Syllabus

AFFILIATED COLLEGES

2022 – 2025 Batch

B Sc Computer Science (Artificial Intelligence)

Programme Educational Objectives (PEOs)	
The B.Sc. Computer Science (Artificial Intelligence) program describe accomplishments that graduates are expected to attain within five to seven years after graduation	
PEO1	Graduates will have Expertise in domain knowledge and get employment in the software industry as well as government departments
PEO2	Graduates will have the potential to work harmoniously as team members and be able to become an entrepreneur and exhibit leadership quality .
PEO3	Graduates will appreciate human values and ethics and will show continuous improvement in their career through lifelong learning.

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Programme Outcomes (POs)	
On successful completion of the B.Sc. Computer Science (Artificial Intelligence)	
PO1	**Disciplinary knowledge:** Capable to apply the knowledge of mathematics, algorithmic principles and computing fundamentals in the modeling and design of computer based systems of varying complexity
PO2	**Scientific reasoning/ Problem analysis:** Ability to critically analyze, categorizes, formulate and solve the problems that emerges in the field of computer science
PO3	**Problem solving:** Able to provide software solutions for complex scientific and business related problems or processes that meet the specified needs with appropriate consideration for the public health and safety and the cultural, societal and environmental considerations
PO4	**Environment and sustainability:** Understand the impact of software solutions in environmental and societal context and strive for sustainable development
PO5	**Modern tool usage:** Use contemporary techniques, skills and tools necessary for integrated solutions.
PO6	**Ethics:** Function effectively with social, cultural and ethical responsibility as an individual or as a team member with positive attitude.
PO7	**Cooperation / Team Work:** Function effectively as member or leader on multidisciplinary teams to accomplish a common objective
PO8	**Communication Skills:** An ability to communicate effectively with diverse types of audience and also able to prepare and present technical documents to different groups
PO9	**Self-directed and Life-long Learning:** Graduates will recognize the need for self-motivation to engage in lifelong learning to be in par with changing technology.
PO10	Enhance the research culture and uphold the scientific integrity and objectivity.

Programme Specific Outcomes (PSOs)	
After the successful completion of B.Sc. Computer Science (Artificial Intelligence) program the students are expected to	
PSO1	Demonstrate mastery of Computer Science in the following core knowledge areas of Data Structures and Programming Languages, Databases, Software Engineering and Artificial Intelligence and Machine Learning
PSO2	Apply the technical and critical thinking skills in the discipline of computer science to find solutions for complex real world problems.
PSO3	Ability to practice as an ethical software engineer/researcher in the evolving discipline of Computer Science and Artificial Intelligence by employing the skills learnt.

Part	**Title of the Course**	**Credits**	**Hours**		**Maximum marks**		
			Theory	**Practical**	**CIA**	**ESE**	**Total**
FIRST SEMESTER							
I	Language – I	4	6		50	50	100
II	English – I	4	6		50	50	100
III	Core1:Programming in C	4	4		50	50	100
III	Core Lab 1: Programming Lab – C	4		3	50	50	100
III	Core 2:Data structures	4	4		50	50	100
III	Allied 1: Discrete Mathematics	4	5		50	50	100
IV	Environmental Studies *	2	2			50	50
	Total	**26**	**27**	**3**	**300**	**350**	**650**
SECOND SEMESTER							
I	Language – II	4	6		50	50	100
II	English – II **&**	2	4		25	25	50
	Naan Muthalvan –Skill Course Effective English http://kb.naanmudhalvan.in/images/c/c7/Cambridge_Course_Details.pdf	2	2	-	25	25	50
III	Core3: Programming in C++	4	5		50	50	100
III	Core Lab2: Programming Lab-C++	4		4	50	50	100
III	Core Lab3: Internet Basics Lab	2		2	25	25	50
III	Allied 2: Introduction to Statistics	4	5		50	50	100
IV	Value Education – Human Rights*	2	2			50	50
	Total	**24**	**24**	**6**	**275**	**325**	**600**
THIRD SEMESTER							
III	Core 4: JAVA Programming	4	6		50	50	100
III	Core Lab 4: JAVA Programming Lab	4		5	50	50	100

III	Core 5: Artificial Intelligence	4	6		50	50	100
III	Allied 3: Software Engineering	4	6		50	50	100
III	Skill based Subject1 : Operating System	3	5		30	45	75
IV	Tamil **/ Advanced Tamil(OR) Non-major elective-1 (Yoga for Human Excellence)* / Women's Rights*	2	2			50	50
	Total	**21**	**25**	**5**	**230**	**295**	**525**
FOURTH SEMESTER							
III	Core 6: Python Programming	4	6		50	50	100
III	Core 7: Introduction to Machine Learning	4	6		50	50	100
III	Core Lab 5: Python Programming Lab	2		3	25	25	50
	Naan Muthalvan-Skill Course Office Fundamentals http://kb.naanmudhalvan.in/Bharathiar_University_(BU)	2		3	25	25	50
III	Allied 4 : Design and analysis of Algorithms	4	6		50	50	100
III	Skill Based Subject 2 (Lab): Capstone Project Work (Based on AI & Machine Learning	3		4	30	45	75
IV	Tamil **/ Advanced Tamil (OR) Non-major elective – II (General Awareness) *	2	2			50	50
	Total	**21**	**20**	**10**	**230**	**295**	**525**
FIFTH SEMESTER							
III	Core 8: Advanced Machine Learning using Python	4	6		50	50	100
III	Core Lab 6: Advanced Machine Learning using Python Lab	4		6	50	50	100
III	Core 9 : Fuzzy Logic and Neural Networks	4	6		50	50	100
III	Elective – I Fundamentals of Robotics /Business Data Analytics/ Social Network Analysis	4	6		50	50	100
III	Skill Based Subject 3: Database Management Systems	3		6	30	45	75
	Total	**19**	**18**	**12**	**230**	**245**	**475**
SIXTH SEMESTER							
III	Core 10 :R Programming	4	4		50	50	100
III	Core Lab 7 : R Programming Lab	4		5	50	50	100
III	Core 11:Project Work Lab	6		5	60	90	150
III	Elective - II Deep Learning/Web Application Security/Software Agents	4	5		50	50	100

III	Elective - III Natural Language Processing/Client Server Computing/Reinforcement Learning	4	5		50	50	100
III	Skill based Subject 4 (Lab): Oracle and SQL Lab	3	4		30	45	75
	Naan Muthalvan - Skill Course Cyber Security **@** http://kb.naanmudhalvan.in/images/7/71/Cybersecurity.pdf (or) Machine Learning **#** http://kb.naanmudhalvan.in/images/1/19/PBL_Google.pdf (or) Android APP Development **$** http://kb.naanmudhalvan.in/images/0/08/Android_App_Dev.pdf	2	2		25	25	50
V	Extension Activities**	2			50	-	50
	Total	**29**	**20**	**10**	**365**	**360**	**725**
	Grand Total	**140**	**134**	**46**	**1630**	**1870**	**3500**

- *NoContinuousInternalAssessment(CIA),UniversityExaminationsOnly.
- **NoUniversityExaminations,ContinuousInternalAssessment(CIA)Only.

- **&** The English II - University semester examination will be conducted for 50 marks (As per existing pattern of Examination) and it will be converted for 25 marks.
- **#** Govt – Non-Autonomous Colleges, **$** Aided – Non-Autonomous Colleges, **@** Self - Financing **(**Non – Autonomous).
- NaanMudhalvan – skill courses- external 25 marks will be assessed by Industry and internal will be offered by respective course teacher.

Course Code		Programming in C	L	T	P	C
Core/elective/Supportive		Core: 1	4	0	0	4
Pre - requisite		• Basic knowledge in computers	Syllabus version		I	

Course Objectives

To introduce the concepts of Procedure Oriented Programming and the various programming constructs of C programming

Expected Course Outcomes

1	Describe the fundamentals of computers, history, operating system, various types of software, hardware devices and overview of C.	K1
2	Interpret the concepts of Data types, Variables, Constant, Operators and various types of expressions, Mathematic functions, formatted input and output statements.	K2
3	Apply the concept of Decision making statements and looping constructs for solving the programs.	K3
4	Apply the concept of user defined functions, scope of the variables, Structure and Union.	K3
5	Illustrate the concepts of Pointers and files in a C program.	K3

K1 – Remember K2 – Understand K3 – Apply K4- Analyze K5 – Evaluate K6- Create

UNIT I	Fundamentals of Computers	12

Fundamentals of Computers : Introduction – History of Computers-Generations of Computers-Classification of Computers-Basic Anatomy of a Computer System-Input Devices-Processor-Output Devices-Memory Management – Types of Software- Overview of Operating System- Programming Languages-Translator Programs-Problem Solving Techniques - Overview of C.

UNIT II	Overview of C	11

Overview of C - Introduction - Character set - C tokens - keyword & Identifiers - Constants - Variables - Data types - Declaration of variables - Assigning values to variables - Defining Symbolic Constants - Arithmetic, Relational, Logical, Assignment, Conditional, Bitwise, Special, Increment and Decrement operators - Arithmetic Expressions - Evaluation of expression - precedence of arithmetic operators - Type conversion in expression – operator precedence &associativity - Mathematical functions - Reading & Writing a character - Formatted input and output.

UNIT III	Decision Making and Branching	12

Decision Making and Branching: Introduction – if, if….else, nesting of if …else statements- else if ladder – The switch statement, The?: Operator – The goto Statement. Decision Making and Looping: Introduction- The while statement- the do statement – the for statement-jumps in loops. Arrays – Character Arrays and Strings

UNIT IV	Functions	12

User-Defined Functions: Introduction – Need and Elements of User-Defined Functions- Definition-Return Values and their types - Function Calls – Declarations – Category of Functions- Nesting of Functions - Recursion – Passing Arrays and Strings to Functions - The Scope, Visibility and Lifetime of Variables- Multi file Programs- Structures and Unions.

UNIT V	Pointers	13
Pointers: Introduction-Understanding pointers-Accessing the address of a variable-Declaration and Initialization of pointer Variable – Accessing a variable through its pointer-Chain of pointers- Pointer Expressions – Pointer Increments and Scale factor- Pointers and Arrays- Pointers and Strings – Array of pointers – Pointers as Function Arguments- Functions returning pointers – Pointers to Functions – Pointers and Structures. File Management in C.		
Total Lecture Hours		**60 Hours**
Text Book(S)		
1	E Balagurusamy: Computing Fundamentals & C Programming – Tata McGraw-Hill, Second Reprint 2008.	
Reference Book(s):		
1	Ashok N Kamthane: Programming with ANSI and Turbo C, Pearson, 2002. 2. Henry Mullish& Hubert L.Cooper: The Sprit of C, Jaico, 1996.	
	Related Online Contents (MOOC, SWAYAM,NPTEL, Websites etc)	
1	**https://onlinecourses.swayam2.ac.in/aic20_sp06/preview**	
2	**https://onlinecourses.swayam2.ac.in/arp19_ap79/preview**	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	S	L	L	-	L	-	L	L	-	-	S	L	-
CO2	S	L	S	-	-	-	L	L	L	-	S	S	L
CO3	S	M	S	-	-	-	L	L	L	-	S	S	L
CO4	S	M	S	-	-	-	L	L	L	-	S	S	L
CO5	S	M	S	-	-	-	L	L	L	-	S	S	L

***S-Strong M-Medium L-Low**

Course Code		Programming Lab - C	L	T	P	C
Core/elective/Supportive		Core Lab : 1	0	0	3	4
Pre - requisite		• Basic knowledge in computers	Syllabus version		I	

Course Objectives

To introduce the concepts of Procedure Oriented Programming and the various programming constructs of C programming.

Expected Course Outcomes

1	Apply the various basic programming constructs like decision making statements, looping statements, functions, structures, pointers and files.	K3
2	Design programs using the concept of files in C and be able to simulate operations.	K6
3	Illustrate the efficient techniques in programming to solve various scientific Problems.	K3

K1 – Remember K2 – Understand K3 – Apply K4- Analyze K5 – Evaluate K6- Create

EXERCISE 1	**Implementation of Control structures**	**6**
Develop various C Programs using Control Structures		
Develop various C programs using Switch case.		
EXERCISE 2	**Implementation of Loopings**	**6**
Develop various C program for the implementation of looping		
Develop various C program for the implementation of looping &Conrtol Structures		
EXERCISE 3	**Implementation of Functions**	**9**
Develop a C program to illustrate recursive function.		
Develop a C program to find the palindrome in a given sentence		
Develop a C program to manipulate strings using string functions.		
Develop a C Program using Functions		
EXERCISE 4	**Implementation of Pointers**	**6**
Develop a C program to swap two integers using pointers.		
Develop a C program using Array of Pointers.		
EXERCISE 5	**Implementation of Structures**	**6**
Develop a C program using the structures.		
Develop a C program using Array of Structures.		
EXERCISE 6	**Implementation of Files**	**6**
Develop a C program to calculate electricity bill using files		
EXERCISE 7	**Implementation of Security**	**6**
Develop a C program to encrypt and decrypt a string		
Develop a G program to encrypt and decrypt Files		
Total Lecture Hours		**45 Hours**

Text Book(S)	
1	E Balagurusamy: Computing Fundamentals & C Programming – Tata McGraw-Hill, Second Reprint 2008.
Reference Book(s)	
1	Ashok N Kamthane: Programming with ANSI and Turbo C, Pearson, 2002. 2. Henry Mullish& Hubert L.Cooper: The Sprit of C, Jaico, 1996.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	**S**	**S**	**S**	**-**	**M**	**-**	**L**	**L**	**L**	**-**	**S**	**S**	**-**
CO2	**S**	**S**	**S**	**-**	**M**	**-**	**L**	**L**	**L**	**-**	**S**	**S**	**-**
CO3	**S**	**S**	**S**	**-**	**M**	**-**	**L**	**L**	**L**	**-**	**S**	**S**	**-**

***S-Strong M-Medium L-Low**

Course Code		Data Structures	L	T	P	C
Core/elective/Supportive		Core : 2	4	0	0	4
Pre - requisite		● Basic knowledge of Programming Constructs	Syllabus version		I	

Course Objectives

- To introduce the concept of data structures and the types of data structures
- To demonstrate how various data structures can be implemented and used in various applications

Expected Course Outcomes

1	Demonstrate the algorithm and how arrays, stacks, queues are represented in the main memory and various operations are performed on those data structures.	K3
2	Demonstrate how linked lists are represented in the main memory and various operations are performed on those data structures.	K3
3	Discuss the Tree and Graph structures, terminology, representation and various travels.	K2
4	Interpret the external sorting on disks, tapes, static and dynamic tree tables and hash tables functions.	K2
5	Apply the different types of Internal sorting, Sorting keys, Index Techniques and files.	K3

K1 – Remember K2 – Understand K3 – Apply K4- Analyze K5 – Evaluate K6- Create

UNIT I	INTRODUCTION	12 Hours

Introduction: Introduction of Algorithms, Analyzing Algorithms. Arrays: Sparse Matrices - Representation of Arrays. Stacks and Queues. Fundamentals - Evaluation of Expression Infix to Postfix Conversion - Multiple Stacks and Queues

UNIT II	LINKED LIST	12

Linked List: Singly Linked List - Linked Stacks and Queues - Polynomial Addition - More on Linked Lists - Sparse Matrices - Doubly Linked List and Dynamic - Storage Management - Garbage Collection and Compaction.

UNIT III	NON LINEAR DATA STRUCTURES	12 Hours

Trees: Basic Terminology - Binary Trees - Binary Tree Representations - Binary Trees -Traversal - More on Binary Trees - Threaded Binary Trees - Binary Tree Representation of Trees - Counting Binary Trees. Graphs: Terminology and Representations - Traversals, Connected Components and Spanning Trees, Shortest Paths and Transitive Closure

UNIT IV	EXTERNAL – SORTING	12 Hours

External Sorting: Storage Devices -Sorting with Disks: K-Way Merging - Sorting with Tapes Symbol Tables: Static Tree Tables - Dynamic Tree Tables - Hash Tables: Hashing Functions - Overflow Handling.

UNIT V	INTERNAL – SORTING	12 Hours

Internal Sorting: Insertion Sort - Quick Sort - 2 Way Merge Sort - Heap Sort - Shell Sort - Sorting on Several Keys. Files: Files, Queries and Sequential organizations - Index Techniques -File Organizations.

