NARAYANA ENGINEERING COLLEGE::GUDUR

AUTONOMOUS

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

B.Tech – CSE - Course Structure, w.e.f AY:2020-21

DEPARTMENT VISION & MISSION

VISION OF THE DEPARTMENT

- To produce globally competent software professionals in the field of computer science and engineering to meet the needs of industry and society along with research and consultancy, lifelong learning, leadership qualities and ethics.

MISSION OF THE DEPARTMENT

- To deliver quality technical education by practicing innovative teaching learning processes making student's self-sufficient individuals
- To inculcate innovative thinking and problem solving skills in learners through training programs and collaborative interaction with industry.
- To develop professional behaviour with strong ethical values, leadership qualities and lifelong learning by providing value based education

PEOs, POs, PSOs

PEOs

PEO 1: To attain higher position in career by exhibiting expertise in solving real world problems.

PEO 2: Fill technical gaps and take leadership roles and achieve substantive results for the development of organization.

PEO 3: Adapt to rapidly changing technologies through lifelong learning.

POs

1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12: Life-long learning: Recognize the need for, and have the preparation and ability to

engage in independent and life-long learning in the broadest context of technological change.

PSOs

PSO 1: Software Product Development: Apply the principles and practices of software Engineering for developing quality software applications

PSO 2: Employment: Get employed in industries through their knowledge attained in Basic and advanced programming languages, specialized software packages or become an entrepreneur.

SEMESTER - I

Course Code	Cat.	Course Title	Contact Periods per week				Credits	Scheme of Examination Max. Marks		
			L	T	P	Total		Int. Marks	Ext. Marks	Total marks
20MA1001	BS	Algebra and Calculus	3	1	0	4	4	40	60	100
20CH1001	BS	Chemistry	3	0	0	3	3	40	60	100
20ES1001	ES	Problem Solving and Programming	3	0	0	3	3	40	60	100
20EN1001	HS	English	2	0	0	2	2	40	60	100
20CH1501	BS	Chemistry Lab	0	0	3	3	1.5	40	60	100
20ES1504	ES	Engineering Graphics Lab	0	1	4	5	3	40	60	100
20ES1506	ES	Problem Solving and Programming lab	0	0	3	3	1.5	40	60	100
20EN1501	HS	English Language Lab	0	0	3	3	1.5	40	60	100
20MC8001	MC	Mandatory course I:Induction Program	--							
		Counselling/Mentoring	0	0	1	1	0	--	--	--
		Sports/Hobby Clubs/Activities	0	0	2	2	0	--	--	--
		Activity Point Programme	During the Semester				20 Pts			
			11	**2**	**16**	**29**	**19.5**	**320**	**480**	**800**

SEMESTER -II

Course Code	Cat.	Course Title	Contact Periods per week				Credits	Scheme of Examination Max. Marks		
			L	T	P	Total		Int. Marks	Ext. Marks	Total marks
20MA1002	BS	Number Theory and Applications	3	1	0	4	4	40	60	100
20PH1004	BS	Semiconductor Physics	3	0	0	3	3	40	60	100
20ES1003	ES	Basic Electrical and Electronics Engineering	3	0	0	3	3	40	60	100
20ES1009	ES	Python Programming	3	0	0	3	3	40	60	100
20PH1504	BS	Semiconductor physics lab	0	0	3	3	1.5	40	60	100
20ES1508	ES	Basic Electrical and Electronics Engineering lab	0	0	2	2	1	40	60	100
20ES1505	ES	Engineering and IT Workshop	0	0	4	4	2	40	60	100
20ES1512	ES	Python Programming Lab	0	0	2	2	1	40	60	100
20EN1502	HS	Oral Communication Skills Lab	0	0	2	2	1	40	60	100
20MC8002-12	MC	Mandatory Course II	2	0	0	2	0	--	--	--
		Counselling/Mentoring	0	0	1	1	0	--	--	--
		Sports/Hobby Clubs/Activities	0	0	2	2	0	--	--	--
		Activity Point Programme	During the Semester				20 Pts			
			14	**1**	**16**	**31**	**19.5**	**360**	**540**	**900**

SEMESTER - III

Course Code	Cat.	Course Title	Contact Periods per week				Credits	Scheme of Examination Max. Marks		
			L	T	P	Total		Int. Marks	Ext. Marks	Total marks
20ES1012	ES	Data Structures and Algorithms	3	0	0	3	3	40	60	100
20CS2001	PC	Computer Organization and Architecture	3	0	0	3	3	40	60	100
20CS2002	PC	Database Management systems	3	0	0	3	3	40	60	100
20CS2003	PC	Mathematical Foundation for Computer Science	3	0	0	3	3	40	60	100
20CS2004	PC	Object Oriented Programming using Java	3	0	0	3	3	40	60	100
20ES1515	ES	Data Structures and Algorithms lab	0	0	3	3	1.5	40	60	100
20CS2501	PC	Database Management Systems lab	0	0	3	3	1.5	40	60	100
20CS2502	PC	Object Oriented Programming using Java Lab	0	0	3	3	1.5	40	60	100
20CD6001	SC	Career competency development I	0	0	2	2	1	40	60	100
20CC6001	SC	Value added course/Certificate course I	0	0	0	0	1	40	60	100
		Counselling/Mentoring	0	0	1	1	0	--	--	--
		Sports/Hobby Clubs/Activities	0	0	2	2	0	--	--	--
		Activity Point Programme	During the Semester				20 Pts			
			15	**0**	**14**	**29**	**21.5**	**400**	**600**	**1000**

