the detailed architecture, define objects, load data, query data and performance tune Document-orients NoSQL databases.

B. Course Outcomes: At the end of the course, students will be able to

[CO.1]. Implements the Data model of storing and retrieving Data.
[CO.2]. Implements of Collection and Document
[CO.3]. Implement the concepts Transactions SpanningDifferent Operations
[CO.4]. Analyze the need of NoSQL Key/Value databases in Modern web development

C. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Internal Examination	10
	Assignment	2.5
	Attendance	2.5
End Term Exam (Summative)	End Term Examination	35
	Total	50
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

List of Practical	
1	Introduction to MongoDB and its Installation
2	Description of mongo Shell, Create database and show database
3	Commands for MongoDB and To study operations in MongoDB – Insert, Query, Update, Delete and Projection
4	Where Clause equivalent in MongoDB
5	To study operations in MongoDB – AND in MongoDB, OR in MongoDB, Limit Records and Sort Records. To study operations in MongoDB – Indexing, Advanced Indexing, Aggregation and Map Reduce
6	Practice with ' macdonalds ' collection data for document oriented database. Import restaurants collection and apply some queries to get specified output.
7	Column oriented databases study, queries and practices

E. TEXT BOOKS

T1. NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, P. J. Sadalage and M. Fowler, Pearson Education, Inc. 2012.

T2. NoSQL For Dummies, 2015 John Wiley & Sons, Pearson Education

T3. Professional NoSQL, Shashank Tiwari, Wrox

F. REFERENCE BOOKS

R1. HBase: The Definitive Guide, Lars George,.O'Reilley, 2011

R2. Cassandra: The Definitive Guide, Eben Hewitt, O'Reilley, 2010

R3. MongoDB: The Definitive Guide, Kristina Chodorow, Cengage Learning

R4. Programming Hive, E. Capriolo, D. Wampler, and J. Rutherglen O'Reilley, 2012

G. Course Articulation Matrix: (Mapping of COs withPOs)

CO	COURSE OUTCOME STATEMENT	CORRELATION WITH PROGRAM OUTCOMES									CORRELATION WITH PROGRAM SPECIFIC OUTCOMES				
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	Implements the Data model of storing and retrieving Data.	1	2	2	2	2	-	-	-	-	2	-	-	3	3
CO2	Implements of Collection and Document	2	2	2	2	-	2	-	-	-	2	1	-	3	3
CO3	Implement the concepts Transactions SpanningDifferent Operations	3	2	2	1	1	-	-	-	-	3	-	1	2	3
CO4	Analyze the need of NoSQL Key/Value databases in Modern web development	1	2	2	1	-	1	-	-	-	2	-	-	3	2

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Discipline Specific Elective (DSE) Course
Data Science (Select any TWO)

Subject: Time Series Analysis Lab

Code: CSC26155
2 Credits | Semester VI
Total Hours Required –60 Total Tutorials Required – 12

A. Introduction: This course introduces the concept of Time Series Analysis. The course provides a survey of the theory and application of time series methods in econometrics. Topics covered will include univariate stationary and non-stationary models, vector auto regressions, frequency domain methods, models for estimation and inference in persistent time series, and structural breaks.

The main objectives of the course are as follows:

- To understand the basic concepts of time series analysis.
- To understand the elementary time series models and model evaluation techniques.
- To understand the integration process of non-stationary data set.
- To understand the importance of ARMA and ARIMA models for forecasting.
- To understand the basic concepts and estimation procedure for VAR models.
- To understand the method to select the appropriate number of order of variables.
- To understand the ARCH and GARCH models.

B. Course Outcomes: At the end of the course, students will be able to

[CO.1]. Understand the different elementary models related to time series analysis.
[CO.2]. Apply different model evaluation technique to identify better model to forecast.
[CO.3]. Understand the importance of stationarity in building time series models.
[CO.4]. Understand the use of Granger Causality and JohensenCointegration method.
[CO.5]. Apply VAR model to the dynamic behaviour of financial time series conditions.
[CO.6]. Select the order of Vector Auto Regression model for better forecast of time series data.
[CO.7]. Build the model using ARCH and GARCH technique for non-constant variance data

C. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Internal Examination	10
	Assignment	2.5
	Attendance	2.5
End Term Exam (Summative)	End Term Examination	35
	Total	50
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination.	