Total Hours	60

		Hours
Text Book(s)		
1	Ellis Horowitz, Sartaj Shani, Data Structures, Galgotia Publication.	
Reference Book(s)		
1	Ellis Horowitz, Sartaj Shani, Sanguthevar Rajasekaran, Computer Algorithms, Galgotia Publication.	
	Related Online Contents (MOOC, SWAYAM,NPTEL, Websites etc)	
1	**https://onlinecourses.swayam2.ac.in/aic20_sp06/preview**	
2	**https://onlinecourses.swayam2.ac.in/arp19_ap79/preview**	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	S	L	L	-	L	-	L	L	-	-	S	S	-
CO2	S	M	S	-	L	-	L	L	-	-	S	S	-
CO3	S	M	S	-	L	-	L	L	-	-	S	S	-
CO4	S	M	S	-	L	-	L	L	-	-	S	S	-
CO5	S	M	S	-	L	-	L	L	-	-	S	S	L

***S-Strong M-Medium L-Low**

Course Code		Discrete Mathematics	L	T	P	C
Core/elective/Supportive		Allied : 1	4	0	0	4
Pre - requisite		Basic knowledge in Mathematics	Syllabus version		I	

Course Objectives

- Introduce students to the techniques, algorithms, and reasoning processes involved in the study of discrete mathematical structures.
- Introduce students to set theory, inductive reasoning, elementary and advanced counting techniques, equivalence relations, recurrence relations, graphs, and trees.
- Introduce students to prove mathematical statements by means of inductive reasoning

Expected Course Outcomes

1	Explain discrete mathematical preliminaries and apply discrete mathematics in formal representation of various computing constructs	**K2**
2	Demonstrate the various type of proof techniques, relations and functions	**K2**
3	Demonstrate the concept of permutations and combinations.	**K2**
4	Describe the homogeneous and non- homogeneous recurrence relations	**K1**
5	Describe the concept of lattices, properties of lattices and lattices as algebraic system	**K1**

K1 – Remember K2 – Understand K3 – Apply K4- Analyze K5 – Evaluate K6- Create

UNIT I	MATHEMATICAL LOGIC	15

Proposition – Logical Operators – Truth Tables – Laws of Logic – Equivalances – Rules of interface – validity Arguments – Consistency of Specifications **–** Propositonal Calculus – Quantifiers and universe of discourse.

UNIT II	PROOF TECHNIQUES & RELATIONS AND FUNCTIONS	15

PROOF TECHNIQUES: Introduction – Methods of proving theorems – Direct Proofs, Proof by Contraposition, Vacuous and trivial proofs, Proofs by contradiction – Mistakes in Proofs – Mathematical induction – Strong Mathematical induction – Strong mathematical induction and well ordering – Program Correctness.

RELATIONS AND FUNCTIONS: Definition and properties of binary relations – Representing Relations – Closures of Relations – Composition of Relations – Equivalence Relations – Partitions and Covering of sets – Partial Orderings – n-array Relations and their applications. Functions – Injective, Surjective, Bijective functions, Composition, identity and inverse.

UNIT III	COMBINATORICS	15

Basics of Counting – The Pigeonhole principle – Permutations and Combinations with and without repetition, Permutations with indistinguishable elements – distributions of objects – Generating permutations and combinations in lexicographic order.

UNIT IV	RECURRENCE RELATIONS	15

Some Recurrence Relation Models – Solution of linear homogeneous recurrence relations with constant coefficients – solution of linear non-homogeneous recurrence relations by the method of characteristic roots – Divide and conquer recurrence relations.

UNIT V	LATTICES	15
Lattices as partially ordered set – Properties of Lattices – Lattices as algebraic system – Sub lattices – Direct Product and Homomorphism – Some special lattices.		
Total Lecture Hours		**75** Hours
Text Book(s)		
1	Kenneth H. Rosen, "Discrete Mathematics and its applications", McGraw Hill, 2011.	
2	Judith L.Gersting, "Mathematical Structures for Computer Science", W.H> Freeman and Company, 2014	
3	Tremblay J.P. and Manohar R., "Discrete and Combinatorial Mathamatics – An Introduction", Addison Wesley, 2009.	
Reference Books		
1	Doerr Alan and Levasseur K., "Applied Discrete Structures for Computer Science", Galgotia Publications, 2002	
2	Benard Kolman, Robert C. Busby and Sharan Ross, " Discrete Mathematical Structures", Pearson Education, 2014	
Related Online Contents (MOOC, SWAYAM,NPTEL, Websites etc)		
1	**https://onlinecourses.swayam2.ac.in/aic20_sp06/preview**	
2	**https://onlinecourses.swayam2.ac.in/arp19_ap79/preview**	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	S	S	S	-	-	-	L	L	-	-	S	S	S
CO2	S	S	S	-	-	-	L	L	-	-	S	S	S
CO3	S	S	S	-	-	-	L	L	-	-	S	S	S
CO4	S	S	S	-	-	-	L	L	-	-	S	S	S
CO5	S	S	S	-	-	-	L	L	-	-	S	S	S

***S-Strong M-Medium L-Low**

Course Code		Programming in C++	L	T	P	C
Core/elective/Supportive		Core : 3	5	0	0	4
Pre - requisite		● Basic knowledge of Procedure Oriented Programming concepts ● Basic knowledge in C Programming	Syllabus version		I	

Course Objectives

To introduce he concepts of Object Oriented Programming Paradigm and the programming constructs of C++

Expected Course Outcomes

1	Describe the concept of object oriented programming, control structures and functions.	K1
2	Describe the concept of class, object, member variable, member functions, friend function, constructor and destructor.	K1
3	Explain the operator overloading, inheritance, polymorphism, virtual base classes and Abstract classes.	K4
4	Demonstrate the concept of pointers, Polymorphism and virtual functions.	K3
5	Demonstrate the various file stream classes, file types, String objects and Exception Handling.	K3

K1 – Remember K2 – Understand K3 – Apply K4- Analyze K5 – Evaluate K6- Create

UNIT I	Introduction to C++	12

Introduction to C++ - key concepts of Object-Oriented Programming –Advantages – Object Oriented Languages – I/O in C++ - C++ Declarations. Control Structures : - Decision Making and Statements : If .. else ,jump, goto, break, continue, Switch case statements - Loops in C++ : for, while, do - functions in C++ - inline functions – Function Overloading.

UNIT II	Classes and Objects	14

Classes and Objects: Declaring Objects – Defining Member Functions – Static Member variables and functions – array of objects –friend functions – Overloading member functions – Bit fields and classes – Constructor and destructor with static members.

UNIT III	Operator Overloading and Inheritance	16

Operator Overloading: Overloading unary, binary operators – Overloading Friend functions – type conversion – Inheritance: Types of Inheritance – Single, Multilevel, Multiple, Hierarchal, Hybrid, Multi path inheritance – Virtual base Classes – Abstract Classes.

UNIT IV	Pointers and Polymorphism	18

Pointers – Declaration – Pointer to Class , Object – this pointer – Pointers to derived classes and Base classes – Arrays – Characteristics – array of classes – Memory models – new and delete operators –

dynamic object – Binding, Polymorphism and Virtual Functions.		
UNIT V	**File and Exception Handling**	**15**
Files – File stream classes – file modes – Sequential Read / Write operations – Binary and ASCII Files – Random Access Operation – Templates – Exception Handling - String – Declaring and Initializing string objects – String Attributes – Miscellaneous functions .		
	Total Lecture Hours	**75 Hours**
Text Book(s)		
1	Ashok N Kamthane, Object-Oriented Programming with Ansi And Turbo C++, Pearson Education, 2003.	
Reference Books		
1	E. Balagurusamy, Object-Oriented Programming with C++, TMH, 1998.	
2	Maria Litvin & Gray Litvin, C++ for you, Vikas publication, 2002.	
3	John R Hubbard, Programming with C, 2nd Edition, TMH publication, 2002	
	Related Online Contents (MOOC, SWAYAM,NPTEL, Websites etc)	
1	**https://onlinecourses.swayam2.ac.in/aic20_sp06/preview**	
2	**https://onlinecourses.swayam2.ac.in/arp19_ap79/preview**	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	**S**	**L**	**L**	**-**	**L**	**-**	**L**	**L**	**-**	**-**	**S**	**L**	**-**
CO2	**S**	**L**	**S**	**-**	**-**	**-**	**L**	**L**	**L**	**-**	**S**	**S**	**L**
CO3	**S**	**M**	**S**	**-**	**-**	**-**	**L**	**L**	**L**	**-**	**S**	**S**	**L**
CO4	**S**	**M**	**S**	**-**	**-**	**-**	**L**	**L**	**L**	**-**	**S**	**S**	**L**
CO5	**S**	**M**	**S**	**-**	**-**	**-**	**L**	**L**	**L**	**-**	**S**	**S**	**L**

***S-Strong M-Medium L-Low**

Course Code		Programming Lab – C++	L	T	P	C
Core/elective/Supportive		Core Lab : 2	0	0	4	4
Pre - requisite		• Basic knowledge of Procedure Oriented Programming concepts • Basic knowledge in C Programming	Syllabus version		I	

Course Objectives

To introduce he concepts of Object Oriented Programming Paradigm and the programming constructs of C++

Expected Course Outcomes

1	Apply the various basic programming constructs, decision making statement, looping statements, functions, concepts like overloading, inheritance, polymorphism, virtual functions , constructors and destructors	K3
2	Illustrate the concept of Virtual Classes, inline functions and friend functions	K3
3	Compare the various file stream classes; file types, usage of templates and exception handling mechanisms.	K5
4	Compare the pros and cons of procedure oriented language with the concepts of object oriented language	K5

K1 – Remember K2 – Understand K3 – Apply K4- Analyze K5 – Evaluate K6- Create

PROGRAM - 1		**5**

Write a C++ Program to create a class to implement the data structure STACK. Write a constructor to initialize the TOP of the STACK. Write a member function PUSH () to insert an element and member function POP () to delete an element check for overflow and underflow conditions.

PROGRAM - 2		**5**

Write a C++ Program to create a class ARITHMETIC which consists of a FLOAT and an INTEGER variable. Write member functions ADD (), SUB (), MUL (), DIV () to perform addition, subtraction, multiplication, division respectively. Write a member function to get and display values.

PROGRAM - 3		**5**

Write a C++ Program to read an integer number and find the sum of all the digits until it reduces to a single digit using constructors, destructors and inline member functions.

PROGRAM - 4		**5**

Write a C++ Program to create a class FLOAT that contains one float data member. Overload all the four Arithmetic operators so that they operate on the object FLOAT.

PROGRAM - 5		**5**

Write a C++ Program to create a class STRING. Write a Member Function to initialize, get and display stings. Overload the operators ++ and == to concatenate two Strings and to compare two strings respectively.

PROGRAM -6		**5**

Write a C++ Program to create class, which consists of EMPLOYEE Detail like E_Number, E_Name, Department, Basic, Salary, and Grade. Write a member function to get and display them. Derive a class PAY from the above class and write a member function to calculate DA, HRA and PF depending on the grade.

PROGRAM - 7		**5**
Write a C++ Program to create a class SHAPE which consists of two VIRTUAL FUNCTIONS Calculate_Area () and Calculate_Perimeter () to calculate area and perimeter of various figures. Derive three classes SQUARE, RECTANGLE, TRIANGE from class Shape and Calculate Area and Perimeter of each class separately and display the result.		
PROGRAM - 8		**5**
Write a C++ Program to create two classes each class consists of two private variables, a integer and a float variable. Write member functions to get and display them. Write a FRIEND Function common to both classes, which takes the object of above two classes as arguments and the integer and float values of both objects separately and display the result.		
PROGRAM - 9		**5**
Write a C++ Program using Function Overloading to read two Matrices of different Data Types such as integers and floating point numbers. Find out the sum of the above two matrices separately and display the sum of these arrays individually.		
PROGRAM -10		**5**
Write a C++ Program to check whether the given string is a palindrome or not using Pointers.		
PROGRAM -11		**5**
Write a C++ Program to create a File and to display the contents of that file with line numbers.		
PROGRAM -12		**5**
Write a C++ Program to merge two files into a single file.		
Total Lecture Hours		**60 Hours**

	Text Book(s)
1	Ashok N Kamthane, Object-Oriented Programming with Ansi And Turbo C++, Pearson Education, 2003.
	Reference Books
1	E. Balagurusamy, Object-Oriented Programming with C++, TMH, 1998.
2	Maria Litvin & Gray Litvin, C++ for you, Vikas publication, 2002.
3	John R Hubbard, Programming with C, 2nd Edition, TMH publication, 2002

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	**S**	**S**	**S**	**-**	**M**	**-**	**L**	**L**	**L**	**-**	**S**	**S**	**-**
CO2	**S**	**S**	**S**	**-**	**M**	**-**	**L**	**L**	**L**	**-**	**S**	**S**	**-**
CO3	**S**	**S**	**S**	**-**	**M**	**-**	**L**	**L**	**L**	**-**	**S**	**S**	**-**
CO4	**S**	**S**	**S**	**-**	**M**	**-**	**L**	**L**	**L**	**-**	**S**	**S**	**-**

***S-Strong M-Medium L-Low**

Course Code		Internet Basics - Lab	L	T	P	C
Core/elective/Supportive		Core Lab : 3	0	0	2	2
Pre - requisite		● Basic knowledge in Computers	Syllabus version		I	

Course Objectives

1. Introduce the fundamentals of Internet and the Web functions.
2. Impart knowledge and essential skills necessary to use the internet and its various components.
3. Find, evaluate, and use online information resources.
4. Use Google Apps for education effectively.

Expected Course Outcomes

1	Apply the predefined procedures to create Gmail account, check and receive messages	**K3**
2	Apply the predefined procedures to perform various basic operations on internet	**K3**
3	Utilize various google applications like docs, google classroom, google drive, google forms, google meet and slides	**K3**

K1 – Remember K2 – Understand K3 – Apply K4- Analyze K5 – Evaluate K6- Create

PROGRAM - 1	**2**
Create an email account in Gmail. Using the account created compose a mail to invite other college students for your college fest, enclose the invitation as attachment and send the mail to at least 50 recipients. Use CC and BCC options accordingly	
PROGRAM - 2	**2**
Open your inbox in the Gmail account created, check the mail received from your peer from other college inviting you for his college fest, and download the invitation. Reply to the mail with a thank you note for the invite and forward the mail to other friends	
PROGRAM - 3	**2**
Assume that you are studying in final year of your graduation and are eagerly looking for a job. Visit any job portal and upload your resume.	
PROGRAM - 4	**2**
Create a meeting using Google calendar and share meeting id to the attendees. Transfer the ownership to the Manager once the meeting id is generated.	
PROGRAM - 5	**2**
Create a label and upload bulk contacts using import option in Google Contacts	
PROGRAM -6	**4**
Create your own Google classroom and invite all your friends through email id. Post study material in Google classroom using Google drive. Create a separate folder for every subject and upload all unit wise E-Content Materials.	
PROGRAM -7	
Create and share a folder in Google Drive using „share a link“ option and set the permission to access that folder by your friends only.	
PROGRAM -8	
Create one-page story in your mother tongue by using voice recognition facility of Google Docs	

PROGRAM -9	**2**
Create a registration form for your Department Seminar or Conference using Google Forms.	
PROGRAM -10	**2**
Create a question paper with multiple choice types of questions for a subject of your choice, using Google Forms.	
PROGRAM -11	**4**
Create a meet using Google Calendar and record the meet using Google Meet. Create a Google slides for a topic and share the same with your friends.	
PROGRAM -12	**4**
Create template for a seminar certificate using Google Slides.	
PROGRAM -13	
Create a sheet to illustrate simple mathematical calculations using Google Sheets. Create student‟s internal mark statement and share the Google sheets via link.	**4**
Total Lecture Hours	**30 Hours**

Text Book(s)	
1	Ian Lamont, Google Drive & Docs in 30 Minutes, 2nd Edition.

Reference Book(s)	
1	Sherry Kinkoph Gunter, My Google Apps, 2014.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	**S**	**S**	**S**	**-**	**S**	**S**	**L**	**L**	**L**	**-**	**S**	**S**	**-**
CO2	**S**	**S**	**S**	**-**	**S**	**S**	**L**	**L**	**L**	**-**	**S**	**S**	**-**
CO3	**S**	**S**	**S**	**-**	**S**	**S**	**L**	**L**	**L**	**-**	**S**	**S**	**-**
CO4	**S**	**S**	**S**	**-**	**S**	**S**	**L**	**L**	**L**	**-**	**S**	**S**	**-**

***S-Strong M-Medium L-Low**

Course Code		Introduction to Statistics	L	T	P	C
Core/elective/Supportive		Allied : 2	5	0	0	4
Pre - requisite		None	Syllabus version		I	

Course Objectives

- Students will summarize data visually and numerically.
- Students will analyse mathematical and probabilistic foundations of statistical inference.
- Apply statistical analyses with professional software.