SEMESTER -IV

Course Code	Cat.	Course Title	Contact Periods per week				Credits	Scheme of Examination Max. Marks		
			L	T	P	Total		Int. Marks	Ext. Marks	Total marks
20MA1007	BS	Statistical Analysis and Techniques using R	3	0	0	3	3	40	60	100
20CS2005	PC	Computer Networks	3	0	0	3	3	40	60	100
20CS2006	PC	Operating Systems	3	0	0	3	3	40	60	100
20CS2007	PC	Software Engineering	3	0	0	3	3	40	60	100
	OE	Open Elective I	3	0	0	3	3	40	60	100
20MA1501	BS	Statistical Analysis and Techniques using R Lab	0	0	3	3	1.5	40	60	100
20CS2503	PC	Operating Systems & Computer Networks Lab	0	0	3	3	1.5	40	60	100
20CS2504	PC	Software Engineering Lab	0	0	3	3	1.5	40	60	100
20CD6002	SC	Career Competency development II	0	0	2	2	1	40	60	100
20CC6002	SC	Value added course/Certificate course II	0	0	0	0	1	40	60	100
20MC8002-12	MC	Mandatory course III	2	0	0	2	0	--	--	--
		Counselling/Mentoring	0	0	1	1	0	--	--	--
		Sports/Hobby Clubs/Activities	0	0	2	2	0	--	--	--
		Activity Point Programme	During the Semester				20 Pts			
			17	**0**	**14**	**31**	**21.5**	**400**	**600**	**1000**

SEMESTER -V

Course Code	Cat.	Course Title	Contact Periods per week				Credits	Scheme of Examination Max. Marks		
			L	T	P	Total		Int. Marks	Ext. Marks	Total marks
20CS2008	PC	Artificial Intelligence	3	0	0	3	3	40	60	100
20CS2009	PC	Design and Analysis of Algorithms	3	0	0	3	3	40	60	100
20CS2010	PC	Theory of Computation	3	0	0	3	3	40	60	100
	OE	Open Elective II	3	0	0	3	3	40	60	100
20CS4001-05	PE	Professional Elective I	3	0	0	3	3	40	60	100
20CS2505	PC	Artificial intelligence lab	0	0	2	2	1	40	60	100
20CS2506	PC	Coding Lab I	0	0	2	2	1	40	60	100
20CS2507	PC	Design and Analysis of Algorithms Lab	0	0	2	2	1	40	60	100
20CD6003	SC	Career competency development III	0	0	2	2	1	40	60	100
20CC6003	SC	Value added Course/Certificate Course III	0	0	0	0	1	40	60	100
20CS7001	PR	Internship I/On job Training/Comm. Service Project	0	0	0	0	1.5	40	60	100
		Counselling/Mentoring	0	0	1	1	0	--	--	--
		Sports/Hobby Clubs/Activities	0	0	2	2	0	--	--	--
		Activity Point Programme	During the Semester				20 Pts			
			15	**0**	**11**	**26**	**21.5**	**440**	**560**	**1100**

SEMESTER -VI

Course Code	Cat.	Course Title	Contact Periods per week				Credits	Scheme of Examination Max. Marks		
			L	T	P	Total		Int. Marks	Ext. Marks	Total marks
20HS5001-08	HS	Humanities and Social Science Elective	2	0	0	2	2	40	60	100
20CS2011	PC	Mobile Application Development	2	0	0	2	2	40	60	100
20CS2012	PC	Web Technologies	3	0	0	3	3	40	60	100
	OE	Open elective III	3	0	0	3	3	40	60	100
20CS4006-10	PE	Professional elective II	3	0	0	3	3	40	60	100
20CS4011-15	PE	Professional Elective III	3	0	0	3	3	40	60	100
20CS2508	PC	Coding Lab II	0	0	2	2	1	40	60	100
20CS2509	PC	Mobile Application Development Lab	0	0	2	2	1	40	60	100
20CS2510	PC	Web technologies Lab	0	0	3	3	1.5	40	60	100
20CD6004	SC	Career competency Development IV	0	0	2	2	1	40	60	100
20CC6004	SC	Value added course/Certificate Course IV	0	0	0	0	1	40	60	100
20MC8002-12	MC	Mandatory course IV	2	0	0	2	0	--	--	--
		Counselling/Mentoring	0	0	1	1	0	--	--	--
		Sports/Hobby Clubs/Activities	0	0	2	2	0	--	--	--
		Activity Point Programme	During the Semester				20 Pts			
			18	**0**	**12**	**30**	**21.5**	**440**	**560**	**1100**