	The allowance of 25% includes all types of leaves including medical leaves.

D. SYLLABUS

List of Practicals	
1	To import pandas and check the version
2	To create a series from a list, numpy array and dict
3	To convert the index of a series into a column of a dataframe
4	To combine many series to form a dataframe?
5	To get the items of series A not present in series B?
6	To get the items not common to both series A and series B?
7	To get the minimum, 25th percentile, median, 75th, and max of a numeric series
8	To convert a series of date-strings to a timeseries
9	To get the day of month, week number, day of year and day of week from a series of date strings
10	To create a TimeSeries starting '2000-01-01' and 10 weekends (saturdays) after that having random numbers as values
11	To fill an intermittent time series so all missing dates show up with values of previous non-missing date

E. TEXT BOOKS

T1. C. Chatfield: The Analysis of Time Series - An Introduction Chapman and Hall.
T2. G.E.P. Box, G.M. Jenkins and G.C. Reinsel: Time Series Analysis, Forecasting and Control, John Wiley & Sons Publications.

F. REFERENCE BOOKS

R1. P.J. Brockwell .and R.A. Davis: Time Series: Theory and Methods, Springer Verlag.

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	COURSE OUTCOME STATEMENT	CORRELATION WITH PROGRAM OUTCOMES									CORRELATION WITH PROGRAM SPECIFIC OUTCOMES				
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	Understand the different elementary models related to time series analysis.	1	2	2	2	2	-	-	-	-	2	-	-	2	-
CO2	Apply different model evaluation technique to identify better model to forecast.	2	2	2	2	-	2	-	-	-	2	1	-	2	1
CO3	Understand the importance of stationarity in building time series models.	3	2	2	1	1	-	-	-	-	3	-	1	3	-
CO4	Understand the use of Granger Causality and JohensenCointegration method.	1	2	2	1	-	1	-	-	-	2	-	-	2	-
CO5	Apply VAR model to the dynamic behaviour of financial time series conditions.	2	-	2	-	1	1	-	-	-	1	2	-	1	2
CO6	Select the order of Vector Auto Regression model for better forecast of time series data.	3	2	1	-	2	1	-	-	-	-	2	1	-	2
CO7	Build the model using ARCH and GARCH technique for non-constant variance data	2	-	1	2	-	2	-	-	-	2	2	-	2	2

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Discipline Specific Elective (DSE) Course
Internet of Things (Select any TWO)

Subject: Embedded C with Arduino Lab

Code: CSC26159
2 Credits | Semester VI
Total Hours Required –60Total Tutorials Required – 12

A. Introduction: The objective of the course is to provide complete knowledge of ARDUINO & Embedded system with the help of language C. Students will be able to know the about various technologies developed & currently used in this field. They will be able to make various kinds of hardware/software projects on this topic.

1. The course will cover programming the Arduino using C code and accessing the pins on the board via the software to control external devices. The students will get firm career growth in electronics domain.
2. Develop an understanding of the technologies behind the embedded computing systems.
3. To introduce students to the design issues of embedded systems.
4. Enable students to analyse and develop software programs for embedded systems

B. Course Outcomes: At the end of the course, students will be able to

[CO.1]. Understand hardware and software design requirements of embedded systems.
[CO.2]. Analyze the embedded systems' specification and develop software programs.
[CO.3]. Evaluate the requirements of programming Embedded Systems, related software architectures and tool chain for Embedded Systems.
[CO.4]. Upon completion of this course the student will be specialized in Embedded system design using Arduino.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Internal Examination	10
	Assignment	2.5
	Attendance	2.5
End Term Exam (Summative)	End Term Examination	35
	Total	50
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

List of Practical	
1	Intro to Addresses, Pointers and Handles
2	Hello Arduino
3	Arduino Digital Output
4	Arduino Digital Input
5	Arduino Analog Input
6	Arduino Reaction Timer
7	Arduino Reaction Timer Redux
8	Arduino Analog Output via PWM
9	Arduino Event Counter
10	Arduino Arbitrary Waveform Generator
11	Arduino Interruptus