Expected Course Outcomes

1	Interpret the concept of various types of distributions and related problems.	**K3**
2	Construct the need for statistical and point estimation of the parameters.	**K3**
3	Categorize various types of sampling distributions concepts.	**K4**
4	Describe the basic idea of statistical and linear regression, correlation coefficient.	**K2**
5	Explain the concept of simulating the specific distributions and Importance Sampling.	**K2**

K1 – Remember K2 – Understand K3 – apply K4- Analyze K5 – evaluate K6- Create

UNIT I	Special Distributions	15

The Bernoulli and Binomial Distributions - The Poisson Distributions - The Negative Binomial Distributions - The Normal Distributions - The Gamma Distributions-Problems.

UNIT II	Estimations	15

Statistical Inference - Prior and Posterior Distributions - Conjugate Prior Distributions - Bayes Estimators - Maximum Likelihood Estimators - Properties of Maximum Likelihood Estimators - Sufficient Statistics - Jointly Sufficient Statistics - Improving an Estimator.

UNIT III	Sampling distribution of a statistic	15

The Chi-Square Distributions - Joint Distribution of the Sample Mean and Sample Variance - The t-Distributions - Confidence Intervals - Bayesian Analysis of Samples from a Normal Distribution - Unbiased Estimators - Fisher Information.

UNIT IV	Regression and Correlation	15

Regression: Statistical regression and predition, linear regression, analysis of variance. **Correlation**: Definition and meaning, Correlation coefficient.

UNIT V	Simulations	15

Simulations: What Is Simulation? - Why Is Simulation Useful? - Simulating Specific Distributions - Importance Sampling - Markov Chain Monte Carlo - The Bootstrap.

Total Lecture Hours	75 Hours

Text Book(s)	
1	Morris H. DeGroot Mark, J. Schervish, “Probability and Statistics”, 4th Edition, Person, 2011.
2	S. P. Gupta & M. P. Gupta, Business Statistics, Sultan Chand and Sons.
Reference Books	
1	A. K. Md. Ehsanes Salah and V. K. Rohatgi, “An Introduction to Probability and Statistics”, 3rd Edition, Wiley, 2015.
2	Sheldon M. Ross, “A First Course in Probability”, 6th Edition, Pearson, 2009.

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PSO1**	**PSO2**	**PSO3**
CO1	**S**	**S**	**S**	**-**	**-**	**-**	**L**	**L**	**-**	**-**	**S**	**S**	**S**
CO2	**S**	**S**	**S**	**-**	**-**	**-**	**L**	**L**	**-**	**-**	**S**	**S**	**S**
CO3	**S**	**S**	**S**	**-**	**-**	**-**	**L**	**L**	**-**	**-**	**S**	**S**	**S**
CO4	**S**	**S**	**S**	**-**	**-**	**-**	**L**	**L**	**-**	**-**	**S**	**S**	**S**
CO5	**S**	**S**	**S**	**-**	**-**	**-**	**L**	**L**	**-**	**-**	**S**	**S**	**S**

***S-Strong M-Medium L-Low**

Course Code		Java Programming	L	T	P	C
Core/elective/Supportive		Core : 4	6	0	0	4
Pre - requisite		• Basic knowledge of Programming Constructs. • Knowledge on Object Oriented Programming Concepts.	Syllabus version		I	

Course Objectives

- To introduce the concepts of Object Oriented Programming Paradigm and the programming constructs of JAVA

Expected Course Outcomes

1	Identify the history of JAVA and its evolution, Features, Outline the benefits and applications of objects oriented programming concepts and how JAVA differs from other programming languages.	K1
2	Discuss the various java programming language concepts, Data types, Operators and expressions, Decision Making and Branching Statements, Classes, Objects and Methods.	K2
3	Explain the Concept of Arrays, Strings and Vectors. Object Oriented Concepts, inheritance, Interfaces, threads and packages	K2
4	Illustrate the concepts of exception handling, Applet Programming and Graphics Programming.	K3
5	Analyze the concepts of files and the concept of file classes and stream classes.	K4

K1 – Remember K2 – Understand K3 – Apply K4- Analyze K5 – Evaluate K6- Create

UNIT I	Fundamentals of OOP	18

Fundamentals of Object-Oriented Programming: Object-Oriented Paradigm – Basic Concepts of Object-Oriented Programming – Benefits of Object-Oriented Programming – Application of Object-Oriented Programming. Java Evolution: History – Features – How Java differs from C and C++ – Java and Internet – Java and www –Web Browsers. Overview of Java: simple Java program – Structure – Java Tokens – Statements – Java Virtual Machine.

UNIT II	Variables & Control Structures	18

Constants, Variables, Data Types - Operators and Expressions – Decision Making and Branching: if, if...else, nested if, switch? : Operator - Decision Making and Looping: while, do, for – Jumps in Loops - Labeled Loops – Classes, Objects and Methods.

UNIT III	Arrays & Classes	18

Arrays, Strings and Vectors – Interfaces: Multiple Inheritance – Packages: Putting Classes together – Multithreaded Programming.

UNIT IV	Error Handling & Graphics	18

Managing Errors and Exceptions – Applet Programming – Graphics Programming.

UNIT V	I/O Streams	18

Managing Input / Output Files in Java: Concepts of Streams- Stream Classes – Byte Stream classes – Character stream classes – Using streams – I/O Classes – File Class – I/O exceptions – Creation of files – Reading / Writing characters, Byte-Handling Primitive Data Types – Random Access Files.

Total Lecture Hours		**90**
Text Book(s)		
1	Programming with Java – A Primer - E. Balagurusamy, 3rd Edition, TMH.	
ReferenceBook(s)		
1	The Complete Reference Java 2 - Patrick Naughton & Hebert Schildt, 3rd Edition, TMH	
2	Programming with Java – John R. Hubbard, 2nd Edition, TMH.	
	Related Online Contents (MOOC, SWAYAM,NPTEL, Websites etc)	
1	**https://onlinecourses.swayam2.ac.in/aic20_sp06/preview**	
2	**https://onlinecourses.swayam2.ac.in/arp19_ap79/preview**	

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PSO1**	**PSO2**	**PSO3**
CO1	**S**	**L**	**L**	**-**	**L**	**-**	**L**	**L**	**-**	**-**	**S**	**L**	**-**
CO2	**S**	**L**	**S**	**-**	**-**	**-**	**L**	**L**	**L**	**-**	**S**	**S**	**L**
CO3	**S**	**M**	**S**	**-**	**-**	**-**	**L**	**L**	**L**	**-**	**S**	**S**	**L**
CO4	**S**	**M**	**S**	**-**	**-**	**-**	**L**	**L**	**L**	**-**	**S**	**S**	**L**
CO5	**S**	**M**	**S**	**-**	**-**	**-**	**L**	**L**	**L**	**-**	**S**	**S**	**L**

***S-Strong M-Medium L-Low**

Course Code		JAVA Programming Lab	L	T	P	C
Core/elective/Supportive		Core Lab :4	0	0	5	4
Pre - requisite		● Basic knowledge of Programming Constructs ● Knowledge on Object Oriented Programming Concepts	Syllabus version		I	

Course Objectives

- To introduce the concepts of Object Oriented Programming Paradigm and the programming constructs of JAVA

Expected Course Outcomes

1	Apply the various basic programming constructs of JAVA including decision making statements. Looping statements, overloading, inheritance, polymorphism, constructors and destructors	K3
2	Illustrate the concepts of threading and multi-threading	K3
3	Design programs using various file stream classes; file types, and frames	K6

K1 – Remember K2 – Understand K3 – Apply K4- Analyze K5 – Evaluate K6- Create

PROGRAM 1	**3**
Write a Java Applications to extract a portion of a character string and print the extracted string.	
PROGRAM 2	**3**
Write a Java Program to implement the concept of multiple inheritance using Interfaces.	
PROGRAM 3	**3**
Write a Java Program to create an Exception called payout-of-bounds and throw the exception.	
PROGRAM 4	**3**
Write a Java Program to implement the concept of multithreading with the use of any three multiplication tables and assign three different priorities to them.	
PROGRAM 5	**6**
Write a Java Program to draw several shapes in the created windows.	
PROGRAM 6	**6**
Write a Java Program to create a frame with four text fields name, street, city and pin code with suitable tables. Also add a button called my details. When the button is clicked its corresponding values are to be appeared in the text fields.	
PROGRAM 7	**6**
Write a Java Program to demonstrate the Multiple Selection List-box.	
PROGRAM 8	**6**
Write a Java Program to create a frame with three text fields for name, age and qualification and a text field for multiple line for address	
PROGRAM 9	**6**
Write a Java Program to create Menu Bars and pull down menus.	
PROGRAM 10	**6**
Write a Java Program to create frames which respond to the mouse clicks. For each events with mouse such as mouse up, mouse down, etc., the corresponding message to be displayed.	
PROGRAM 11	**6**
Write a Java Program to draw circle, square, ellipse and rectangle at the mouse click positions.	
PROGRAM 12	**6**

Write a Java Program which open an existing file and append text to that file.	
Total Lecture Hours	**60 Hours**
Text Book(s)	
1	Programming with Java – A Primer - E. Balagurusamy, 3rd Edition, TMH.
Reference Book(s)	
1	The Complete Reference Java 2 - Patrick Naughton & Hebert Schildt, 3rd Edition, TMH

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PSO1**	**PSO2**	**PSO3**
CO1	**S**	**S**	**S**	**-**	**M**	**-**	**L**	**L**	**L**	**-**	**S**	**S**	**-**
CO2	**S**	**S**	**S**	**-**	**M**	**-**	**L**	**L**	**L**	**-**	**S**	**S**	**-**
CO3	**S**	**S**	**S**	**-**	**M**	**-**	**L**	**L**	**L**	**-**	**S**	**S**	**-**

***S-Strong M-Medium L-Low**

Course code		Artificial Intelligence	L	T	P	C
Core/Elective/ Supportive		Core : 5	5	0	0	4
Pre-requisite		Basic knowledge on knowledge representation, reasoning and problem solving skills	Syllabus Version		I	

Course Objectives:

The main objectives of this course are to:

1. To understand the basic concepts of Artificial Intelligence and identify the AI problems and domains.
2. To provide search techniques to solve the problems.
3. To represent and access the domain specific knowledge.
4. Ability to apply knowledge representation and machine learning techniques to real-world problems

Expected Course Outcomes:

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

1	Describe the nature of AI problems and techniques of AI, Problem space search and issues in design of search.	**K1**
2	Apply the appropriate Heuristic Search techniques to solve the problems by using various algorithms.	**K3**
3	Select the suitable knowledge representation method and issues.	**K4**
4	Explain Representing simple facts and logic computable functions and predicates using Predicate Logic.	**K2**
5	Compare the Procedural Versus Declarative knowledge, forward and backward reasoning and Matching by Representing the knowledge using Rules.	**K4**

K1 – Remember K2 – Understand K3 – Apply K4- Analyze K5 – Evaluate K6- Create

Unit:1	INTRODUCTION	15 hours

Introduction: AI Problems – AI techniques – Criteria for success. Problems, Problem Spaces, Search: State space search – Production Systems – Problem Characteristics – Issues in design of Search.

Unit:2	HEURISTIC SEARCH TECHNIQUES	12 hours

Heuristic Search techniques: Generate and Test – Hill Climbing – Best-Fist, Problem Reduction, Constraint Satisfaction, Means-end analysis.

Unit:3	KNOWLEDGE REPRESENTATION	15 hours

Knowledge representation issues: Representations and mappings – Approaches to Knowledge representations – Issues in Knowledge representations – Frame Problem.

Unit:4	PREDICATE LOGIC	15 hours

Using Predicate Logic: Representing simple facts in logic – Representing Instance and Is a relationships – Computable functions and predicates – Resolution – Natural deduction.

Unit:5	REPRESENTING KNOWLEDGE USING RULES	15 hours

Representing knowledge using rules: Procedural Vs Declarative knowledge – Logic programming – Forward Vs Backward reasoning – Matching – Control knowledge Brief explanation of Expert Systems-Definition- Characteristics-architecture- Knowledge Engineering- Expert System Life Cycle-Knowledge Acquisition Strategies- Expert System Tools.

Unit:6	Contemporary Issues	3 hours
Expert lectures, online seminars – webinars		
	Total Lecture hours	**75 hours**

Text Book(s)	
1	Artificial Intelligence, Elaine Rich and Kelvin Knight, TMH, 2nd Edn, 1991
2	Artificial Intelligence A Modern Approach, Stuart Russell & Peter Norvig, 2nd Edition Perason.
Reference Books	
1	Artificial Intelligence, George F Luger, 4th Edition, Pearson, 2002.
2	Foundations of Artificial Intelligent and Expert Systems, V S Janaki Raman, K Sarukesi, P Gopalakrishnan, MacMillan India limited.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	S	M	M	-	-	-	L	L	-	L	S	-	-
CO2	S	M	M	-	-	-	L	L	-	L	S	-	-
CO3	S	M	M	-	-	-	L	L	-	L	S	-	-
CO4	S	M	M	-	-	-	L	L	-	L	S	-	-
CO5	S	M	M	-	-	-	L	L	-	L	S	-	-

***S-Strong M-Medium L-Low**

Course code		Software Engineering	L	T	P	C
Core/Elective/Supportive		Allied : 3	6	0	0	4
Pre-requisite		Basic understanding in software project and system analysis and design concepts	Syllabus Version		I	

Course Objectives:

The main objectives of this course are to:

1. To enhance the basic software engineering methods and practices.
2. To learn the techniques for developing software systems.
3. To understand the design concepts.
4. To understand software testing approaches

Expected Course Outcomes:

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

1	Identify the basics of software engineering, planning a software project.	**K1**
2	Express the knowledge in software cost estimation and techniques.	**K2**
3	Interpret the software requirements specification, formal specification techniques, and software design concepts.	**K2**
4	Select the design notations, design techniques and implementation issues.	**K4**
5	Summarize the verification and validation techniques, software maintenance and Configuration management.	**K2**

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	INTRODUCTION TO SOFTWARE ENGINEERING	14 hours

Introduction to Software Engineering: Definitions – Size Factors – Quality and Productivity Factors. Planning a Software Project: Planning the Development Process – Planning an Organizational Structure.

Unit:2	SOFTWARE COST ESTIMATION	14 hours

Software Cost Estimation: Software cost Factors – Software Cost Estimation Techniques – Staffing-Level Estimation – Estimating Software Estimation Costs.

Unit:3	SOFTWARE REQUIREMENTS	14 hours

Software Requirements Definition: The Software Requirements specification – Formal Specification Techniques. Software Design: Fundamental Design Concepts – Modules and Modularization Criteria.

Unit:4	DESIGN NOTATIONS	15 hours

Design Notations – Design Techniques. Implementation Issues: Structured Coding Techniques – Coding Style – Standards and Guidelines – Documentation Guidelines.

Unit:5	VERIFICATION AND VALIDATION TECHNIQUES	15 hours

Verification and Validation Techniques: Quality Assurance – Walkthroughs and Inspections – Unit Testing and Debugging – System Testing. Software Maintenance: Enhancing Maintainability during Development – Managerial Aspects of Software Maintenance – Configuration Management.

Unit:6	Contemporary Issues	3 hours

Expert lectures, online seminars – webinars

	Total Lecture hours	75 hours

Text Book(s)	
1	Software Engineering Concepts, Richard Fairley, 1997, TMH. (UNIT-I: 1.1-1.3, 2.3-2.4 UNIT-II: 3.1-3.4 UNIT III: 4.1-4.2, 5.1-5.2 UNIT-IV: 5.3-5.4, 6.1-6.4 UNIT-V: 8.1-8.2, 8.5-8.6, 9.1-9.3)
Reference Books	
1	Software Engineering for Internet Applications, Eve Anderson, Philip Greenspun, Andrew Grumet, 2006, PHI.
2	Software Engineering Project Management – 2nd Edition, Wiley India.
3	Software Quality Engineering, Jeff Tian, Student Edition, 2006, Wiley India.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	**S**	**-**	**L**	**-**	**-**	**-**	**L**	**L**	**-**	**L**	**S**	**-**	**-**
CO2	**S**	**-**	**L**	**-**	**-**	**-**	**L**	**L**	**-**	**L**	**S**	**-**	**-**
CO3	**S**	**-**	**L**	**-**	**-**	**-**	**L**	**L**	**-**	**L**	**S**	**-**	**-**
CO4	**S**	**-**	**L**	**-**	**-**	**-**	**L**	**L**	**-**	**L**	**S**	**-**	**-**
CO5	**S**	**-**	**L**	**-**	**-**	**-**	**L**	**L**	**-**	**L**	**S**	**-**	**-**

***S-Strong M-Medium L-Low**

Course code		Operating Systems	L	T	P	C
Core/Elective/ Supportive		Skill Based Subject : 1	6	0	0	4
Pre-requisite		Knowledge on Operating system and how it controls the information and hardware.	Syllabus Version	I		

Course Objectives:

The main objectives of this course are to:

1. To understand the processing of programs on a computer system to design and implementation of language processor.
2. To enhance the ability of program generation through expansion and gain knowledge about Code optimization using software tools.
3. Students will gain knowledge of basic operating system concepts.
4. To have an in-depth understanding of process concepts, deadlock and memory management.
5. To provide an exposure to scheduling algorithms, devices and information management.