SEMESTER -VII

Course Code	Cat.	Course Title	Contact Periods per week				Credits	Scheme of Examination Max. Marks		
			L	T	P	Total		Int. Marks	Ext. Marks	Total marks
20CS2013	PC	Cryptography and Network Security	3	0	0	3	3	40	60	100
20CS2014	PC	Data Science	3	0	0	3	3	40	60	100
20CS2015	PC	Machine Learning	2	0	0	2	2	40	60	100
	OE	Open Elective IV	2	0	2	4	3	40	60	100
20CS4016-20	PE	Professional Elective IV	3	0	0	3	3	40	60	100
20CS4021-25	PE	Professional Elective V	3	0	0	3	3	40	60	100
20CS2511	PC	Data Science Lab	0	0	3	3	1.5	40	60	100
20CS2512	PC	Machine Learning Lab	0	0	2	2	1	40	60	100
20CD6005	SC	Career competency Development V	0	0	2	2	1	40	60	100
20CC6501	SC	Skill development Training	0	0	2	2	1	40	60	100
20CS7002	PR	Internship I/On job Training/Comm. Service Project	0	0	0	0	1.5	40	60	100
		Counselling/Mentoring	0	0	1	1	0	--	--	--
		Sports/Hobby Clubs/Activities	0	0	2	2	0	--	--	--
		Activity Point Programme	During the Semester				20 Pts			
			16	**0**	**14**	**30**	**23**			**1100**

SEMESTER -VIII

Course Code	Cat.	Course Title	Contact Periods per week				Credits	Scheme of Examination Max. Marks		
			L	T	P	Total		Int. Marks	Ext. Marks	Total marks
20CS7003	PR	Project work, seminar and internship	0	0	0	0	12	60	140	200
		Activity Point Programme	During the Semester				20 Pts			
			0	**0**	**0**	**0**	**12**	**60**	**140**	**200**

OPEN ELECTIVES (OE) – FOR OTHER BRANCHES

OPEN ELECTIVES OFFERED BY DEPARTMENT OF CSE		
S. No	**COURE CODE**	**TITLE OF THE COURSE**
1	20CS3001	Introduction to Data Structures
2	20CS3002	Introduction to Python
3	20CS3003	JAVA Programming
4	20CS3004	Advanced Java Programming
5	20CS3005	Principles of Databases
6	20CS3006	Operating System Concepts
7	20CS3007	Computer Communication Networks
8	20CS3008	Mobile Application Development
9	20CS3009	Web Technologies
10	20CS3010	Applied Artificial intelligence
11	20CS3011	Information & Cyber Security
12	20CS3012	Cloud Computing
13	20CS3013	Introduction to Machine Learning

THE PROFESSIONAL ELECTIVES

The Professional Elective Courses (PE) are shown in different tracks/groups: The students will have options of selecting the electives from the different tracks/groups depending on the specialization one wishes to acquire.

Electives Track/ Groups	**Professional Elective-1**	**Professional Elective-2**	**Professional Elective-3**	**Professional Elective-4**	**Professional Elective-5**
Computer Networks and Securities	Network Protocols and Programming 20CS4001	Ethical Hacking 20CS4006	Information and Cyber Security 20CS4011	Computer Forensics 20CS4016	Block chain Technologies 20CS4021
Software Engineering	Software Project Management 20CS4002	Software Architecture 20CS4007	Software Testing 20CS4012	Object Oriented Analysis and Design 20CS4017	Agile Software Development 20CS4022
Data Science and Engineering	Data warehousing and data mining 20CS4003	Business Intelligence and Analytics 20CS4008	Information Storage and Retrieval Systems 20CS4013	Predictive Modeling and Analytics 20CS4018	Tools and Techniques for Data Science 20CS4023
Cloud Computing	Distributed Systems 20CS4004	Green Computing 20CS4009	Cloud Computing 20CS4014	High Performance Computing 20CS4019	Grid Computing 20CS4024
Virtualization and Others	Compiler Design 20CS4005	Robotic Process Automation 20CS4010	Deep Learning 20CS4015	Augmented and Virtual Reality 20CS4020	Virtualization Technologies 20CS4025

HONORS

Course Code	Course Name	L-T-P	Credits
POOL-1			
20CSH001	Object Oriented Programming with C++	3-1-0	4
20CSH002	Linux Programming	3-1-0	4
20CSH003	Advanced Data structures	3-1-0	4
20CSH004	Advanced JAVA and J2EE	3-1-0	4
POOL-2			
20CSH005	Social Network Mining and Analysis	3-1-0	4
20CSH006	Cyber Crime Investigation and Digital Forensics	3-1-0	4
20CSH007	Firewall and VPN Security	3-1-0	4
20CSH008	No SQL Databases	3-1-0	4
POOL-3			
20CSH009	Design Patterns	3-1-0	4
20CSH010	User Interface Design	3-1-0	4
20CSH011	Object Oriented Modeling and Design	3-1-0	4
20CSH012	Multimedia Systems	3-1-0	4
POOL-4			
20CSH013	Big Data Technologies	3-1-0	4
20CSH014	High Performance Computing	3-1-0	4
20CSH015	Advanced Cloud Computing	3-1-0	4
20CSH016	Storage Area Networks	3-1-0	4