E. TEXT BOOKS

T1. C Programming for Arduino, Julien Bayle, Packt Publishing

F. REFERENCE BOOKS

R1. Beginning C for Arduino, 2nd Edition, Jack Purdum, Apress

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	COURSE OUTCOME STATEMENT	CORRELATION WITH PROGRAM OUTCOMES									CORRELATION WITH PROGRAM SPECIFIC OUTCOMES				
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	Understand hardware and software design requirements of embedded systems.	1	2	2	3	2	1	-	-	-	2	1	-	1	1
CO2	Analyze the embedded systems' specification and develop software programs.	1	2	2	3	2	2	-	-	-	2	1	-	2	1
CO3	Evaluate the requirements of programming Embedded Systems, related software architectures and tool chain for Embedded Systems.	1	2	2	3	2	2	-	-	-	3	2	1	1	2
CO4	Upon completion of this course the student will be specialized in Embedded system design using Arduino & ready to make a project.	1	2	2	3	2	3	-	-	-	2	3	2	2	2

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Discipline Specific Elective (DSE) Course
Internet of Things (Select any TWO)

Subject: Digital Signal Processing Lab

Code: CSC25142
2 Credits | Semester IV
Total Hours Required –60 Total Tutorials Required – 12

A. Introduction: The purpose of this course is to provide an understanding of Digital Signal Processing. The topics include: Introduction to digital signal processing and application, discrete time signals and systems; Analysis of LTI systems; Structures of discrete time systems; Filter designing techniques; DFT and FFT; Architecture of DSP Processors, and Multi-rate Signal Processing and applications.

The main objectives of the course are as follows:

- To learn the concepts and architecture of DSP.
- To acquire the fundamental knowledge of the DSP.
- To learn the various operations performed by the Digital signal Processor.
- Students will capable of designing DSP kit.

B. Course Outcomes: At the end of the course, students will be able to
[CO.1]. Analyze digital and analog signals and systems.
[**CO.2].** Change sampling rate of the signal.
[**CO.3].** Conceptualize the need of adaptive filters in communication applications.
[CO.4]. Understand the key Architectural features of Digital Signal Processor.
[CO.5]. Apply digital signal processing algorithms to various areas.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Internal Examination	10
	Assignment	2.5
	Attendance	2.5
End Term Exam (Summative)	End Term Examination	35
	Total	50
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

List of Practical	
1.	Write a program for Direct form – I, II form realization of the given IIR system function
2.	Write a program to plot pole-zero of a given FIR filter.

3.	(A)Create Blackman Harris, Hamming and Gaussian window and plot them in the same filter design tool. (B) Design an FIR filter with side lobe attenuation of 40 dB using Kaiser Window of 200 points
4.	(A) Design low pass butter worth digital filter with given specification using impulse invariance method. (B) Design a high pass elliptical filter with given specification using impulse invariance method. (C) Design a band pass chebychev-2 filter with given specification using impulse invariance method
5.	Design a second-order digital bandpass Butterworth filter with the following specifications: fu= 2.6 kHz,fL = 2.4 kHz , fs = 8000 Hz. Plot the magnitude and phase response.
6.	Write a program to demonstrate the time shifting and frequency shifting property of DTFT.
7.	Write a program to perform circular convolution of two sequences using DFT.
8.	Write a program to up sample the sinusoidal sequence by an integer factor.
9.	Write a program to down sample the sinusoidal sequence by an integer factor
10.	Write a program to convert the sampling by non integer factor of a sinusoidal sequence.

E. TEXT BOOKS

T1. Digital Signal Processing: Principles, Algorithm & Application, 4th edition, Proakis, Manolakis, Pearson

T2. Discrete Time Signal Processing: Oppeheim, Schafer, Buck Pearson education publication, 2nd Edition, 2003.