Expected Course Outcomes:

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

1	Describe the basic objectives, functions and types of operating system	**K1**
2	Explain the different services of operating system functions and structures, information management.	**K2**
3	Summarize the concepts of process management, multiprogramming evolution and operation on a process.	**K2**
4	Explain the concepts of memory management in operating systems.	**K2**
5	Summarize the knowledge on distributed processing, client-server technologies and clusters	**K2**

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

Unit:1	OPERATING SYSTEM OVERVIEW	12 hours

Operating System Objectives and Functions – The Evolution of Operating Systems – Major Achievements – Developments Leading to Modern Operating Systems – Microsoft Windows Overview – Traditional UNIX Systems – Modern UNIX Systems – Linux 95.

Unit:2	OS-FUNCTIONS AND STRUCTURE	15 hours

Different Services of Operating System – Operating System Structure – Booting. **Information Management:** The File System - Device Driver.

Unit:3	PROCESS MANAGEMENT	15 hours

What Is A Process? – Evolution of Multiprogramming – Context Switching – Process States – Process State Transitions – Operations on a Process.

Unit:4	MEMORY MANAGEMENT	15 hours
Introduction – Single Contiguous Memory Management – Fixed Partition Memory Management – Variable Partitions – Non-contiguous Allocation – Paging – Segmentation – Combined Systems – Virtual Memory Management Systems.		
Unit:5	**DISTRIBUTED PROCESSING, CLIENT/SERVER AND CLUSTERS**	**15 hours**
Client/Server Computing – Distributed Message Passing- Remote Procedure Calls – Clusters –Windows Cluster – Sun Cluster – Beowulf And Linux Clusters.		
Unit:6	**Contemporary Issues**	**3 hours**
Expert lectures, online seminars – webinars		
	Total Lecture hours	**75 hours**

Text Book(s)

1	**OPERATING SYSTEMS Internals and Design Principles – William Stallings**, 5th edition,PHI. *(UNIT-I: 2.1-2.8 UNIT-V: 14.1-14.7)*
2	**OPERATING SYSTEMS – Achyut Godbole** , 2nd edition, TMH. *(UNIT II: 3.2, 3.7, 3.9, 4.2, 4.3 UNIT-III: 5.2-5.6, 5.9 UNIT-IV: 8.1-8.9)*

Reference Books

1	**OPERATING SYSTEMS Concepts and Design – Milan Milankovic,** 2nd edition, TMH.
2	**MODERN OPERATIING SYSTEMS – Andrew S. Tanenbaum,** 2nd edition, PHI.
3	**OPERATING SYSTEM PRINCIPLES – Abraham Silberschatz, Peter Baer Galvin, Greg Gagne,** 7th Edition, Wiley India.

CO1	**S**	-	-	-	-	-	**L**	**L**	-	**L**	**S**	-	-
CO2	**S**	-	-	-	-	-	**L**	**L**	-	**L**	**S**	-	-
CO3	**S**	-	-	-	-	-	**L**	**L**	-	**L**	**S**	-	-
CO4	**S**	-	-	-	-	-	**L**	**L**	-	**L**	**S**	-	-
CO5	**S**	-	-	-	-	-	**L**	**L**	-	**L**	**S**	-	-

***S-Strong M-Medium L-Low**

Course Code		Python Programming	L	T	P	C
Core/elective/Supportive		Core : 6	6	0	0	4
Pre - requisite		• Knowledge in Basics of Object Oriented Programming	Syllabus version		I	

Course Objectives

- To introduce the concepts of the various programming constructs of Python programming

Expected Course Outcomes

1	Identify the various basic programming constructs, Reserved Words, datatypes and operators.	K1
2	Construct various control structures, string operations, Boolean expressions and the concept of lists, tuples for solving programs.	K3
3	Demonstrate the concept of functions and arguments for solving basic programs.	K3
4	Categorize the concepts of error handling mechanisms, data streams and handling I/O exceptions.	K4
5	Describe the concepts of object oriented features, special characters, type definition and greedy matches.	K2

K1 – Remember K2 – Understand K3 – Apply K4- Analyze K5 – Evaluate K6- Create

UNIT I	BASICS	16

Python - Variables - Executing Python from the Command Line - Editing Python Files -Python Reserved Words - Basic Syntax-Comments - Standard Data Types – Relational Operators -Logical Operators - Bit Wise Operators - Simple Input and Output.

UNIT II	CONTROL STATEMENTS, LISTS, TUPLES	17

CONTROL STATEMENTS: Control Flow and Syntax - Indenting - if Statement - statements and expressions- string operations- Boolean Expressions -while Loop - break and continue - for Loop.
LISTS: List-list slices - list methods - list loop–mutability–aliasing - cloning lists - list parameters**.**
TUPLES: Tuple assignment, tuple as return value -Sets–Dictionaries.

UNIT III	FUNCTIONS:	20

Definition - Passing parameters to a Function - Built-in functions- Variable Number of Arguments - Scope – Type conversion-Type coercion-Passing Functions to a Function – Mapping Functions in a Dictionary – Lambda - Modules - Standard Modules – sys – math – time - dir – help Function.

UNIT IV	ERROR HANDLING:	18

Run Time Errors - Exception Model - Exception Hierarchy - Handling Multiple Exceptions - Data Streams - Access Modes Writing - Data to a File Reading - Data From a File - Additional File Methods - Using Pipes as Data Streams - Handling IO Exceptions - Working with Directories.

UNIT V	OBJECT ORIENTED FEATURES:	19

Classes Principles of Object Orientation - Creating Classes -Instance Methods - File Organization - Special Methods - Class Variables – Inheritance – Polymorphism - Type Identification - Simple Character Matches - Special Characters – Character Classes – Quantifiers - Dot Character - Greedy Matches – Grouping - Matching at Beginning or End - Match Objects – Substituting - Splitting a String - Compiling Regular Expressions.

Total Lecture Hours	90 Hours

Text Book(s)

1	Mark Summerfield. ―Programming in Python 3: A Complete introduction to the Python
	Language, Addison-Wesley Professional, 2009.

2	Martin C. Brown, ―PYTHON: The Complete Reference‖, McGraw-Hill, 2001
Reference Book(s)	
1	Allen B. Downey, ``Think Python: How to Think Like a Computer Scientist,,,,, 2nd edition, Updated for Python 3, Shroff/O,,Reilly Publishers, 2016
2	Guido van Rossum and Fred L. Drake Jr, ―An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	S	L	L	-	L	-	L	L	-	-	S	L	-
CO2	S	L	S	-	-	-	L	L	L	-	S	S	-
CO3	S	M	S	-	-	-	L	L	L	-	S	S	-
CO4	S	M	S	-	-	-	L	L	L	-	S	S	-
CO5	S	M	S	-	-	-	L	L	L	-	S	S	-

***S-Strong M-Medium L-Low**

Course Code		Introduction to Machine Learning	L	T	P	C
Core/elective/Supportive		Core :7	6	0	0	4
Pre - requisite		None	Syllabus version		I	

Course Objectives

- To explain about the basics of machine learning

Expected Course Outcomes

1	Identify the algorithmic models of Learning classifiers, functions, probabilistic models and frameworks.	K1
2	Illustrate the mathematical relationships across Machine Learning algorithm and paradigms of supervised learning models including decision trees, neural networks , Support Vector Machines and ensemble classifiers.	K3
3	Describe the concepts of computational learning theory, dimensionality reduction, feature selection and visualization.	K2
4	Demonstrate the mathematical relationships across Machine Learning algorithms and paradigms of un-supervised learning models, clustering and reinforcement learning.	K3
5	Interpret the concepts of applications in data mining, pattern recognition, text and language processing.	K2

K1 – Remember K2 – Understand K3 – apply K4- Analyze K5 – evaluate K6- Create

UNIT I	Introduction to Learning	18

Algorithmic models of learning, Learning classifiers, functions, relations, grammars, probabilistic models, value functions, behaviors and programs for experience. Bayesian, maximum some posterior, and minimum description length frameworks.

UNIT II	ML Supervised Learning - Models	18

Parameter Estimation, sufficient statistics, decision trees, neural networks, support vector machines, Bayesian networks, bag of words classifiers, N-gram models; Markov and Hidden Markov models, probabilistic relational models, association rules, nearest neighbor classifiers, locally weighted regression, ensemble classifiers.

UNIT III	Computational Learning	17

Computational Learning theory, mistake bound analysis, sample complexity analysis, VC dimension, Occam learning, accuracy and confidence boosting, Dimensionality reduction: Principal component Analysis, feature selection and visualization.

UNIT IV	ML Unsupervised Learning - Models	18

Unsupervised Learning: Clustering, mixture models, k-means clustering, hierarchical clustering, distributional clustering, Reinforcement learning; Learning from heterogeneous, distributed, data and knowledge.

UNIT V	Applications in Data Mining	19

Selected applications in data mining, automated knowledge acquisition, pattern recognition, program Synthesis, text and language processing, internet-based information systems, human computer interaction, semantic web, and bioinformatics and computational biology.

Total Lecture Hours	90 Hours

	Text Book(s)
1	Bishop, C. (2006). Pattern Recognition and Machine Learning. Berlin: Springer-Verlag.
	ReferenceBook(s)
1	Russel, S. And Norving, P. (2003). Artificial Intelligence: A Modern Approach. 2nd Edition, New York: Prentice-Hall.
2	Baldi, P., Frasconi, P., Smyth, P. (2002). Bioinformatics: A Machine Learning Approach. Cambridge, MA: MIT Press.
3	Baldi, P., Frasconi, P., Smyth, P. (2003). Modeling the Internet and the Web – Probabilistic Methods and Algorithms. New York: Wiley.
4	Bishop, C.M. Neural Networks for pattern recognition. New York: Oxford University press (1995).
5	Hastie, T., Tibshirani, R., and Friedman, J. (2001). The elements of Statistical Learning – Data mining, Inference, and Prediction, Berlin: Springer- Verlag.
6	Cohen, P.R. (1995) Empirical Methods in Artificial Intelligence. Cambridge, MA: MIT Press.
7	Cowell, R.G., Dawid, A.P., Lauritzen, S.L., and Spiegelhalter. D.J. (1999). Graphical Models and Expert Syatems. Berlin: Springer.
	Related Online Contents (MOOC, SWAYAM,NPTEL, Websites etc)
1	**https://onlinecourses.swayam2.ac.in/aic20_sp06/preview**
2	**https://onlinecourses.swayam2.ac.in/arp19_ap79/preview**

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PSO1**	**PSO2**	**PSO3**
CO1	**S**	**M**	**M**	**-**	**-**	**-**	**L**	**L**	**-**	**L**	**S**	**-**	**-**
CO2	**S**	**M**	**M**	**-**	**-**	**-**	**L**	**L**	**-**	**L**	**S**	**-**	**-**
CO3	**S**	**M**	**M**	**-**	**-**	**-**	**L**	**L**	**-**	**L**	**S**	**-**	**-**
CO4	**S**	**M**	**M**	**-**	**-**	**-**	**L**	**L**	**-**	**L**	**S**	**-**	**-**
CO5	**S**	**M**	**M**	**-**	**-**	**-**	**L**	**L**	**-**	**L**	**S**	**-**	**-**

***S-Strong M-Medium L-Low**

Course Code		Python Programming - Lab	L	T	P	C
Core/elective/Supportive		Core Lab : 5	0	0	3	2
Pre - requisite		● Knowledge in basic Programming	Syllabus version		I	

Course Objectives

- To introduce the concepts of python programming constructs of C++

Expected Course Outcomes

1	Apply the concept of Decision making statements, looping constructs , functions for solving basic programs	K3
2	Analyze the concepts of Lists, tuples and error handling mechanisms	K4
3	Evaluate a program incorporating all the python language constructs	K5

K1 – Remember K2 – Understand K3 – Apply K4- Analyze K5 – Evaluate K6- Create

PROGRAM - 1	**5**
Write a python program that displays the following information: Your name, Full address Mobile number, College name, Course subjects.	
PROGRAM - 2	**5**
Write a python program to find the largest three integers using if-else and conditional operator.	
PROGRAM - 3	**5**
Write a python program that asks the user to enter a series of positive numbers (The user should enter a negative number to signal the end of the series) and the program should display the numbers in order and their sum.	
PROGRAM - 4	**5**
Write a python program to find the product of two matrices [A]mxp and [B]pxr	
PROGRAM - 5	**5**
Write recursive functions for GCD of two integers.	
PROGRAM - 6	**10**
Write recursive functions for the factorial of positive integer.	
PROGRAM - 7	**10**
Write recursive functions for Fibonacci Sequence up to given number n.	
PROGRAM -8	**10**
Write recursive functions to display prime number from 2 to n.	
PROGRAM - 9	**10**
Write a python program that writes a series of random numbers to a file from 1 to n and display.	
PROGRAM - 10	**10**
Write a python program to sort a given sequence: String, List and Tuple.	
PROGRAM -11	**10**
Write a python program to make a simple calculator.	
PROGRAM -12	**10**
Write a python program for Linear Search and Binary Search.	
Total Lecture Hours	**90 Hours**

Text Book(s)

1	Mark Summerfield. ―Programming in Python 3: A Complete introduction to the Python Language, Addison-Wesley Professional, 2009.
2	Martin C. Brown, ―PYTHON: The Complete Reference‖, McGraw-Hill, 2001
Reference Book(s)	
1	Allen B. Downey, ``Think Python: How to Think Like a Computer Scientist,,,,, 2nd edition, Updated for Python 3, Shroff/O,,Reilly Publishers, 2016
2	Guido van Rossum and Fred L. Drake Jr, ―An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.

													PSO3
CO1	**S**	**S**	**S**	**-**	**M**	**-**	**L**	**L**	**L**	**-**	**S**	**S**	**-**
CO2	**S**	**S**	**S**	**-**	**M**	**-**	**L**	**L**	**L**	**-**	**S**	**S**	**-**
CO3	**S**	**S**	**S**	**-**	**M**	**-**	**L**	**L**	**L**	**-**	**S**	**S**	**-**

***S-Strong M-Medium L-Low**

Course Code		Design and Analysis of Algorithms	L	T	P	C
Core/elective/Supportive		Allied : 4	6	0	0	4
Pre - requisite		• Foundation in designing algorithms • Basic knowledge on data structural concepts	Syllabus version		I	

Course Objectives

- To emphasize the importance of analysis of algorithms and finding the time complexity.
- To explain various algorithm design techniques

Expected Course Outcomes

1	Describe the notation of algorithm and fundamentals of analysis of algorithmic efficiency and the various Frameworks for analysis of recursive and non-recursive algorithms.	K1
2	Explain the various algorithm design techniques, divide and conquer, brute force, travelling salesman problem and knapsack problem methodology.	K2
3	Select the various algorithm design techniques for Dynamic programming and Greedy Techniques.	K4
4	Categorize the various iterative methods including Simplex Method, Maximum Matching in Bipartite Graphs.	K4
5	Compare lower bound arguments and its limitations algorithms by calculating their time efficiency using the prescribed framework	K4

K1 – Remember K2 – Understand K3 – apply K4- Analyze K5 – evaluate K6- Create

UNITI	INTRODUCTION	18

Notion of Algorithm – Fundamentals of Algorithmic Problem Solving – Important Problem types– Fundamentals of the Analysis of Algorithmic Efficiency –Asymptotic Notations and their properties. Analysis Framework – Empirical analysis – Mathematical analysis for Recursive and Non-recursive algorithms

UNIT II	BRUTE FORCE AND DIVIDE-AND-CONQUER	18

Brute Force – Computing an– String Matching – Closest Pair and Convex-Hull Problems -Exhaustive Search – Travelling Salesman Problem – Knapsack Problem – Assignment problem. Divide and Conquer Methodology – Binary Search – Merge sort – Quick sort – Heap Sort -Multiplication of Large Integers – Closest-Pair and Convex – Hull Problems.

UNIT III	DYNAMIC PROGRAMMING AND GREEDY TECHNIQUE	19

Dynamic programming – Principle of optimality – Coin changing problem, Computing a Binomial Coefficient – Floyd_s algorithm – Multi stage graph – Optimal Binary Search Trees – Knapsack Problem and Memory functions. Greedy Technique – Container loading problem – Prim_s algorithm and Kruskal‘s Algorithm.