SUBJECTS FOR MINOR

Course Code	Course Name	L-T-P	Credits
20CSM001	Operating Systems	3-1-0	4
20CSM002	Database Management Systems	3-1-0	4
20CSM003	Software Engineering	3-1-0	4
20CSM004	Object Oriented Programming using JAVA	3-1-0	4
20CSM005	Web Technologies	3-1-0	4
20CSM006	Computer Networks	3-1-0	4
20CSM007	Computer Organization and Architecture	3-1-0	4
20CSM008	Mobile Application Development	3-1-0	4

HUMANITIES AND SOCIAL SCIENCES (HS)

SEMESTER	SUBJECT	CREDITS
I Sem	English	2
	English language Lab	1.5
II Sem	Oral Communication Skills lab	1
VI Sem	Humanities and Social Science	2
	TOTAL	**6.5**

BASIC SCIENCES (BS)

SEMESTER	SUBJECT	CREDITS
I Sem	Algebra and Calculus	4
	Chemistry	3
	Chemistry Lab	1.5
II Sem	Number Theory and Applications	4
	Semiconductor Physics	3
	Semiconductor physics lab	1.5
IV Sem	Statistical Analysis and Techniques using R	3
	Statistical Analysis and Techniques using R Lab	1.5
	TOTAL	**21.5**

ENGINEERING SCIENCES (ES)

SEMESTER	SUBJECT	CREDITS
I Sem	Problem Solving and programming	3
	Problem Solving and programming lab	1.5
	Engineering Graphics Lab	3
II Sem	Python Programming	3
	Basic Electrical and Electronics Engineering	3
	Python Programming Lab	1
	Basic Electrical and Electronics Engineering lab	1
	Engineering and IT Workshop	2
III Sem	Data Structures and Algorithms	3
	Data Structures and Algorithms lab	1.5
	TOTAL	**22**

PROFESSIONAL CORE (PC)

SEMESTER	SUBJECT	CREDITS
SEM-III	Mathematical Foundation for Computer Science	3
	Object Oriented Programming using Java	3
	Database Management systems	3
	Computer Organization and Architecture	3
	Object Oriented Programming using Java Lab	1.5
	Database Management Systems Lab	1.5
SEM-IV	Operating Systems	3
	Software Engineering	3
	Computer Networks	3
	Operating Systems & Computer Networks Lab	1.5
	Software Engineering Lab	1.5
SEM-V	Theory of Computation	3
	Design and Analysis of Algorithms	3
	Artificial Intelligence	3
	Design and Analysis of Algorithms Lab	1
	Artificial intelligence lab	1
	Coding Lab I	1
SEM-VI	Web Technologies	3
	Mobile Application Development	2
	Mobile Application Development Lab	**1**
	Web technologies Lab	1.5
	Coding Lab II	1
SEM-VII	Cryptography and Network Security	3
	Data science	3
	Machine Learning	2
	Data Science Lab	1.5
	Machine Learning Lab	1
	TOTAL	**58**

PROFESSIONAL ELECTIVES (PE)

SEMESTER	SUBJECT	CREDITS
V Sem	Professional elective 1	3
VI Sem	Professional elective 2	3
	Professional elective 3	3
VII Sem	Professional elective 4	3
	Professional elective 5	3
	TOTAL	**15**

OPEN ELECTIVES (OE)

SEMESTER	SUBJECT	CREDITS
IV Sem	Open Elective 1	3
V Sem	Open Elective 2	3
VI Sem	Open Elective 3	3
VII Sem	Open Elective 4	3
	TOTAL	**12**

SKILL ORIENTED COURSES (SC)

SEMESTER	SUBJECT	CREDITS
SEM III	Career competency Development I	1
	Value added course/Certificate course I	1
SEM IV	Career competency Development II	1
	Value added course/Certificate course II	1
SEM V	Career competency Development III	1
	Value added course/Certificate Course III	1
SEM VI	Career competency Development IV	1
	Value added course/Certificate course IV	1
SEM VII	Career competency Development V	1
	Skill development Training	1
	TOTAL	**10**

PROJECT (PR)

SEMESTER	SUBJECT	CREDITS
V Sem	Internship I/on job training/Community Service Project	**1.5**
VII Sem	Internship II/on job training/Community Service Project	1.5
VIII Sem	Project work, seminar and internship	12
	TOTAL	**15**