T3. Digital Signal Processing fundamentals and Applications, Li Tan , Jean Jiang, Academic Press,2nd edition,2013

T4. Digital Signal Processing – A computer based Approach, S.K.Mitra, Tata McGraw Hill,3rd edition,2006

F. REFERENCE BOOKS

R1. Fundamentals of digital Signal Processing –Lonnie c.Ludeman, Wiley

R2. Digital Signal processing-A Practical Approach, second edition, Emmanuel I. feacher, and BarrieW. Jervis, Pearson Education

R3. Digital Signal Processing, S.Salivahanan, A.Vallavaraj, C.Gnapriya TMH

R4. Digital Signal Processors, Architecture, programming and applications by B. Venkatramani, M Bhaskar, Mc-Graw Hill

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	COURSE OUTCOME STATEMENT	CORRELATION WITH PROGRAM OUTCOMES									CORRELATION WITH PROGRAM SPECIFIC OUTCOMES				
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	Analyze digital and analog signals and systems.	**1**	**2**	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**3**	**3**
CO2	Change sampling rate of the signal.	**2**	**2**	**2**	**2**	**-**	**2**	**-**	**-**	**-**	**2**	**1**	**-**	**3**	**3**
CO3	Conceptualize the need of adaptive filters in communication applications	**3**	**2**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**3**	**-**	**1**	**2**	**3**
CO4	Understand the key Architectural features of Digital Signal Processor.	**1**	**2**	**2**	**1**	**-**	**1**	**-**	**-**	**-**	**2**	**-**	**2**	**3**	**2**
CO5	Apply digital signal processing algorithms to various areas	**1**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**2**	**1**	**1**	**-**	**-**

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Discipline Specific Elective (DSE) Course
Internet of Things (Select any TWO)

Subject: Artificial Neural Networks Lab

Code: CSC26161
2 Credits | Semester VI
Total Hours Required –60 Total Tutorials Required – 12

A. Introduction: The objective of the course is to provide complete knowledge of **Artificial Neural Network**(**ANN**) **uses** the processing of the brain as a basis to develop algorithms that **can** be **used** to model complex patterns and prediction problems. ... In our brain, there **are** billions of cells called neurons, which processes information in the form of electric signals.

The main objectives of the course are as follows:

- To introduce concepts of artificial neural networks and principles of leaning and regression
- To learn various types of neural networks and their working principles
- To understand role of neural network in various applications and apply it to multi- class classification etc.

B. Course Outcomes: At the end of the course, students will be able to
[CO.1]. Understand basic concepts of neural networks.
[CO.2]. Use neural networks to perform classification for single class and multiclass problems.
[CO.3]. Learn and apply the concept of self-organizing maps.
[CO.4]. To be able to formalize the problem, to solve it by using a neural network

C. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Internal Examination	10
	Assignment	2.5
	Attendance	2.5
End Term Exam (Summative)	End Term Examination	35
	Total	50
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

Practical No	Details
1	To study about MATLAB
2	Write a program to perform the basics matrix operations.
3	Write a program to plot straight line
4	Write a program to plot the Sine curve.
5	How the weight & bias value effects the output of neurons.
6	How the choice of activation function effect the output of neuron experiment with the following function purelin(n), bimary threshold(hardlinm(n), haradlims(n)), Tansig(n) logsig(n)
7	How the weight and biased value are able to represent a decision boundary in the feature space.
8	How the Perceptron Learning rule works for Linearly Separabale Problem.
9	How the Perceptron Learning rule works for Non-Linearly Separable Problem.
10	Write a program to draw a graph with multiple curve.