UNIT IV	ITERATIVE IMPROVEMENT	17

The Simplex Method – The Maximum-Flow Problem – Maximum Matching in Bipartite Graphs, Stable marriage Problem.

UNIT V	COPING WITH THE LIMITATIONS OF ALGORITHM POWER	18

Lower – Bound Arguments – P, NP NP- Complete and NP Hard Problems. Backtracking – n-Queen problem – Hamiltonian Circuit Problem – Subset Sum Problem. Branch and Bound – Assignment problem – Knapsack Problem – Travelling Salesman Problem – Approximation Algorithms for NP-Hard Problems – Travelling Salesman problem – Knapsack problem.

	Total Lecture Hours	**90Hour s**
	Text Book(s)	
1	AnanyLevitin, ―Introduction to the Design and Analysis of Algorithms‖, Third Edition, Pearson Education, 2012.	
	ReferenceBook(s)	
1	Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, ―Introduction to Algorithms‖, Third Edition, PHI Learning Private Limited, 2012	
2	Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, ―Data Structures and Algorithms‖, Pearson Education, Reprint 2006.	
3	Donald E. Knuth, ―The Art of Computer Programming‖, Volumes 1& 3 Pearson Education, 2009. Steven S. Skiena, ―The Algorithm Design Manual‖, Second Edition, Springer, 2008.	
	Related Online Contents (MOOC, SWAYAM,NPTEL, Websites etc)	
1	**https://onlinecourses.swayam2.ac.in/aic20_sp06/preview**	
2	**https://onlinecourses.swayam2.ac.in/arp19_ap79/preview**	

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PSO1**	**PSO2**	**PSO3**
CO1	**S**	**L**	**L**	**-**	**L**	**-**	**L**	**L**	**-**	**-**	**S**	**L**	**-**
CO2	**S**	**L**	**S**	**-**	**-**	**-**	**L**	**L**	**L**	**-**	**S**	**S**	**L**
CO3	**S**	**M**	**S**	**-**	**-**	**-**	**L**	**L**	**L**	**-**	**S**	**S**	**L**
CO4	**S**	**M**	**S**	**-**	**-**	**-**	**L**	**L**	**L**	**-**	**S**	**S**	**L**
CO5	**S**	**M**	**S**	**-**	**-**	**-**	**L**	**L**	**L**	**-**	**S**	**S**	**L**

***S-Strong M-Medium L-Low**

Course Code		Capstone Project Work	L	T	P	C
Core/elective/Supportive		Skill Based Subject 2	0	0	4	3
Pre - requisite		● Students should have a good understanding of software engineering ● Student should possess strong analytical skills ● Strong coding skills in any one programming paper	Syllabus version		I	

Course Objectives

- To understand and select the task based on their core skills.
- To get the knowledge about analytical skill for solving the selected task.
- To get confidence for implementing the task and solving the real time problems.

Expected Course Outcomes

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

1	Illustrate a real world problem and identify the list of project requirements	**K3**
2	Judge the features of the project including forms, databases and reports	**K5**
3	Design code to meet the input requirements and to achieve the required output	**K6**
4	Compose a project report incorporating the features of the project	**K6**

K1 – Remember K2 – Understand K3 – apply K4- Analyze K5 – evaluate K6- Create

Aim of the project work

1. The aim of the project work is to acquire practical knowledge on the implementation of the programming concepts studied.

2. Each student should carry out individually one project work and it may be a work using the software packages that they have learned or the implementation of concepts from the papers studied or implementation of any innovative idea focusing on application oriented concepts.

3. The project work should be compulsorily done in the college only under the supervision of the department staff concerned.

Viva Voce

1. Viva-Voce will be conducted at the end of the year by both Internal (Respective Guides) and External Examiners, after duly verifying the Annexure Report available in the College, for a total of 75 marks at the last day of the practical session.

2. Out of 75 marks, 45 marks for project report and 30 Marks for Viva Voce.

Project Work Format

PROJECT WORK

TITLE OF THE DISSERTATION

Bonafide Work Done by

STUDENT NAME

REG. NO.

Dissertation submitted in partial fulfillment of the requirements for the award of
<Name of the Degree>
of Bharathiar University, Coimbatore-46.

College Logo

Signature of the Guide Signature of the HOD

Submitted for the Viva-Voce Examination held on _____

Internal Examiner External Examiner

Month – Year

CONTENTS

Input Design

Output Design

Database Design

System Development

Description of Modules (Detailed explanation about the project work)

4 Software Testing and Implementation

Conclusion

Bibliography

Appendices

A. Data Flow Diagram

B. Table Structure

C. Sample Coding

D. Sample Input

E. Sample Output

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	**S**	**S**	**S**	**-**	**L**	**-**	**L**	**L**	**L**	**-**	**S**	**S**	**S**
CO2	**S**	**S**	**S**	**-**	**L**	**-**	**L**	**L**	**L**	**-**	**S**	**S**	**S**
CO3	**S**	**S**	**S**	**-**	**L**	**-**	**L**	**L**	**L**	**-**	**S**	**S**	**S**
CO4	**S**	**S**	**S**	**-**	**L**	**-**	**L**	**L**	**L**	**-**	**S**	**S**	**S**

***S-Strong M-Medium L-Low**

Course Code		Advanced Machine Learning using Python	L	T	P	C
Core/elective/Supportive		Core : 8	6	0	0	4
Pre - requisite		● Knowledge in Basics of Programming	Syllabus version		I	

Course Objectives

- Understand the fundamental Concepts, Algorithms and Applications of Machine Learning.
- To Understand the Methods of working with text data, including text-specific processing techniques.

Expected Course Outcomes

1	Explain knowledge on fundamental concepts and applications of Machine Learning	**K2**
2	Describe the Concept of Supervised Learning algorithms.	**K2**
3	Apply the knowledge on clustering algorithms.	**K3**
4	Apply the knowledge on feature engineering techniques.	**K3**
5	Apply the concept of text data processing.	**K3**

K1 – Remember K2 – Understand K3 – Apply K4- Analyze K5 – Evaluate K6- Create

UNIT I	Introduction	18

Why Machine Learning? – Why Python? – Essential Libraries and Tools
A First Application: Classifying Iris Species-Meet the data-Measuring Success: Training and Testing Data-Making Predictions-Evaluation of the model.

UNIT II	Supervised Learning	18

Classification and Regression- Generalization, Overfitting and Underfitting-Relation of Model Complexity to Dataset Size-Supervised Machine Learning Algorithms-Some Sample Datasets-K-Nearest Neighbors-Linear Models-Naive Bayes Classifiers-Decision Trees-Kernelized Support Vector Machine-Neural Networks.

UNIT III	Clustering	18

K-means clustering-Agglomerative Clustering-DBSCAN-Comparing and Evaluating Clustering Algorithms.

UNIT IV	Representing Data and Engineering Features	18

Categorical Variables-Binning, Discretization, Linear Models and Trees-Interaction and Polynomials-Univariate Nonlinear Transformations-Automatic Feature Selection.

UNIT V	Working with Text Data	18

Types of Data Represented as String- Example Applications: Sentiment Analysis of Movie Reviews-Representing Text Data as a Bag of Words-Stopwords-Rescaling the Data with tf-idf-Investigating Model Specifiers.

	Text Book(s)
1	"Introduction to Machine Learning with Python" A Guide for Data Scientists, Andreas C.Muller and Sarah Guido, 2017
2	Tom M.Mitchell, "Machine Learning", First Edition by Tata McGraw-Hill Education, 2013
	ReferenceBook(s)
1	Christopher M, Bishop, "Pattern Recognition and Machine Learning" by Springer, 2007.
2	Mevin P. Murphy "Machine Learning: A Probabilistic Perspective" by The MIT Press, 2012.
	Related Online Contents (MOOC, SWAYAM,NPTEL, Websites etc)
1	**https://onlinecourses.nptel.ac.in/noc22_cs29/preview**
2	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	S	S	S	-	L	-	-	L	-	-	S	S	-
CO2	S	S	S	-	L	-	-	L	-	-	S	S	-
CO3	S	S	S	-	L	-	-	L	-	-	S	S	-
CO4	S	S	S	-	L	-	-	L	-	-	S	S	-
CO5	S	S	S	-	L	-	-	L	-	-	S	S	-

***S-Strong M-Medium L-Low**

Course Code		Advanced Machine Learning using Python Lab	L	T	P	C
Core/elective/Supportive		Core Lab :6	0	(	6	4
Pre - requisite		● Knowledge in Basics of Programming	Syllabus version		I	

Course Objectives

- To learn to use python code for implementing a range of machine learning algorithms and techniques.
- To familiarize students will explore several clustering, classification and regression models to perform a variety of machine learning tasks.

Expected Course Outcomes

1	Apply the Machine Learning for visualization using python	**K3**
2	Apply the Supervised Learning Algorithms to implement NavieBayes classifier and Decision Trees.	**K3**
3	Apply the Unsupervised Learning Concept to implement K-means and DBSCAN models.	**K3**
4	Apply Linear model to find the polynomial features using Python.	**K3**
5	Apply the Investing model to visualize the coefficients.	**K3**

K1 – Remember K2 – Understand K3 – apply K4- Analyze K5 – evaluate K6- Create

List of Programs

1. A program to Simple line plot of the sine function using Matplotlib.
2. A program to implement matrix operations using Python.
3. A program to implement Navie Bayes Classifier for simple training data.
4. A program to apply Decision Tree Using Python.
5. A program to implement K-means Algorithm Using Python.
6. A program to illustrate DBSCAN Models for dataset.
7. A program to apply Linear Models for training dataset.
8. A program to apply Linear Regression to Polynomial Features.
9. A program to reading the datasets with tf-idf function using Python. A program to apply Investigating Model to visualize the Coefficients

Total Lecture Hours	**90 Hours**

Text Book(s)

1	Mark Summerfield. —Programming in Python 3: A Complete introduction to the Python Language, Addison-Wesley Professional, 2009.
2	"Introduction to Machine Learning with Python" A Guide for Data Scientists, Andreas C.Muller and Sarah Guido, 2017

Reference Book(s)

1	Christopher M, Bishop, “Pattern Recognition and Machine Learning” by Springer, 2007.
2	Mevin P. Murphy “Machine Learning: A Probabilistic Perspective” by The MIT Press, 2012.

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PSO1**	**PSO2**	**PSO3**
CO1	**S**	**S**	**S**	**-**	**L**	**-**	**-**	**L**	**-**	**-**	**S**	**S**	**L**
CO2	**S**	**S**	**S**	**-**	**L**	**-**	**-**	**L**	**-**	**-**	**S**	**S**	**L**
CO3	**S**	**S**	**S**	**-**	**L**	**-**	**-**	**L**	**-**	**-**	**S**	**S**	**L**
CO4	**S**	**S**	**S**	**-**	**L**	**-**	**-**	**L**	**-**	**-**	**S**	**S**	**L**
CO5	**S**	**S**	**S**	**-**	**L**	**-**	**-**	**L**	**-**	**-**	**S**	**S**	**L**

***S-Strong M-Medium L-Low**

Course Code		Fuzzy Logic and Artificial Neural Networks	L	T	P	C
Core/elective/Supportive		Core : 9	6	0	0	4
Pre - requisite		● Knowledge in Basics of Object Oriented Programming	Syllabus Version		I	

Course Objectives

- To introduce the concepts of neural networks and fuzzy systems
- To explain the basic mathematical elements of the theory of fuzzy sets.

Expected Course Outcomes		
1	Explain the basic concepts of fuzzy sets and fuzzy logic	K2
2	Describe the basic mathematical elements of fuzzy sets.	K2
3	Explain the fundamentals of neural networks and its algorithm.	K2
4	Outline the mapping and recurrent networks	K4
5	Apply fuzzy logic and neural network in signal and image processing.	K4

K1 – Remember K2 – Understand K3 – Apply K4- Analyze K5 – Evaluate K6- Create

UNIT I	Fuzzy Set Theory and Fuzzy Logic Control:	18

Basic concepts of fuzzy sets- Operations on fuzzy sets- Fuzzy relation equations- Fuzzy logic control Fuzzification –Defuzzificatiuon- Knowledge base- Decision making logic- Membership functions – Rule base.

UNIT II	Adaptive Fuzzy Systems	18

Performance index- Modification of rule base0- Modification of membership functions- Simultaneous modification of rule base and membership functions- Genetic algorithms-Adaptive fuzzy system Neuro fuzzy systems.

UNIT III	Artificial Neural Networks:	18

Introduction- History of neural networks- multilayer perceptions- Back propagation algorithm and its Variants- Different types of learning, examples.

UNIT IV	Mapping and Recurrent Networks:	18

Counter propagation –Self organization Map- Congnitron and Neocognitron- Hopfield Net- Kohonnen Nets- Grossberg Nets- Art-I, Art-II reinforcement learning

UNIT V	Case Studies	18

Application of fuzzy logic and neural networks to Measurement- Control- Adaptive Neural Controllers – Signal Processing and Image Processing

Total Lecture Hours	90 Hours

Text Book(s)

1	Vallum B.R And Hayagriva V.R C++, Neural networks and Fuzzy logic, BPB Publications, New Delhi, 1996

Reference Book(s)

1	Fuzzy logic & Neural Networks/ Chennakesava R. Alavala/ New Age International, 2008
2	Neural Networks for control, Millon W. T, Sutton R.S and Werbos P. J, MIT Press 1992
3	Fuzzy sets Fuzzy logic, Klir, G. J anfd Yuan B.B Prentice Hall oif India Pvt. Ltd.,, New Delhi
4	Neural Networks and Fuzzy systems, Kosko.. Prentice hall of India Pvt. Ltd.,, New Delhi 1994

5	Introduction to Fuzzy control, Dirankov D. Hellendoorn H, Reinfrank M., Narosa Publications House, New Delhi 1996
6	Introduction to Artificial Neural systems, Zurada J. M Jaico Publishing House, New Delhi 1994

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	**S**	**L**	**L**	**-**	**L**	**-**	**-**	**L**	**-**	**-**	**S**	**L**	**-**
CO2	**S**	**L**	**S**	**-**	**-**	**-**	**-**	**L**	**-**	**-**	**S**	**S**	**-**
CO3	**S**	**M**	**S**	**-**	**-**	**-**	**-**	**L**	**-**	**-**	**S**	**S**	**-**
CO4	**S**	**M**	**S**	**-**	**-**	**-**	**-**	**L**	**-**	**-**	**S**	**S**	**-**
CO5	**S**	**M**	**S**	**-**	**-**	**-**	**-**	**L**	**-**	**-**	**S**	**S**	**-**

***S-Strong M-Medium L-Low**

Course Code		**Fundamentals of Robotics**	**L**	**T**	**P**	**C**

Core/elective/Supportive	Elective : I	5	0	0	4
Pre - requisite	None				I

Course Objectives

- To introduce the basic concepts of robotics and its characteristics

Expected Course Outcomes

1	Describe the different physical forms of robot architectures.	**K2**
2	Demonstrate to mathematically describe a kinematic robot system.	**K2**
3	Explain about the actuators and characteristics of actuating system	**K2**
4	Understand the Sensors and Characteristics	**K2**
5	Analyze manipulation and navigation problems using knowledge of coordinate frames, kinematics, optimization, control, and uncertainty.	**K4**

K1 – Remember K2 – Understand K3 – Apply K4- Analyze K5 – Evaluate K6- Create

UNIT I	**Introduction to Robotics**	**14**

Introduction to Robotics: Classification, Components, Characteristics, Applications.

UNIT II	**Robotics Kinematics**	**16**

Robotics Kinematics: Position Analysis, Robots as Mechanisms, Matrix Representation, Transformation Matrices, Forward and Inverse Kinematics.

UNIT III	**Actuators**	**15**

Actuators: Characteristics of Actuating Systems, Actuating Devices and Control.

UNIT IV	**Sensors**	**16**

Sensors: Sensor Characteristics, Description of Different Sensors. Dynamic characteristics- speed of motion, load carrying capacity & speed of response-Sensors-Internal sensors: Position sensors, & Velocity sensors, External sensors: Proximity sensors, Tactile Sensors, Force and Torque sensors.