Credits Table

SUBJECT AREA	CREDITS PER SEMESTER								CREDITS
	I	II	III	IV	V	VI	VII	VIII	
HS	3.5	1				2			**6.5**
BS	8.5	8.5		4.5					**21.5**
ES	7.5	10	4.5						**22**
PC			15	12	12	8.5	10.5		**58**
OE				3	3	3	3		**12**
PE					3	6	6		**15**
PR					1.5		1.5	12	**15**
SC			2	2	2	2	2		**10**
TOTAL	**19.5**	**19.5**	**21.5**	**21.5**	**21.5**	**21.5**	**23**	**12**	**160**

SEMESTER - I

NARAYANA ENGINEERING COLLEGE:GUDUR								
20ES1001	**PROBLEM SOLVING AND PROGRAMMING**							R20
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
I	3	0	0	48	3	40	60	100

Pre-requisite: Mathematics Knowledge, Analytical and Logical skills

Course Objectives:

1. To understand various steps in Program development.
2. To understand the basic concepts in C Programming Language.
3. To learn how to write modular and readable C Programs.
4. To learn the syntax and semantics of a C Programming language.
5. To learn structured programming approach for problem solving.

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

CO 1	Identify methods to solve a problem through computer programming. (BL - 3)
CO 2	Understand the use of basic elements of C language. (BL - 2)
CO 3	Understand the difference and the usage of various control statement. (BL - 2)
CO 4	Apply the modular approach for solving the problems. (BL - 3)
CO 5	Apply the Arrays and Pointers for solving problems. (BL - 3)
CO 6	Explain User-Defined Data Types and Files. (BL - 2)

CO-PO Mapping

CO	PO												PSO	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	3											1	
CO2	1	2	1										1	
CO3	1	2	1		2								2	2
CO4	2	2	3	2	1							2	3	2
CO5	3	3	2	2								1	2	
CO6	2	2	2	2								1	2	

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1	**Fundamentals of Computers and Programming**	**8H**

Fundamentals of computers: History of Computers, Generations of Computer, The Computer System - The Input-Process-Output Concept, Components of Computer System, Operating System - Introduction, Objectives, Functions.

Introduction to Programming, Algorithms and Flowcharts: Programs and Programming, Programming languages, Compiler, Interpreter, Structured Programming Concept, Algorithms, Flowcharts, How to Develop a Program.

Fundamental Algorithms: Exchanging the values of Two Variables, Counting, Summation of a set of numbers, Factorial computation, Generation of the FibonacciSequence, Reversing the digits of an integer.

At the end of the Module 1, students will be able to:

1. Illustrate the working of a Computer. (BL - 2)
2. Solve problems using language independent notations. (BL - 3)
3. Understand the compilers and interpreters. (BL - 2)
4. Understand Structured Programming. (BL - 2)
5. Develop algorithms and flowcharts for problems.(BL - 3)

MODULE -2	**Basic Elements of C**	**7 H**

Basics of C: Introduction**,** Character Set, Structure of a C Program, A Simple C Program, Variables,

Data Types and Sizes, Declaration, How does The Computer Store Data in Memory, Identifiers, Keywords, Constants, Assignment, and Initialization.

Operators and Expressions: Arithmetic Operators, Relational Operators, Logical Operators, Bitwise Operators, Conditional Operator, Comma operator, size of operator, Expressions, L values and R values, Expression Evaluation- Precedence and Associativity, Type Conversion.

At the end of the Module 2, students will be able to:

1. Understand the basic structure of a program in C. (BL - 2)
2. Understand tokens in C language.(BL - 2)
3. Illustrate the working of expressions.(BL - 2)
4. Understand the precedence and Associativity rules of operators. (BL - 2)
5. Understand the rules of type conversion. (BL - 2)

MODULE-3	Data Input / Output and Control Statements	8 H

Input and Output: Basic Screen and Keyboard I/O in C, Formatted Input and Output, Unformatted Input and Output Functions

Control Statements: Selection Statements - if, Nested if, if-else, Nested if-else, else-if ladder, switch Looping Statements - while, do-while, for, Nested loops, Unconditional Statements - goto, break, continue, return.

At the end of the Module 3, students will be able to:

1. Explain the Formatted and Unformatted I/O functions. (BL - 2)
2. Understand Selection Statements. (BL - 2)
3. Understand Looping Statements. (BL - 2)
4. Explain Unconditional Statements. (BL - 2)

MODULE-4	Functions and Program Structure	8 H

Functions: Introduction, Using Functions, Passing Arguments to a Function, Working with Function, Scope and Extent, Recursion, The C Preprocessor.

Program Structure: Storage classes, Automatic variables, External variables, Static variables, Register variables, Multi file programs.

At the end of the Module 4, students will be able to:

1. Understand the basic concept of functions. (BL - 2)
2. Understand concept of Recursion and Preprocessor. (BL - 2)
3. Explain storage specifiers. (BL - 2)

MODULE-5	Arrays and Pointers	9 H

Arrays and Strings: Introduction, One-Dimensional Array, Multidimensional Arrays, Passing Arrays to Function, Strings - Declaration, Initialization, Printing Strings, String Input, Character Manipulation, String Manipulation, Arrays of Strings.