E. TEXT BOOKS

T1. Neural Networks, fuzzy Logic, and Genetic Algorithms, Rajasekaran&VijayalakhmiPai, Pearson 2011

T2. Principles of Soft Computing, Sivanandam, Deepa, Wiley, 2014

F. REFERENCE BOOKS

R1. Neural Networks – A Classroom Approach, Satish Kumar, Tata McGraw Hill, 2010

G. Course Articulation Matrix: (Mapping of COs withPOs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES									CORRELATION WITH PROGRAM SPECIFICOUTCOMES				
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	Understand basic concepts of neural networks.	2	3	3	2	1	2	2	-	-	2	-	1	2	2
CO2	Use neural networks to perform classification for single class and multiclass problems.	2	3	2	2	2	2	-	-	-	2	1	-	1	2
CO3	Learn and apply the concept of self-organizing maps.	2	2	2	2	1	2	-	-	-	3	-	1	-	2
CO4	To be able to formalize the problem, to solve it by using a neural network	3	2	2	2	2	1	1	-	-	2	2	1	1	2

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Discipline Specific Elective (DSE) Course
Artificial Intelligence (Select any TWO)

Subject: Cloud Deployment and Management Lab

Code: CSC26164
2 Credits | Semester VI
Total Hours Required –60 Total Tutorials Required – 12

A. Introduction: Objective of this course is to provide students with a practical and theoretical knowledge of Cloud Computing and their Application implementation.

The main objectives of the course are as follows:

- To define Cloud Computing
- To provide an in-depth and comprehensive knowledge of the Cloud Computing fundamental issues, technologies, applications and implementations.
- To expose the students to the frontier areas of Cloud Computing
- To motivate students to do programming and experiment with the various cloud computing environments
- To shed light on the Security issues in Cloud Computing
- To introduce about the Cloud Standards

B. Course Outcomes: At the end of the course, students will be able to

[CO.1]. Analyze the components of cloud computing showing how business agility in an organization can be created
[CO.2]. Evaluate the deployment of web services from cloud architecture
[CO.3]. Critique the consistency of services deployed from a cloud architecture
[CO.4]. Compare and contrast the economic benefits delivered by various cloud models based on application requirements, economic constraints, and business requirements.
[CO.5]. Critically analyze case studies to derive the best practice model to apply when developing and deploying cloud based applications

C. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Internal Examination	10
	Assignment	2.5
	Attendance	2.5
End Term Exam (Summative)	End Term Examination	35
	Total	50
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination.	

	The allowance of 25% includes all types of leaves including medical leaves.

D. SYLLABUS

List of Practicals		
TOPICS		
1	Introduction to cloud computing.	
2	Creating a Warehouse Application in SalesForce.com.	
3	Creating an Application in SalesForce.com using Apex programming Language.	
4	Implementation of SOAP Web services in C#/JAVA Applications.	
5	Implementation of Para-Virtualization using VM Ware's Workstation/ Oracle's Virtual Box and Guest O.S.	
6	Installation and Configuration of Hadoop.	
7	Create an application (Ex: Word Count) using Hadoop Map/Reduce.	
8	Case Study: PAAS(Facebook, Google App Engine)	
9	Case Study: Amazon Web Services.	
10	Sketch out and analyze architecture of Aneka / Eucalyptus / KVM identify different entities to understand the structure of it.	
11	Sketch out and analyze architecture of Microsoft Azure.	
12	Sketch out and analyze architecture of Amazon Web Service (AWS).	
13	Implement and use sample cloud services with the help of Microsoft Azure.	
14	Create a scenario in Aneka / Eucalyptus to create a datacenter and host. Also create virtual machines with static configuration to run cloudlets on them.	
15	Organize a case in Aneka / Eucalyptus for simulation entities in run-time using a its toolkit support and manage virtual cloud.	

E. TEXT BOOKS

T1. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing, A Practical Approach" McGraw-Hill Osborne Media

F. REFERENCE BOOKS

R1. Dimitris N. Chorafas, "Cloud Computing Strategies" CRC Press
R2. Cloud Computing Bible, Barrie Sosinsky, Wiley-India
R3. Cloud Computing: Principles and Paradigms, Editors: Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Wiley