UNIT V	**Kinematics**	**14**

Kinematics-Manipulators Kinematics, Rotation Matrix, Homogenous Transformation Matrix, D-H transformation matrix, D-H method of assignment of frames. Direct and Inverse Kinematics for industrial robots. Differential Kinematics for planar serial robots

Total Lecture Hours	**75 Hours**

Text Book(s)

1	Saeed B. Niku, Introduction to Robotics Analysis, Application, Pearson Education Asia, 2001

Reference Book(s)

1	R.K.Mittal and I J Nagrath, Robotics and Control, TMH, 2003.
2	Computational Intelligence, Davis Poole, Alan Mackwath, Randy Coehel, Oxford University Press 1998.
3	Industrial Robotics / Groover M P /McGraw Hill
4	Introduction to Robotics / John J. Craig/ Pearson

Related Online Contents (MOOC, SWAYAM,NPTEL, Websites etc)

1	**https://onlinecourses.swayam2.ac.in/aic20_sp06/preview**
2	**https://onlinecourses.swayam2.ac.in/arp19_ap79/preview**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	**S**	**L**	**L**	**-**	**L**	**-**	**-**	**L**	**-**	**-**	**S**	**L**	**-**
CO2	**S**	**L**	**S**	**-**	**-**	**-**	**-**	**L**	**-**	**-**	**S**	**S**	**-**
CO3	**S**	**M**	**S**	**-**	**-**	**-**	**-**	**L**	**-**	**-**	**S**	**S**	**-**
CO4	**S**	**M**	**S**	**-**	**-**	**-**	**-**	**L**	**-**	**-**	**S**	**S**	**-**
CO5	**S**	**M**	**S**	**-**	**-**	**-**	**-**	**L**	**-**	**-**	**S**	**S**	**-**

***S-Strong M-Medium L-Low**

Course Code		Business Data Analytics	L	T	P	C
Core/elective/Supportive		Elective : I	6	0	0	4
Pre - requisite		None	Syllabus version		I	

Course Objectives

- To introduce the fundamental concepts of Business data analytics and associated methodologies

Expected Course Outcomes

1	Express basic concepts and methods of business analytics	K2
2	Demonstrate the various methodologies of descriptive statistics	K2
3	Infer model uncertainty and statistical inference	K2
4	Apply analytical frameworks of Hadoop and /mapreduce	K3
5	Apply different analytical and database framework for business.	K3

K1 – Remember K2 – Understand K3 – Apply K4- Analyze K5 – Evaluate K6- Create

UNIT I	OVERVIEW OF BUSINESS ANALYTICS	18

Introduction – Drivers for Business Analytics – Applications of Business Analytics: Marketing and Sales, Human Resource, Healthcare, Product Design, Service Design, Customer Service and Support – Skills Required for a Business Analyst – Framework for Business Analytics Life Cycle for Business Analytics Process.

UNIT II	ESSENTIALS OF BUSINESS ANALYTICS	17

Descriptive Statistics – Using Data – Types of Data – Data Distribution Metrics: Frequency, Mean, Median, Mode, Range, Variance, Standard Deviation, Percentile, Quartile, z-Score, Covariance, Correlation – Data Visualization: Tables, Charts, Line Charts, Bar and Column Chart, Bubble Chart, Heat Map – Data Dashboards.

UNIT III	MODELING UNCERTAINTY AND STATISTICAL INFERENCE	19

Modeling Uncertainty: Events and Probabilities – Conditional Probability – Random Variables – Discrete Probability Distributions – Continuous Probability Distribution – Statistical Inference: Data Sampling – Selecting a Sample – Point Estimation – Sampling Distributions – Interval Estimation – Hypothesis Testing.

UNIT IV	ANALYTICS USING HADOOP AND MAPREDUCE FRAMEWORK	19

Introducing Hadoop – RDBMS versus Hadoop – Hadoop Overview – HDFS (Hadoop Distributed File System) – Processing Data with Hadoop – Introduction to MapReduce – Features of MapReduce – Algorithms Using Map-Reduce: Matrix-Vector Multiplication, Relational Algebra Operations, Grouping and Aggregation – Extensions to MapReduce.

UNIT V	OTHER DATA ANALYTICAL FRAMEWORKS	17

Overview of Application development Languages for Hadoop – PigLatin – Hive – Hive Query Language (HQL) – Introduction to Pentaho, JAQL – Introduction to Apache: Sqoop, Drill and Spark, Cloudera Impala – Introduction to NoSQL Databases – Hbase and MongoDB.

Total Lecture Hours	90 Hours

Text Book(s)

1	VigneshPrajapati, “Big Data Analytics with R and Hadoop”, Packt Publishing, 2013.

2	Umesh R Hodeghatta, UmeshaNayak, "Business Analytics Using R – A Practical Approach", Apress, 2017.
Reference Book(s)	
1	AnandRajaraman, Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2012.
2	Jeffrey D. Camm, James J. Cochran, Michael J. Fry, Jeffrey W. Ohlmann, David R. Anderson, "Essentials of Business Analytics", Cengage Learning, second Edition, 2016
3	U. Dinesh Kumar, "Business Analytics: The Science of Data-Driven Decision Making", Wiley, 2017.
4	A. Ohri, "R for Business Analytics", Springer, 2012 7. Rui Miguel Forte, "Mastering Predictive Analytics with R", Packt Publication, 2015.
	Related Online Contents (MOOC, SWAYAM,NPTEL, Websites etc)
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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	S	L	L	-	L	-	-	L	-	-	S	L	-
CO2	S	L	S	-	-	-	-	L	-	-	S	S	-
CO3	S	M	S	-	-	-	-	L	-	-	S	S	-
CO4	S	M	S	-	-	-	-	L	-	-	S	S	-
CO5	S	M	S	-	-	-	-	L	-	-	S	S	-

***S-Strong M-Medium L-Low**

Course Code		Social Network Analysis	L	T	P	C
Core/elective/Supportive		Elective : I	6	0	0	4
Pre - requisite		None	Syllabus version		I	

Course Objectives

- To explain the methodologies used in social network analysis

Expected Course Outcomes

1	Classify supervised learning and unsupervised learning concepts.	**K2**
2	Apply the various data mining techniques on social media data.	**K3**
3	Use data mining approach for detecting mining communities in web social networks.	**K3**
4	Analyse Human behavioral analysis and privacy issues on social network data using various trust analysis.	**K3**
5	Evaluate visualization results from application of social network.	**K5**

K1 – Remember K2 – Understand K3 – apply K4- Analyze K5 – evaluate K6- Create

UNIT I	CLUSTERING AND CLASSIFICATION	17

Supervised Learning – Decision tree - Naïve Bayesian Text Classification - Support Vector Machines - Ensemble of Classifiers – Unsupervised Learning – K-means Clustering – Hierarchical Clustering – Partially Supervised Learning – Markov Models – Probability-Based Clustering – Vector Space Model

UNIT II	SOCIAL MEDIA MINING	17

Data Mining Essentials –Data Mining Algorithms - Web Content Mining –Latent semantic Indexing – Automatic Topic Extraction – Opinion Mining and Sentiment Analysis – Document Sentiment Classification

UNIT III	EXTRACTION AND MINING COMMUNITIES IN WEB SOCIAL NETWORKS	18

Extracting evolution of Web Community from a Series of Web Archive – Detecting Communities in Social Networks – Definition of Community – Evaluating Communities – Methods for Community Detection & Mining – Applications of Community Mining Algorithms – Tools for Detecting Communities – Social Network Infrastructure and Communities – Decentralized Online Social Networks – Multi-Relational Characterization of Dynamic Social Network Communities

UNIT IV	HUMAN BEHAVIOR ANALYSIS AND PRIVACY ISSUES	19

Understanding and Predicting Human Behavior for Social Communities – Use Data Management, Inference and Distribution – Enabling New Human Experiences – Reality Mining – Context Awareness – Privacy in Online Social Networks – Trust in Online Environment – Trust Models Based on Subjective Logic – Trust Network Analysis – Trust Transitivity Analysis – Combining Trust and Reputation – Trust Derivation Based on Trust Comparisons – Attack Spectrum and Countermeasures.

UNIT V	VISUALIZATION AND APPLICATIONS OF SOCIAL NETWORKS	19

Graph Theory – Centrality – Clustering – Node-Edge Diagrams – Matrix representation – Visualizing Online Social Networks – Visualizing Social Networks with Matrix-Based Representations – Node-Link Diagrams – Hybrid Representations – Applications – Covert Networks – Community Welfare – Collaboration Networks – Co-Citation Networks – Recommendation in Social Media: Challenges – Classical Recommendation Algorithms – Recommendation Using Social Context – Evaluating Recommendations	
Total Lecture Hours	**90 Hours**
Text Book(s)	
1	1. Peter Mika, "Social networks and the Semantic Web", Springer, 2007.
2	2. BorkoFurht, "Handbook of Social Network Technologies and Applications", Springer, 2010.
Reference Book(s)	
1	Bing Liu, "Web Data Mining: Exploring Hyperlinks, Contents, and Usage Data (DataCentric Systems and Applications)", Springer; Second Edition, 2011.
2	Reza Zafarani, Mohammad Ali Abbasi, Huan Liu, "Social Media Mining", Cambridge University Press, 2014.
3	GuandongXu, Yanchun Zhang and Lin Li, "Web Mining and Social Networking Techniques and applications", Springer, 2011
4	Dion Goh and Schubert Foo, "Social information retrieval systems: emerging technologies and Applications for searching the Web effectively", Idea Group, 2007.
	Related Online Contents (MOOC, SWAYAM,NPTEL, Websites etc)
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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	S	L	L	-	L	-	-	L	-	-	S	L	-
CO2	S	L	S	-	-	-	-	L	-	-	S	S	-
CO3	S	M	S	-	-	-	-	L	-	-	S	S	-
CO4	S	M	S	-	-	-	-	L	-	-	S	S	-
CO5	S	M	S	-	-	-	-	L	-	-	S	S	-

***S-Strong M-Medium L-Low**

Course Code		Database Management Systems	L	T	P	C
Core/elective/Supportive		Skill Based Subject : 3	6	0	0	4
Pre - requisite		None	Syllabus version		I	

Course Objectives

- The objective of the 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.

Expected Course Outcomes

1	Describe the fundamental elements of relational database management systems and the normalization techniques to improvise the database design	**K2**
2	Develop DDL and DML commands to perform basic operations on a database	**K6**
3	Explain the concepts of transaction processing and locking mechanisms.	**K2**
4	Explain file Organization, distributed database technology and client server techniques.	**K2**
5	Apply security concepts in database management systems.	**K2**

K1 – Remember K2 – Understand K3 – apply K4- Analyze K5 – evaluate K6- Create

UNIT I	INTRODUCTION TO DBMS	18

File Systems Organization – Sequential, Pointer, Indexed, Direct – Purpose of Database System- Database System Terminologies-Database characteristics- Data models – Types of data models – Components of DBMS- Relational Algebra. LOGICAL DATABASE DESIGN: Relational DBMS – Codd‟s Rule – Entity- Relationship model – Extended ER Normalization – Functional Dependencies, Anomaly- 1NF to 5NF- Domain Key Normal Form – Denormalization

UNIT II	SQL & QUERY OPTIMIZATION	18

I SQL Standards – Data types – Database Objects- DDL-DML-DCL-TCL-Embedded SQL-Static Vs Dynamic SQL – QUERY OPTIMIZATION: Query Processing and Optimization – Heuristics and Cost Estimates in Query Optimization.

UNIT III	TRANSACTION PROCESSING AND CONCURRENCY CONTROL	18

Introduction-Properties of Transaction- Serializability- Concurrency Control – Locking Mechanisms- Two Phase Commit Protocol-Dead lock.

UNIT IV	TRENDS IN DATABASE TECHNOLOGY	18

Overview of Physical Storage Media – Magnetic Disks – RAID – Tertiary storage – File Organization – Organization of Records in Files – Indexing and Hashing –Ordered Indices – B+ tree Index Files – B tree Index Files – Static Hashing – Dynamic Hashing – Introduction to Distributed Databases- Client server technology- Multidimensional and Parallel databases- Spatial and multimedia databases- Mobile and web databases- Data Warehouse-Mining- Data marts.

UNIT V	ADVANCED TOPICS	18

DATABASE SECURITY: Data Classification-Threats and risks – Database access Control – Types of Privileges –Cryptography- Statistical Databases.- Distributed Databases-Architecture-Transaction

Processing-Data Warehousing and Mining-Classification-Association rules-Clustering-Information Retrieval- Relevance ranking-Crawling and Indexing the Web- Object Oriented Databases-XML Databases.	
Total Lecture Hours	**90**
Text Book(s)	
1	RamezElmasri and Shamkant B. Navathe, "Fundamentals of Database Systems",Fifth Edition, Pearson Education, 2008.
ReferenceBook(s)	
1	Abraham Silberschatz, Henry F. Korth and S. Sudharshan, "Database System Concepts", Sixth Edition, Tata McGraw Hill, 2011.
2	C.J.Date, A.Kannan and S.Swamynathan, "An Introduction to Database Systems", Eighth Edition, Pearson Education, 2006.
3	AtulKahate, "Introduction to Database Management Systems", Pearson Education, New Delhi, 2006.
4	Alexis Leon and Mathews Leon, "Database Management Systems", Vikas Publishing House Private Limited, New Delhi, 2003.
5	Raghu Ramakrishnan, "Database Management Systems", Fourth Edition, Tata McGraw Hill, 2010.
6	G.K.Gupta, "Database Management Systems", Tata McGraw Hill, 2011.
7	Rob Cornell, "Database Systems Design and Implementation", Cengage Learning, 2011.
	Related Online Contents (MOOC, SWAYAM,NPTEL, Websites etc)
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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	S	S	S	-	L	-	-	L	-	-	S	S	-
CO2	S	S	S	-	L	-	-	L	-	-	S	S	-
CO3	S	S	S	-	L	-	-	L	-	-	S	S	-
CO4	S	S	S	-	L	-	-	L	-	-	S	S	-
CO5	S	S	S	-	L	-	-	L	-	-	S	S	-

***S-Strong M-Medium L-Low**

Course Code		R Programming	L	T	P	C
Core/elective/Supportive		Core :10	6	0	0	4
Pre - requisite		None	Syllabus version		I	

Course Objectives

- To expose the student sot the fundamental concepts of R Programming

Expected Course Outcomes

1	Describe basics of R programming in terms of constructs, functions , Scalars Vector Operations.	**K1**
2	Apply basic function of R for Vector/Matrix and list.	**K3**
3	Apply R programming for data frames to perform various operations.	**K3**
4	Apply the concepts of class and objects in R Programming.	**K3**
5	Illustrate a various model in R	**K6**

K1 – Remember K2 – Understand K3 – Apply K4- Analyze K5 – Evaluate K6- Create

UNITI	**Introduction to R**	**18**

Introducing to R – R Data Structures – Help Functions in R – Vectors – Scalars – Declarations – Recycling – Common Vector Operations – Using all and any – Vectorized operations – NA and NULL values – Filtering – Victoriesed if-then else – Vector Element names.

UNIT II	**Matrices and operations**	**18**

Creating matrices – Matrix Operations – Applying Functions to Matrix Rows and Columns – Adding and deleting rows and columns - Vector/Matrix Distinction – Avoiding Dimension Reduction – Higher Dimensional arrays – lists – Creating lists – General list operations – Accessing list components and values – applying functions to lists – recursive lists.

UNIT III	**Data Frames**	**18**

Creating Data Frames – Matrix-like operations in frames – merging Data frames – Applying functions to Data Frames – Factors and Tables – Factors and levels – Common Functions used with factors – Working with tables – Other factors and table related functions – Control statements – Arithmetic and Boolean operators and values – Default Values for arguments – Returning Boolean Values – Functions are objects – Environment and scope issues – Writing Upstairs – Recursion – Replacement functions – Tools for Composing function code – Math and Simulation in R.

UNIT IV	**Classes and Objects**	**18**

S3 Classes – S4 Classes – Managing your objects – Input/output – accessing keyboard and monitor – reading and writing files – accessing the internet – String Manipulation – Graphics – Creating Graphs – Customizing Graphs – Saving Graphs to files – Creating Three-Dimensional plots.

UNIT V	**Modelling in R**	**18**

Interfacing R to other languages – Parallel R – Basic Statistics – Linear Model – Generalized Linear models – Non-linear Models – Time Series and Auto-Correlation – Clustering.

Total Lecture Hours	**90 Hours**

Text Book(s)

1	Norman Matloff, "The Art of R Programming: A Tour of Statistical Software Design", No Starch Press, 2011.
2	Jared P. Lander, "R for Everyone: Advanced Analytics and Graphics", Addison-Wesley Data & Analytics Series, 2013.