Pointers: Fundamentals, Pointer Declarations, Operations on pointers, Passing Pointers to a Function, Pointers and Arrays, Arrays of Pointers, Pointer to Pointer, Pointer to Functions, Command line arguments, Dynamic Memory Management.

At the end of the Module 5, students will be able to:

1. Understand the concept of Arrays. (BL - 2)
2. Understand the concept of pointers. (BL - 2)
3. Explain Dynamic Memory Management. (BL -2)

MODULE-6	User-Defined Data Types and Files	8 H

Structures and Unions: Basics of Structures, Nesting of Structures, Arrays of Structures, Structures and Pointers, Structures and Functions, Self-Referential Structures, Unions, Bit-fields, Enumerations, typedef.

Files: Introduction, Using Files in C, Working with Text Files, Random Accesses to Files of Records.

At the end of the Module 6, students will be able to:

1. Explain user defined data types. (BL - 2)
2. Understand the concept of Self-Referential Structures. (BL - 2)
3. Understand the working of files. (BL - 2)

Total hours:	**48 HOURS**

Content Beyond Syllabus:

1. Analysis of Algorithms
2. Binary Files

3. Variable Length Argument Lists

Text Book(s):

1. Pradip Dey, and Manas Ghosh, "Programming in C", 2018, Oxford University Press.
2. Byron Gottfried, Schaum's Outline of Programming with C, 4th Edition, 2018, McGraw-Hill

Reference Books :

1. Brian W. Kernighan, and Dennis M. Ritchie, "The C Programming Language", 2nd Edition, Pearson.
2. Ajay Mittal, Programming in C: A Practical Approach , 3/e, Pearson Publication
3. SCHILDT and HERBERT, C: The Complete Reference,4th Edition, McGraw Hill, 2020
4. SOMASHEKARA, M. T., GURU, D. S., MANJUNATHA, K. S., Problem Solving with C,2nd Edition, PHI Learning, 2018
5. Paul Deitel, Deitel& Harvey Deitel, C How to Program,6th Edition, Pearson Education
6. Jeri R. Hanly, Elliot B. Koffman, Ashok Kamthane and A.Ananda Rao, Programming in C and Data Structures, 1st Edition, Pearson Education, 2010.
7. H.Cheng, C for Engineers and Scientists, Mc.Graw-Hill International Edition Education / PHI, 2009
8. Yashavant P. Kanetkar, Let us C, 16th Edition, BBP Publications, Delhi, 2017.
9. R.G. Dromey, "How to Solve it by Computer". Pearson,2014.
10. Anita Goel, Computer Fundamentals, Pearson Publication,2010.

NARAYANA ENGINEERING COLLEGE::GUDUR								
20ES1506	**Problem Solving and Programming Lab**							R20
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
I	0	0	3	48	1.5	40	60	100

Pre-requisite: Mathematics Knowledge, Analytical & Logical Skills

Course Objectives:

1. To work with the compound data types
2. To explore dynamic memory allocation concepts
3. To able to design the flowchart and algorithm for real world problems
4. To able to write C programs for real world problems using simple and compound data types
5. To employee good programming style, standards and practices during program development

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

CO 1	Translate algorithms into programs (In C language) (BL - 2)
CO 2	Code and debug programs in C program language using various constructs. (BL - 3)
CO 3	Solve the problems and implement algorithms in C. (BL - 3)
CO 4	Make use of different data types to handle the real time data (BL - 3)

CO-PO Mapping

	PO												PSO	
CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	1	2											1	
CO2	2	2	2										2	1
CO3	2	2	3	1	2								2	2
CO4	2	2	3	1	1								2	2

1: Low, 2-Medium, 3- High

COURSE CONTENT	**CO**
TASK-1 (3H)	
1. Practice DOS and LINUX Commands necessary for execution of C Programs. 2. Study of the Editors, Integrated development environments, and Compilers in chosen platform. 3. Write, Edit, Debug, Compile and Execute Sample C programs to understand the programming environment.	CO 1
TASK-2 (6H)	
1. Practice programs: Finding the sum of three numbers, exchange of two numbers, largest of two numbers, to find the size of data types, Programs on precedence and associativity of operators, sample programs on various library functions.	CO 1
TASK-3 (6H)	
1. Write a C program to calculate the factorial of a given number 2. Fibonacci sequence is defined as follows: the first and second terms in the sequence are 0 & 1. Subsequent terms are found by adding the preceding two terms in the sequence. Write a C program to generate the first n terms of the sequence. 3. Write a program to find the roots of a Quadratic equation.	CO1
TASK-4 (6H)	
1. Write a program to generate the series of prime numbers in the given range. 2. Write a program to reverse the digits of a number. 3. Write a C program to find the sum of individual digits of a positive integer.	CO 2