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	COURSE OUTCOME STATEMENT	CORRELATION WITH PROGRAM OUTCOMES									CORRELATION WITH PROGRAM SPECIFIC OUTCOMES				
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	Analyze the components of cloud computing showing how business agility in an organization can be created	**3**	**3**	**3**	**2**	**1**	**2**	**2**	**-**	**-**	**2**	**-**	**1**	**1**	**2**
CO2	Evaluate the deployment of web services from cloud architecture	**3**	**2**	**2**	**2**	**2**	**2**	**-**	**-**	**-**	**2**	**1**	**-**	**1**	**2**
CO3	Critique the consistency of services deployed from a cloud architecture	**3**	**2**	**2**	**2**	**1**	**2**	**-**	**-**	**-**	**3**	**-**	**1**	**1**	**2**
CO4	Compare and contrast the economic benefits delivered by various cloud models based on application requirements, economic constraints, and business requirements.	**3**	**2**	**2**	**2**	**2**	**1**	**1**	**-**	**-**	**2**	**2**	**1**	**1**	**2**
CO5	Critically analyze case studies to derive the best practice model to apply when developing and deploying cloud based applications	**3**	**2**	**3**	**2**	**1**	**2**	**1**	**-**	**-**	**2**	**3**	**2**	**1**	**2**

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Discipline Specific Elective (DSE) Course
Artificial Intelligence (Select any TWO)

Subject: Natural Language Processing Lab

Code: CSC26165
2 Credits | Semester VI
Total Hours Required –60 Total Tutorials Required – 12

A. Introduction: The objective of the course is to provide complete knowledge of Natural Language Processing. Students will be able to develop logical abilities, which will help them to create programs, applications. The students will also develop an ability, which can easily help them switch to any other language in future.

The main objectives of the course are as follows

- Teach students the leading trends and systems in natural language processing.
- Make them understand the concepts of morphology, syntax, semantics and pragmatics of the language and that they are able to give the appropriate examples that will illustrate various concepts.
- Teach them to recognize the significance of pragmatics for natural language understanding.
- Enable students to be capable to describe the application based on natural language processing and to show the points of syntactic, semantic and pragmatic processing.

B. Course Outcomes: At the end of the course, students will be able to

[CO.1]. How key concepts from NLP are used to describe and analyze language
[CO.2]. POS tagging and context free grammar for English language
[CO.3]. Understanding semantics and pragmatics of English language for processing
[CO.4]. Writing programs to carry out natural language processing

C. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Internal Examination	10
	Assignment	2.5
	Attendance	2.5
End Term Exam (Summative)	End Term Examination	35
	Total	50
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

List of Practicals
1. Word Analysis Application
2. Word Generation Application
3. Morphology Application
4. N-Grams Application
5. N-Grams Smoothing Application
6. POS Tagging: Hidden Markov Model Application
7. POS Tagging: Viterbi Decoding Application
8. Building POS Tagger Application
9. Fighting Spam Application(Spam filtering)
10. Sentiment Analysis
11. Chunking Application
12. Building Chunker

E. TEXT BOOKS

T1. Daniel Jurafsky, James H. Martin, Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, Pearson Publication, 2014.
T2. Steven Bird, Ewan Klein and Edward Loper, Natural Language Processing with Pythonll, First Edition, OReilly Media, 2009.

F. REFERENCE BOOKS

R1. Breck Baldwin, Language Processing with Java and LingPipe Cookbook, Atlantic Publisher, 2015.
R2. Richard M Reese, Natural Language Processing with Javall, OReilly Media, 2015.
R3. Nitin Indurkhya and Fred J. Damerau, Handbook of Natural Language Processing, Second Edition, Chapman and Hall/CRC Press, 2010.
R4. Tanveer Siddiqui, U.S. Tiwary, Natural Language Processing and Information Retrieval, Oxford University Press, 2008.

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	COURSE OUTCOME STATEMENT	CORRELATION WITH PROGRAM OUTCOMES									CORRELATION WITH PROGRAM SPECIFIC OUTCOMES				
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	How key concepts from NLP are used to describe and analyze language	3	2	2	2	2	-	-	-	-	2	-	-	2	-
CO2	POS tagging and context free grammar for English language	2	2	3	2	-	2	-	-	-	2	1	-	2	1
CO3	Understanding semantics and pragmatics of English language for processing	3	2	2	1	1	-	-	-	-	3	-	1	3	-
CO4	Writing programs to carry out natural language processing	1	3	2	1	-	1	-	-	-	2	-	-	2	-

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Discipline Specific Elective (DSE) Course
Artificial Intelligence (Select any TWO)

Subject: Artificial Neural Networks Lab

Code: CSC26161
2 Credits | Semester VI
Total Hours Required –60 Total Tutorials Required – 12

A. Introduction: The objective of the course is to provide complete knowledge of **Artificial Neural Network**(**ANN**) **uses** the processing of the brain as a basis to develop algorithms that **can** be **used** to model complex patterns and prediction problems. ... In our brain, there **are** billions of cells called neurons, which processes information in the form of electric signals.