Reference Book(s)

1	Mark Gardner, "Beginning R – The Statistical Programming Language", Wiley, 2013.	
2	Robert Knell, "Introductory R: A Beginner"s Guide to Data Visualisation, Statistical Analysis and programming in R", Amazon Digital South Asia Services Inc, 2013. Richard Cotton(2013). Learning R, O"Reilly Media.	
3	Garret Grolemund (2014). Hands-on Programming with R. O"Reilly Media, Inc.	
4	Roger D.Peng (2018). R Programming for Data Science. Lean Publishing.	
	Related Online Contents (MOOC, SWAYAM,NPTEL, Websites etc)	
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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	**S**	**S**	**S**	**-**	**L**	**-**	**-**	**L**	**-**	**-**	**S**	**S**	**-**
CO2	**S**	**S**	**S**	**-**	**L**	**-**	**-**	**L**	**-**	**-**	**S**	**S**	**-**
CO3	**S**	**S**	**S**	**-**	**L**	**-**	**-**	**L**	**-**	**-**	**S**	**S**	**-**
CO4	**S**	**S**	**S**	**-**	**L**	**-**	**-**	**L**	**-**	**-**	**S**	**S**	**-**
CO5	**S**	**S**	**S**	**-**	**L**	**-**	**-**	**L**	**-**	**-**	**S**	**S**	**-**

***S-Strong M-Medium L-Low**

Course Code		R Programming Lab	L	T	P	C
Core/elective/Supportive		Core Lab :7	0	0	6	4
Pre - requisite		None	Syllabus version		I	

Course Objectives

- To expose the student sot the fundamental concepts of R Programming

Expected Course Outcomes

1	Apply basics in R programming in terms of Expressions, operators and functions.	**K3**
2	Apply R programming for data frames, List.	**K3**
3	Demonstrate R programming for graphics and 3D plot.	**K3**

K1 – Remember K2 – Understand K3 – apply K4- Analyze K5 – evaluate K6- Create

List of Programs

1. R Expressions and Data Structures
2. Manipulation of vectors and matrix
3. Operators on Factors in R
4. Data Frames in R
5. Lists and Operators
6. Working with looping statements.
7. Graphs in R
8. 3D plots in R

Total Lecture Hours	**90 Hours**

Text Book(s)

1	Norman Matloff, "The Art of R Programming: A Tour of Statistical Software Design", No Starch Press, 2011.
2	Jared P. Lander, "R for Everyone: Advanced Analytics and Graphics", Addison-Wesley Data & Analytics Series, 2013.

Reference Book(s)

1	Mark Gardner, "Beginning R – The Statistical Programming Language", Wiley, 2013.
2	Robert Knell, "Introductory R: A Beginner"s Guide to Data Visualisation, Statistical Analysis and programming in R", Amazon Digital South Asia Services Inc, 2013. Richard Cotton(2013). Learning R, O"Reilly Media.
3	Garret Grolemund (2014). Hands-on Programming with R. O"Reilly Media, Inc.
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CO1	S	S	S	-	M	-	L	L	L	-	S	S	-
CO2	S	S	S	-	M	-	L	L	L	-	S	S	-
CO3	S	S	S	-	M	-	L	L	L	-	S	S	-

***S-Strong M-Medium L-Low**

Course Code		Project Work Lab	L	T	P	C
Core/elective/Supportive		Core - 11	0	0	5	8
Pre - requisite		Students should have the strong knowledge in any one of the programming languages in this course.	Syllabus version		I	

Course Objectives

The main objectives of this course are to:

- To understand and select the task based on their core skills.
- To get the knowledge about analytical skill for solving the selected task.
- To get confidence for implementing the task and solving the real time problems.
- Express technical and behavioral ideas and thought in oral settings.
- Prepare and conduct oral presentations

Expected Course Outcomes

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

1	Formulate a real world problem and develop its requirements develop a design solution for a set of requirements	**K3**
2	Test and validate the conformance of the developed prototype against the original requirements of the problem	**K5**
3	Work as a responsible member and possibly a leader of a team in developing software solutions	**K3**
4	Express technical ideas, strategies and methodologies in written form. Self-learn new tools, algorithms and techniques that contribute to the software solution of the project	**K1-K4**
5	Generate alternative solutions, compare them and select the optimum one	**K6**

K1 – Remember K2 – Understand K3 – Apply K4- Analyze K5 – Evaluate K6- Create

Aim of the project work

1. The aim of the project work is to acquire practical knowledge on the implementation of the programming concepts studied.
2. Each student should carry out individually one project work and it may be a work using the software packages that they have learned or the implementation of concepts from the papers studied or implementation of any innovative idea focusing on application oriented concepts.
3. The project work should be compulsorily done in the college only under the supervision of the department staff concerned.

Viva Voce

1. Viva-Voce will be conducted at the end of the year by both Internal (Respective Guides) and External Examiners, after duly verifying the Annexure Report available in the College, for a total of 150 marks at the last day of the practical session.
2. Out of 150 marks, 60 marks for CIA and 90 for CEE (60 evaluation of project report + 30 Viva Voce).

Project Work Format

PROJECT WORK

TITLE OF THE DISSERTATION

Bonafide Work Done by

STUDENT NAME

REG. NO.

Dissertation submitted in partial fulfillment of the requirements for the award of
<Name of the Degree>
of Bharathiar University, Coimbatore-46.

College Logo

Signature of the Guide Signature of the HOD
Submitted for the Viva-Voce Examination held on _____

Internal Examiner External Examiner

Month – Year

CONTENTS

Input Design

Output Design

Database Design

System Development

Description of Modules (Detailed explanation about the project work)

4 Software Testing and Implementation

Conclusion

Bibliography

Appendices

F. Data Flow Diagram

G. Table Structure

H. Sample Coding

I. Sample Input

J. Sample Output

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	**S**	**S**	**S**	**-**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**
CO2	**S**	**S**	**S**	**-**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**
CO3	**-**	**-**	**-**	**-**	**S**	**S**	**S**	**S**	**S**	**-**	**S**	**S**	**S**
CO4	**S**	**S**	**S**	**-**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**
CO5	**S**	**S**	**S**	**L**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**

***S-Strong M-Medium L-Low**

Course Code		Deep Learning	L	T	P	C
Core/elective/Supportive		Elective : II	6	0	0	4
Pre - requisite		None	Syllabus version		I	

Course Objectives

- To introduce students to the basic concepts and techniques of deep Learning.

Expected Course Outcomes

1	Apply basic concepts of Neural Network.	**K3**
2	Apply basic operations of Tensor flow.	**K2**
3	Discuss deep learning architectures of CNN.	**K2**
4	Discuss architecture of RNN.	**K2**
5	Describe basic of reinforcement learning.	**K2**

K1 – Remember K2 – Understand K3 – Apply K4- Analyze K5 – Evaluate K6- Create

UNITI	**Basics of Neural Network**	**14**
The Neural Network – Limits of Traditional Computing – Machine Learning – Neuron – FF Neural Networks – Types of Neurons – Softmax output layers		
UNIT II	**Variables & Operations**	**16**
Tensor flow – Variables – Operations – Placeholders – Sessions – Sharing Variables – Graphs – Visualization		
UNIT III	**Basics of CNN**	**16**
Convolution Neural Network – Feature Selection – Max Pooling – Filters and Feature Maps – Convolution Layer –Applications		
UNIT IV	**Basics of RNN**	**14**
Recurrent Neural Network – Memory cells – sequence analysis – word2vec- LSTM - Memory augmented Neural Networks – NTM—Application		
UNIT V	**Reinforcement Learning**	**15**
Reinforcement Learning – MDP – Q Learning – Applications		
Total Lecture Hours		**75 Hours**

Text Book(s)

1	Nikhil Buduma, Nicholas Locascio, “Fundamentals of Deep Learning: Designing NextGeneration Machine Intelligence Algorithms”, O'ReillyMedia, 2017.

Reference Book(s)

1	Ian Goodfellow, Yoshua Bengio, Aaron Courville, ”Deep Learning (Adaptive computation and Machine Learning series”, MITPress, 2017.
	Related Online Contents (MOOC, SWAYAM,NPTEL, Websites etc)
1	**https://onlinecourses.swayam2.ac.in/aic20_sp06/preview**
2	**https://onlinecourses.swayam2.ac.in/arp19_ap79/preview**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	**S**	**M**	**M**	**-**	**-**	**-**	**L**	**L**	**-**	**L**	**S**	**-**	**-**
CO2	**S**	**M**	**M**	**-**	**-**	**-**	**L**	**L**	**-**	**L**	**S**	**-**	**-**
CO3	**S**	**M**	**M**	**-**	**-**	**-**	**L**	**L**	**-**	**L**	**S**	**-**	**-**
CO4	**S**	**M**	**M**	**-**	**-**	**-**	**L**	**L**	**-**	**L**	**S**	**-**	**-**
CO5	**S**	**M**	**M**	**-**	**-**	**-**	**L**	**L**	**-**	**L**	**S**	**-**	**-**

***S-Strong M-Medium L-Low**

Course Code		Web Application Security	L	P	C
Core/elective/Supportive		Elective : II	5	0	4
Pre - requisite		None	Syllabus version	I	

Course Objectives

- To introduce the concepts of security in web applications
- To explain about basic tools and techniques for developing web application.

Expected Course Outcomes

1	Apply the core concepts of web applications to create web pages.	K3
2	Apply the concepts of scripting languages to enrich web applications.	K3
3	Apply the concepts of servers side programming..	K3
4	Summarize the basics of HTML 5 and CSS 3.	K2
5	Apply the concept of web2.0 for designing web application.	K2

K1 – Remember K2 – Understand K3 – Apply K4- Analyze K5 – Evaluate K6- Create

UNIT I	Introduction to web applications	14

Data with URL- HTML - DHTML: Cascading Style Sheets, Common GatewayInterface: Programming CG! Scripts - HTML Forms-:- Custom Database Query Scripts - Server Side Includes - Server _security issues.

UNIT II	Introduction to Scripting Languages	14

XHTML: Introduction, CSS- Scripting languages- Java Script: Control statements,Functions, Arrays, Objects - DOM- Aiax enable rich internet applications.

UNIT III	Server Side Programming	15

Server side Programming - Active server pages - Java server pages - Java Servlets: Servlet container- Exceptions - Sessions and Session Tracking_ - Using Servlet context - Dynamic Content Generation - Servlet Chaining and Communications.

UNIT IV	HTML 5 & CSS 3	15

HTML review, Feature detection , The HTML5 new Elements, Canvas, Video and audio, Web storage, Geo location, Offline Web pages , Micro data, HTML5 APLS, Migrating from HTML4 to HTML5, CSS3 .

UNIT V	Web 2.0	17

WEB 2.0- HISTORY, characteristics, technologies, concepts, usage, web2.0 in education, philanthropy, social work. Web 3.0- Theory-and history understanding.basic web artifacts and applications, implementation. MS share point - Share point 2013 overview ,share (Put social to work ,Share your stuff, Take share point on the go), Discover (find experts, discover answers, find what you are looking for), Manage (cost, risk, time)

Total Lecture Hours	75 Hours

Text Book(s)

1	Deitel, Deitel and Neita, -Internet and World Wide _Web- How to programll, Pearson Education 4th Edition, 2009.
2	Elliotte Rusty Herold, -Java Network Programming II, O'Reilly Publications, 3rd Edition, 2004.

Reference Book(s)

1	Jeffy Dwight, Michael Erwin and Robert Nikes -USING CGIII, PH.I Publications, 1997

2	Jason Hunter, William Crawford -Java Servlet Programming O'Reilly Publications, 2nd Edition, 2001.
3	Eric Ladd and Jim O'Donnell, etal, -USING HTML4, XML, and JAVA1.2, Prentice Hall, 2003
4	Jeremy Keith, -Html5 for web designers
	Related Online Contents (MOOC, SWAYAM,NPTEL, Websites etc)
1	**https://onlinecourses.swayam2.ac.in/aic20_sp06/preview**
2	**https://onlinecourses.swayam2.ac.in/arp19_ap79/preview**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	**S**	**M**	**M**	**-**	**-**	**L**	**L**	**L**	**-**	**L**	**S**	**-**	**-**
CO2	**S**	**M**	**M**	**-**	**-**	**L**	**L**	**L**	**-**	**L**	**S**	**-**	**-**
CO3	**S**	**M**	**M**	**-**	**-**	**L**	**L**	**L**	**-**	**L**	**S**	**-**	**-**
CO4	**S**	**M**	**M**	**-**	**-**	**L**	**L**	**L**	**-**	**L**	**S**	**-**	**-**
CO5	**S**	**M**	**M**	**-**	**-**	**L**	**L**	**L**	**-**	**L**	**S**	**-**	**-**

***S-Strong M-Medium L-Low**

Course Code		Software Agents	L	T	P	C
Core/elective/Supportive		Elective : II	5	0	0	4
Pre - requisite		None	Syllabus version		I	

Course Objectives

- To explain the fundamentals of software agents and agent programming paradigms.
- To explain about software agents and security.

Expected Course Outcomes

1	Describe the fundamentals of agents and agent programming paradigms.	**K1**
2	Discuss the components of java beans, ActiveX and Aglets Programming.	**K2**
3	Explain the concepts of different types of agents and interaction between agents.	**K2**
4	Apply the concepts of intelligent software agents.	**K3**
5	Point out the concepts security agents and its issues.	**K3**

K1 – Remember K2 – Understand K3 – Apply K4- Analyze K5 – Evaluate K6- Create

UNIT I	AGENTS – OVERVIEW	15

UNIT I Agent Definition – Agent Programming Paradigms – Agent Vs Object – Aglet – Mobile Agents –Agent Frameworks – Agent Reasoning

UNIT II	JAVA AGENTS	15

UNIT II Processes – Threads – Daemons – Components – Java Beans – ActiveX – Sockets – RPCs – Distributed Computing –Aglets Programming – Jini Architecture – Actors and Agents – Typed and Proactive Messages

UNIT III	MULTIAGENT SYSTEMS	15

Interaction between Agents – Reactive Agents – Cognitive Agents – Interaction Protocols – Agent Coordination – Agent negotiation – Agent Cooperation – Agent Organization – Self-Interested Agents in Electronic Commerce Applications

UNIT IV	INTELLIGENT SOFTWARE AGENTS	15

Interface Agents – Agent Communication Languages – Agent Knowledge Representation – Agent Adaptability – Belief Desire Intension – Mobile Agent Applications

UNIT V	AGENTS AND SECURITY	15

Agent Security Issues – Mobile Agents Security – Protecting Agents against Malicious Hosts – Untrusted Agent – Black Box Security – Authentication for Agents – Security Issues for Aglets

Total Lecture Hours	75 Hours

Text Book(s)

1	Bigus & Bigus, "Constructing Intelligent agents with Java", Wiley, 2010.
2	Bradshaw, "Software Agents", MIT Press, 2012.

Reference Book(s)

1	Russel & Norvig, "Artificial Intelligence a modern approach", Prentice Hall, 1994.
2	Richard Murch and Tony Johnson, "Intelligent Software Agents", Prentice Hall, 2000.
3	Michael Wooldridge, "An Introduction to Multi Agent Systems", John Wiley, 2002.

	Related Online Contents (MOOC, SWAYAM,NPTEL, Websites etc)	
1	https://onlinecourses.swayam2.ac.in/aic20_sp06/preview	
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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	S	M	M	-	-	-	L	L	-	L	S	-	-
CO2	S	M	M	-	-	-	L	L	-	L	S	-	-
CO3	S	M	M	-	-	-	L	L	-	L	S	-	-
CO4	S	M	M	-	-	-	L	L	-	L	S	-	-
CO5	S	M	M	-	-	-	L	L	-	L	S	-	-

***S-Strong M-Medium L-Low**

Course Code		Natural Language Processing	L	T	P	C
Core/elective/Supportive		Elective : III	6	0	0	4
Pre - requisite		None				I

Course Objectives

- To introduce the fundamental concepts and techniques of natural language processing (NLP)

Expected Course Outcomes

1	Describe the fundamental concepts of natural language processing (NLP), Sentiment classification.	K1
2	Explain models of Neural Networks and Neural Language.	K2
3	Demonstrate the computational properties of natural languages and the commonly used Algorithms for processing context-free grammar.	K2
4	Summarize Information Extraction algorithm and Lexical Relations.	K2
5	Analyze the concepts of Chatbot and Dialogue Systems	K4

K1 – Remember K2 – Understand K3 – Apply K4- Analyze K5 – Evaluate K6- Create

UNIT I	Introduction to NLP	13

Regular Expressions, Text Normalization, Edit Distance- N-gram Language Models: N-Grams - Evaluating Language Models -Smoothing. Naive Bayes and Sentiment Classification: Naive Bayes Classifiers - Training the Naive Bayes Classifier - Optimizing for Sentiment Analysis- Vector Semantics and Embeddings- Lexical Semantics- Vector Semantics- Words and Vectors.

UNIT II	Word Level Analysis	14

Neural Networks and Neural Language Models- Feed-Forward Neural Networks - Neural Language Models. Sequence Labeling for Parts of Speech and Named Entities: (Mostly) English Word Classes- Part-of-Speech Tagging- Named Entities and Named Entity Tagging- HMM Part-of-Speech Tagging. Deep Learning Architectures for Sequence Processing.