TASK-5 (3H)	
1. Write a program to check for number palindrome. 2. Write a program to find the maximum of a set of numbers. 3. Write a C program to find the GCD (greatest common divisor) of two given integers	CO 2
TASK-6 (3H)	
1. Write a program to find the sum of positive and negative numbers in a given set of numbers. 2. Write C code to reverse the elements of the array. For example, [1,2,3,4,5] should become [5,4,3,2,1] 3. Write a C program to find factorial of a given integer number using recursion	CO 3
TASK-7 (6H)	
1. Write a C program that use pointers to find Addition of Two Matrices 2. Write a C program that use functions to find Multiplication of Two Matrices	CO 3
TASK-8 (3H)	
1. Write a program to accept a line of characters and print the number of Vowels, Consonants, blank spaces, digits and special characters. 2. Write a C program to check whether a given string is a palindrome or not, without using any built-in functions.	CO 3
TASK-9 (6H)	
1. Illustrate the use of auto, static, register and external variables. 2. Write a program to read and print student information using structures 3. Write a C program to define a union and structure both having exactly the same numbers using the size of operators print the size of structure variables as well as union variable	CO 4
TASK-10 (6H)	
1. Write a program to split a "file" into two files, say file1 and file2. Write lines into the 'file' from standard input. Read the contents from 'file' and write odd numbered lines into file1 and even numbered lines into file2. 2. Write a program to merge two files.	CO 4

Additional Experiments:	
TASK-1	
1. Programs on bitwise operators. 2. Programs on bit fields.	CO4
TASK-2	
1. Write a program to read a set of strings and sort them in alphabetical order. 2. Programs on implementation of structures using files.	CO 4

Virtual Labs:	
1. Problem Solving Lab (IIIT HYDERABAD) :http://ps-iiith.vlabs.ac.in/	
List of Experiments	
1. Numerical Representation 2. Beauty of Numbers 3. More on Numbers 4. Factorials 5. String Operations	6. Recursion 7. Advanced Arithmetic 8. Searching and Sorting 9. Permutation 10. Sequences
Computer Programming Lab (IIIT HYDERABAD) :http://cse02-iiith.vlabs.ac.in/	

List of Experiments	
1. Numerical Approximation 2. Functions 3. Advanced Control Flow 4. Arrays 5. Structures	6. Basic Control Flow 7. Pointers 8. Recursion 9. Expression Evaluation

Text Book(s):

1. "How to Solve it by Computer", R.G. Dromey, 2014, Pearson.
2. Programming in C and Data Structures, J.R.Hanly, Ashok N. Kamthane and A.Ananda Rao, Pearson Education, 1st Edition, 2010.

Reference Book(s):

1. "The C Programming Language", Brian W. Kernighan, Dennis M. Ritchie, 2nd Edition, Pearson.
2. "Let us C", Yeswant Kanetkar, BPB publications
3. "Pointers in C", Yeswant Kanetkar, BPB publications, 16th Edition, 2017
4. Computer Science, A Structured Programming Approach Using C by Behrouz A. Forouzan& Richard F. Gilberg, 3rd Edition, Cengage Learning
5. C Programming A Problem-Solving Approach, Behrouz A. Forouzan & E.V. Prasad, F. Gilberg, 3rd Edition, Cengage Learning
6. Programming with C RemaTheraja, Oxford, 2018
7. Programming in C, 3rd Edition, 2015, Ashok N. Kamthane, Pearson Education
8. Programming in C, 3/e : A Practical Approach by Ajay Mittal, Pearson Publication
9. Problem Solving with C by SOMASHEKARA, M. T., GURU, D. S., MANJUNATHA, K. S., PHI Learning, 2nd Edition, 2018
10. C Programming with problem solving, J.A. Jones & K. Harrow, Dreamtech Press, 2001
11. Byron Gottfried, Schaum's Outline of Programming with C, 4th Edition, 2018, McGraw-Hill

SEMESTER - II

NARAYANA ENGINEERING COLLEGE:GUDUR								
20ES1009	PYTHON PROGRAMMING							R20
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
II	3	0	0	48	3	40	60	100

Pre-requisite: Knowledge of Mathematics and Basic Programming Language

Course Objectives:

1. To learn the fundamentals of python.
2. To implement python programs for conditional loops and functions.
3. To handle the compound data using python lists, tuples, sets, dictionaries.
4. To learn the files, modules, packages concepts.
5. To introduce the concepts of class and exception handling using python.
6. To train in regular expression concepts.