The main objectives of the course are as follows:

- To introduce concepts of artificial neural networks and principles of leaning and regression
- To learn various types of neural networks and their working principles
- To understand role of neural network in various applications and apply it to multi- class classification etc.

B. Course Outcomes: At the end of the course, students will be able to
[CO.1]. Understand basic concepts of neural networks.
[CO.2]. Use neural networks to perform classification for single class and multiclass problems.
[CO.3]. Learn and apply the concept of self-organizing maps.
[CO.4]. To be able to formalize the problem, to solve it by using a neural network

C. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Internal Examination	10
	Assignment	2.5
	Attendance	2.5
End Term Exam (Summative)	End Term Examination	35
	Total	50
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. SYLLABUS

Practical No	Details
1	To study about MATLAB

2	Write a program to perform the basics matrix operations.
3	Write a program to plot straight line
4	Write a program to plot the Sine curve.
5	How the weight & bias value effects the output of neurons.
6	How the choice of activation function effect the output of neuron experiment with the following function purelin(n), bimary threshold(hardlinm(n), haradlims(n)), Tansig(n) logsig(n)
7	How the weight and biased value are able to represent a decision boundary in the feature space.
8	How the Perceptron Learning rule works for Linearly Separabale Problem.
9	How the Perceptron Learning rule works for Non-Linearly Separable Problem.
10	Write a program to draw a graph with multiple curve.

E. TEXT BOOKS

T1. Neural Networks, fuzzy Logic, and Genetic Algorithms, Rajasekaran&VijayalakhmiPai, Pearson 2011

T2. Principles of Soft Computing, Sivanandam, Deepa, Wiley, 2014

F. REFERENCE BOOKS

R1. Neural Networks – A Classroom Approach, Satish Kumar, Tata McGraw Hill, 2010

G. Course Articulation Matrix: (Mapping of COs withPOs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES									CORRELATION WITH PROGRAM SPECIFICOUTCOMES				
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	Understand basic concepts of neural networks.	2	3	3	2	1	2	2	-	-	2	-	1	2	2
CO2	Use neural networks to perform classification for single class and multiclass problems.	2	3	2	2	2	2	-	-	-	2	1	-	1	2
CO3	Learn and apply the concept of self-organizing maps.	2	2	2	2	1	2	-	-	-	3	-	1	-	2
CO4	To be able to formalize the problem, to solve it by using a neural network	3	2	2	2	2	1	1	-	-	2	2	1	1	2

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Subject: Project

Code: CSC26048

5 Credits | Semester VI

A. Introduction: The objective of this course is to prepare students to use applications of the theory and practical learned during the course. It will also help students to develop an industry or research oriented project. This course helps students how to carry out project/studies in the field of interest of the student or as given by the industry.

The main objectives of the course are as follows:

- To learn languages to code front end and back end of a software.
- To initiate into the process of designing, coding and testing a software module.
- To develop a complete software module.

B. Course Outcomes: At the end of the course, students will be able to:
[CO.1]. Apply Software Development Cycle to develop a software module.
[CO.2]. Use the techniques, skills and modern engineering tools necessary for software development.
[CO.3]. Develop a software product along with its complete documentation.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Internal Examination(Assessment)	30
	Assignment	-
	Attendance	-
End Term Exam (Summative)	End Term Examination	70
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

D. Project/ Dissertation

Students will carry out a research/industrial project under the supervision of faculty(s) on a particular software and at the end of the semester; they will submit their compiled Research / Industrial Project to the department. The details on how to prepare the project is available in Annexure I. By following the details, students can develop their research writing and project compilation skills.