UNIT III	Syntactic Level Analysis	16

Language Models Revisited- Recurrent Neural Networks- Managing Context in RNNs: LSTMs and GRUs-Contextual Embeddings. Machine Translation and Encoder-Decoder Models- Language Divergences and Typology- The Encoder-Decoder Model- Encoder-Decoder with Transformers. Constituency Grammars-- Context-Free Grammars- Grammar Equivalence and Normal Form- Lexicalized Grammars.

UNIT IV	Semantic Level Analysis	15

Information Extraction- Relation Extraction- Relation Extraction Algorithms- Extracting Times- Extracting Events and their Times. Word Senses and WordNet- Word Senses- Relations Between Senses - WordNet: A Database of Lexical Relations. Lexicons for Sentiment, Affect, and Connotation- Defining Emotion- Available Sentiment and Affect Lexicons- Semi-supervised Induction of Affect Lexicons- Supervised Learning of Word Sentiment.

UNIT V	Speech Recognition	17

Chatbots & Dialogue Systems- Properties of Human Conversation- Chatbots- GUS: Simple Frame-based Dialogue Systems. Automatic Speech Recognition and Text-to-Speech- The Automatic Speech Recognition Task - Speech Recognition Architecture- Other Speech Tasks.

Total Lecture Hours	75 Hours

Text Book(s)		
1	Daniel J and James H. Martin, “Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistcs & Speech Recognition” Prentice hall, 2009.	
Reference Book(s)		
1	Steven Bird, Ewan Klein and Edward Loper, —”Natural Language Processing with Python”, First Edition, OReilly Media, 2009.	
	Related Online Contents (MOOC, SWAYAM,NPTEL, Websites etc)	
1	**https://onlinecourses.swayam2.ac.in/aic20_sp06/preview**	
2	**https://onlinecourses.swayam2.ac.in/arp19_ap79/preview**	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	S	M	M	-	-	-	L	L	-	L	S	-	-
CO2	S	M	M	-	-	-	L	L	-	L	S	-	-
CO3	S	M	M	-	-	-	L	L	-	L	S	-	-
CO4	S	M	M	-	-	-	L	L	-	L	S	-	-
CO5	S	M	M	-	-	-	L	L	-	L	S	-	-

***S-Strong M-Medium L-Low**

Course Code		Client Server Computing	L	T	P	C
Core/elective/Supportive		Elective : III	5	0	0	4
Pre - requisite		None	Syllabus version		I	

Course Objectives

- To introduce the concepts of client and server
- To describe the various components of client server computing

Expected Course Outcomes

1	Identify the concept of client and server in a network	**K1**
2	Explain the various components and Role of client server Applications.	**K2**
3	Analyze the Client Server application connectivity and Communication Interface technology.	**K4**
4	Analyze the various software and hardware applications of client / server.	**K4**
5	Analyze the components of Client Server computing in terms of Service & Support	**K4**

K1 – Remember K2 – Understand K3 – Apply K4- Analyze K5 – Evaluate K6- Create

UNIT I	**Introduction**	**14**

Client / Server Computing–Advantages of Client / Server Computing–Technology Revolution – Connectivity – Ways to improve Performance – How to reduce network Traffic.

UNIT II	**Components of Client / Server Applications**	**16**

Components of Client / Server Applications–The Client: Role of a Client–Client Services – Request for Service. Components of Client / Server Applications – The Server: The Role of a Server – Server Functionality in Detail – The Network Operating System – What are the Available Platforms – The Server Operating system.

UNIT III	**Connectivity & IPC**	**15**

Components of Client / Server Applications–Connectivity: Open System Interconnect – Communications Interface Technology – Inter-process communication – WAN Technologies.

UNIT IV	**Components of C/S application H/W & S/W**	**14**

Components of Client / Server Applications–Software. Components of Client /Server Applications – Hardware.

UNIT V	**Service & Support**	**16**

Components of Client / Server applications–Service and Support: System Administration. The Future of Client / Server Computing: Enabling Technologies – Transformational Systems.

Total Lecture Hours	**75 Hours**

Text Book(s)

1	Client /Server Computing, Patrick Smith, Steve Guenferich, 2nd edition, PHI. *(Chapters1-8 & 10)*

Reference Book(s)

1	RobertOrfali, Dan Harkey, Jeri Edwards: The Essential Client/Server Survival Guide, 2nd edition, Galgotia Publications.
2	Dewire and Dawana Travis, Client/ Server Computing, TMH

Related Online Contents (MOOC, SWAYAM,NPTEL, Websites etc)

1	https://onlinecourses.swayam2.ac.in/aic20_sp06/preview	
2	https://onlinecourses.swayam2.ac.in/arp19_ap79/preview	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	S	M	M	-	-	-	L	L	-	L	S	-	-
CO2	S	M	M	-	-	-	L	L	-	L	S	-	-
CO3	S	M	M	-	-	-	L	L	-	L	S	-	-
CO4	S	M	M	-	-	-	L	L	-	L	S	-	-
CO5	S	M	M	-	-	-	L	L	-	L	S	-	-

***S-Strong M-Medium L-Low**

Course Code		Reinforcement Learning	L	T	P	C
Core/elective/Supportive		Elective : III	5	0	0	4
Pre - requisite		None	Syllabus version			I

Course Objectives

- To understand the Reinforcement Learning techniques
- To apply the latest techniques in solving real time problems.

Expected Course Outcomes

1	Describe the basic concepts of reinforcement learning Techniques.	K1
2	Apply the most appropriate Markov decision processes and dynamic programming technique for a given real time world problem	K3
3	Implement Monte Carlo methods TD methods for solving real world applications.	K3
4	Apply existing performance analysis techniques to improve the performance effectively.	K3
5	Explain the Various Approximate Solution Methods and Applications.	K2

K1 – Remember K2 – Understand K3 – Apply K4- Analyze K5 – Evaluate K6- Create

UNIT I	Reinforcement Learning Problem and Multi Arm Bandits	14

Reinforcement learning (RL) – Examples – Elements of RL – Limitation and Scope – An Extended Example: Tic Tac Toe – An n- armed Bandit Problem – Action Value Methods – Incremental Implementation – Tracking a Nonstationary problem – Optimistic Initial Values – Upper Confidence bound Action Selection - Gradient Bandits – Associative Search (Contextual Bandits).

UNIT II	Finite Markov Decision Processes and Dynamic Programming	16

The Agent – Environment Interface – Goals and Rewards – Returns – Unified Notation for Episodic and Continuing Tasks – The Markov Property – Markov Decision Process – Value Functions – Optimal value Functions – Optimality and Approximation – Policy Evaluation – Policy Improvement – Policy Iteration – Value Iteration – Asynchronous Dynamic Programming – Generalized Policy Iteration – Efficiency of Dynamic Programming.

UNIT III	Monte Carlo Methods and Temporal Difference Learning	15

Monte carlo Prediction – Monte carlo estimation of Action Values – Monte Carlo Control – Monte carlo Control without Exploring Starts – Off Policy prediction via Importance Sampling – Incremental implementation – Off Policy Monte carlo control – Importance Sampling on Truncated Returns – TD Prediction – Advantages of TD Prediction methods – Optimality of TD (0) – Sarsa: On Policy TD Control – Q learning: Off policy TD Control – Games, Afterstates and other Special cases.

UNIT IV	Eligibility Traces, Planning and Learning with Tabular Methods	14

N step TD Prediction - The Forward View of TD – The Backward View of TD – Equivalences of Forward and Backward Views – Sarsa – Watkins's Q - O_-policy Eligibility Traces using Importance Sampling - Implementation Issues - Variable lambda - Models and Planning - Integrating Planning, Acting, and Learning - When the Model Is Wrong - Prioritized Sweeping - Full vs. Sample Backups - Trajectory Sampling - Heuristic Search - Monte Carlo Tree Search.

UNIT V	Approximate Solution Methods and Applications	16

On-policy Approximation of Action Values - Value Prediction with Function Approximation - Gradient-Descent Methods - Linear Methods - Control with Function Approximation - Should We Bootstrap? – Off policy Approximation of Action Values - Policy Approximation – Actor Critic Methods - Eligibility Traces for Actor Critic Methods - R-Learning and the Average-Reward Setting – Applications – Alpha Go – Self Driving Car.	
Total Lecture Hours	**75 Hours**
Text Book(s)	
1	Richard S. Sutton and Andrew G. Barto, "Reinforcement Learning: An Introduction" 2nd Edition, MIT Press, 2015.
	Reference Book(s)
1	S.N. Sivanandam and S.N. Deepa, "Principles of Soft Computing", Wiley India (P) Ltd., New Delhi, 2007
2	S.N. Sivanandam, S.Sumathi and S.N. Deepa, "Introduction to Neural Networks using Matlab 6.0" Tata McGrawHill Publications, New Delhi, 2005.
3	Laurene Fausett, " Fundamentals of Neural Networks", Pearson Education India, New Delhi, 2004.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	**S**	**M**	**M**	**-**	**-**	**-**	**L**	**L**	**-**	**L**	**S**	**-**	**-**
CO2	**S**	**M**	**M**	**-**	**-**	**-**	**L**	**L**	**-**	**L**	**S**	**-**	**-**
CO3	**S**	**M**	**M**	**-**	**-**	**-**	**L**	**L**	**-**	**L**	**S**	**-**	**-**
CO4	**S**	**M**	**M**	**-**	**-**	**-**	**L**	**L**	**-**	**L**	**S**	**-**	**-**
CO5	**S**	**M**	**M**	**-**	**-**	**-**	**L**	**L**	**-**	**L**	**S**	**-**	**-**

***S-Strong M-Medium L-Low**

Course Code		Oracle and Sql Lab	L	P	C
Core/elective/Supportive		Skill based Subject : 4	0	6	4
Pre - requisite		Knowledge in Database Management System	Syllabus version	I	

Course Objectives

- Enhance the knowledge of the processes of Database Development using Oracle and SQL
- Enhance Programming skills and techniques in Oracle and SQL.

Expected Course Outcomes

1	Apply various DDL and DML commands	**K3**
2	Demonstrate Aggregation functions, Arithmetic and Comparison operators in SQL	**K2**
3	Apply String and Set operations in SQL	**K3**
4	Illustrate Subquery and logical operations.	**K1**
5	Evaluate SQL queries to exhibit the concept of Constraints and Special operators	**K5**

K1 – Remember K2 – Understand K3 – Apply K4- Analyze K5 – Evaluate K6- Create

List of Programs

1. **Implementation of DDL Commands**

Create a table EMPLOYEE with following schema: (Emp_no, E_name, E_address, E_ph_no, Dept_no, Dept_name,Job_id ,Job_name, Salary)

a) Add a new column; HIREDATE to the existing relation.
b) Change the datatype of JOB_ID from char to varchar2.
c) Change the name of column/field Emp_no to E_no.
d) Modify the column size of the Job_name field of emp table
e) Describe the table Employee using desc command
f) Create another new table and drop it.

2. **Implementation of DML Commands**

Create a table EMPLOYEE with following schema: (Emp_id, E_name, E_address, E_ph_no, Dept_no, Dept_name,Job_id , Salary)

Write SQL queries for following question:

a) Insert aleast 5 rows in the table.
b) Display all the information of EMP table.
c) Display the record of each employee who works in department D10.
d) Update the city of Emp_id = 12 with current city as Nagpur.
e) Display the details of Employee who works in department MECH.
f) Delete the email_id of employee James.
g) Display the complete record of employees working in SALES Department.

3. **Implementation of Aggregation Functions**

Create a table EMPLOYEE with following schema: (Emp_no, E_name, E_address, E_ph_no, Dept_no, Dept_name,Job_id, Designation , Salary)

a) print the count of tuple in E_name excluding duplicate values
b) print the sum of salary for all Employees
c) print the average of salary for all Employees
d) print the sum of salary for all managers
e) display highest and lowest salary for all Employees
f) display highest and lowest salary for all Managers
g) display the number of employees in the CSE department

4. **Implementation of Arithmetic and Comparison Operators**

Create a table for Employee details with Employee Number as primary key and following fields: Name, Designation, Gender, Age, Date of Joining and Salary.

a) Write a query to calculate the salary increase of 1000 for all the employees and display a new salary + 1000 column in the output.
b) Write a query to calculate the salary reduction of 1000 for all the employees and display a new salary - 1000 column in the output.
c) Write a query to retrieve the Name and Salary for all employees whose Salary is less than or equal to 15000.
d) Write a query to retrieve the Name and Salary for all employees whose Salary is greater than or equal to 25000.
e) **Display first 50% records from Employee table**
f) **Display last 50% records from Employee table**
g) **Display the name of employees whose age are greater than or equal to 45 and salary is greater than 10000?**

5. **Implementation of String Operations**

Create a table for Student details with Register Number as primary key and following fields: Reg_no, Name, Department, Gender, Age, Marks.

a) Write a query to retrieve name of all students whose name begins with "r".
b) Write a query to retrieve name of all students whose second letter of name is "a".
c) Write a query to retrieve name of all students who have "a" and "u" letters in their name.
d) Find the length of the strings
e) Convert strings to Uppercase and Lowercase

6. **Implementation of Set Operations:**

Create a table for Course details with course_id, course_name, semester(odd/even), started_year

a) Find all courses taught in the odd 2009 semester.
b) Find all courses taught in the even 2010 semester.
c) Find all courses taught either in odd 2009 or in even 2010, or both.
d) Find the set of all courses taught in the odd 2009 as well as in even 2010
e) Find all courses taught in the odd 2009 semester but not in the even 2010

7. **Implementation of Subquery Operations**

Create a table for Employee details with Employee Number as primary key and following fields: Emp_name, Designation, Gender, Age, Date of Joining and Salary

a) **Select all records from Employee table whose name is 'Amit' and 'Pradnya**
b) **Select all records from Employee table where name not in 'Amit' and 'Pradnya'**
c) **Find maximum salary of each department?**
d) Write a query to display the average salaries of those departments that have an average salary greater than Rs.8000.
e) Write a query to display all the designation which have a lowest average salary
f) Write a query to display the distinct values of Emp_name field.

8.**Implementation of AND, OR, NOT Operators**

Create a customer table with the following fields: CustomerID, CustomerName,ContactName, Address, City, PostalCode, Country.

a) Write a query to retrieve the CustomerID, CustomerName, ContactName, Address of all customers whose country is "NOT IN" "India".
b) Write a query to retrieve the CustomerID, CustomerName, ContactName, Address of all customers whose country contains the string "in"
c) Display all fields from "Customers" where city is "Berlin" OR "Malaysia"
d) Display all fields from "Customers" where country is "Germany" OR "Spain"
e) Display all fields from "Customers" where country is NOT "Germany"
f) Display all fields from "Customers" where country is "Germany" AND city must be "Berlin" OR "Malaysia"
g) Display all fields from "Customers" where country is NOT "Germany" and NOT "USA"

9. **Implementation of Constraints**

Create tables for library management system which demonstrate the use of primary key and foreign key.

a) Master table should have the following fields: Accno, Title, Author and Rate.
b) Create Primary key constraint on the column Accno, also assign Not Null constraint for all the other fields
c) Transaction table should have the following fields: User id, Accno, Student name, Date of Issue and Date of Return.
d) Create Foreign key constraint on the column Accno with reference to the Transaction table and also assign Not Null constraint for all the other fields
e) Add unique constraint to the column student_name in d Transaction table
f) Display the tuples of Accno, Title and Date of issue

10. **Implementation of Special Operators**

Write a query to create a table Employee with the following list of attributes Empid, Name,Salary and Designation.

a) Write a query to retrieve Name,Empid and Salary for all employees whose designation is "Manager".
b) Write a query to retrieve Name,Empid, Salary and Designation of all employees and sort the result in a descending of Name using "ORDER BY" clause.
c) Write a query to retrieve the Empid, Name, and salary of all employees whose empid is a123 and a125 using "IN" condition.
d) Write a query to retrieve Name and Salary of all employees whose salary is between 10000 and 150000 using "BETWEEN" and "AND" condition.
e) Write a q**uery to fetch first record from Employee table?**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	**S**	**S**	**S**	-	**L**	-	-	**L**	-	-	**S**	**S**	**L**
CO2	**S**	**S**	**S**	-	**L**	-	-	**L**	-	-	**S**	**S**	**L**
CO3	**S**	**S**	**S**	-	**L**	-	-	**L**	-	-	**S**	**S**	**L**
CO4	**S**	**S**	**S**	-	**L**	-	-	**L**	-	-	**S**	**S**	**L**
CO5	**S**	**S**	**S**	-	**L**	-	-	**L**	-	-	**S**	**S**	**L**

***S-Strong M-Medium L-Low**