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

CO 1	Summarize the fundamental concepts of python programming. (BL - 2)
CO 2	Apply the basic elements and constructs the python to solve logical problems. (BL - 3)
CO 3	Organize data using different data structures of python. (BL - 3)
CO 4	Implement the files modules and packages in programming. (BL - 3)
CO 5	Apply object oriented &exception handling concepts to build simple applications.(BL - 3)
CO 6	Implement the concepts of Regular expressions and Turtle Graphics. (BL - 3)

CO-PO Mapping

CO	PO												PSO	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	1	2											1	
CO2	2	3	1	2									1	1
CO3	2	2	2	2	2							2	2	
CO4	2	2	2	1	1							1	3	2
CO5	2	2	2	1								1	2	2
CO6	2	1	2	1								1	2	2

1: Low, 2-Medium, 3- High

COURSE CONTENT		
MODULE – 1	**Introduction to Python**	**7H**
Introduction: History of Python, Features of Python Programming, Applications of Python Programming, Running Python Scripts, Comments, Typed Language, Identifiers, Variables, Keywords, Input/output, Indentation, Data types, Type Checking, range( ), format( ), Math module.		
At the end of the Module 1, students will be able to: **1.** Learn the basics of python. **(BL - 1)** **2.** Write the python programs. **(BL - 1)** **3.** Understand command line arguments. **(BL - 2)**		
MODULE -2	**Operators Expressions and Functions**	**8H**
Operators and Expressions: Operators: Arithmetic, Assignment, Relational, Logical, Boolean, Bitwise, Membership, Identity, Expressions and Order of Evaluations, Control Statements. **Functions:** Introduction, Defining Functions, Calling Functions, Anonymous Function, Fruitful Functions and Void Functions, Composition, lambda Function, Parameters and Arguments, Passing Arguments, Types of Arguments-Positional Arguments, Keyword Arguments, Default Arguments, Variable Length Arguments, Scope of variables, Adding new Functions, Recursive Functions.		
At the end of the Module 2, students will be able to: **1.** Solve the problems using operators, conditional and looping. **(BL - 3)** **2.** Solve the problems using the functions. **(BL -3)** **3.** Apply the principle of recursion to solve the problems. **(BL-3)**		
MODULE-3	**Strings, Lists, Tuples, Dictionaries and Sets**	**9H**
Strings, Lists, Tuples, Dictionaries and Sets: Strings- Operations, Slicing, Methods, List- Operations, slicing, Methods, Tuple- Operations, Methods, Sets- Operations, Methods, Dictionaries- Operations, Methods, Mutable Vs Immutable, Arrays Vs Lists, Map, Reduce, Filter, Comprehensions.		
At the end of the Module 3, students will be able to: 1. Write programs for manipulating the strings. (BL - 1) 2. Understand the knowledge of data structures like Tuples, Lists, Dictionaries and Sets.(BL-2) 3. Select appropriate data structure of Python for solving a problem.(BL -3)		
MODULE-4	**Files, Modules and Packages**	**8H**
Files, Modules and Packages: Files- Persistent, Text Files, Reading and Writing Files, Format Operator, Filename and Paths, Command Line Arguments, File methods, Modules- Creating Modules, Import Statement, Form Import Statement, name spacing, Packages- Introduction to PIP, Installing Packages via PIP(Numpy, Pandas), Using Python Packages.		
At the end of the Module 4, students will be able to: 1. Understand the concepts of files. (BL - 2) 2. Implement the modules and packages. (BL - 3) 3. Organize data in the form of files. (BL - 3)		
MODULE-5	**Object Oriented Programming, Errors and Exceptions**	**8H**
OOP in Python: Object Oriented Features, Classes, self variable, Methods, Constructors, Destructors, Inheritance, Overriding Methods, Data hiding, Polymorphism, Operator Oveloading, Abstract Classes. **Error and Exceptions:** Difference between an error and Exception, Handling Exception, try except block, Raising Exceptions, User Defined Exceptions.		
At the end of the Module 5, students will be able to: 1. Apply object orientation concepts.(BL -3) 2. Apply the exception handling concepts. (BL -3)		

3. Implement OOPs using Python for solving real-world problems. (BL -3)

MODULE-6	Regular Expressions and Turtle Graphics	8H

Regular Expressions: Introduction, Sequence Characters in Regular Expressions, Quantifiers in Regular Expressions, Special Characters in Regular Expressions, Using Regular Expressions on Files, Retrieving Information from a HTML File, Pattern finding programs using regular expression.

Turtle Graphics: Move and Draw, Turtle Operations, Turtle object, Simple Graphics, The Vagrant, The Beautiful Patterns, Drawing with Colors.

At the end of the Module 6, students will be able to:

4. Describe the concepts of Regular Expressions. (BL -2)
5. Write the regular expression applications using Python. (BL -1)
6. Develop GUI applications using Python. (BL -3)

Total hours:	**48 HOURS**

Content Beyond Syllabus:

4. Testing
5. GUI Programming
6. Matplotlib
7. Databases

Text Book(s):

1. Vamsi Kurama, Python Programming: A Modern Approach, Pearson, 2017.
2. Mark Lutz,Learning Python,5th Edition, Orielly, 2013

Reference Books :

1. R. Nageswara Rao, Core Python Programming, 2nd edition, Dreamtech Press, 2019.
2. Allen B. Downey, "Think Python", 2nd Edition, SPD/O'Reilly, 2016
3. Martin C. Brown, The Complete Reference: Python, McGraw-Hill, 2018.
4. Reema Thareja, Python Programming: Using Problem Solving Approach, First Edition, Oxford University Press; 2017.
5. Allen Downey, Think Python, 2nd Edition, Green Tea Press.
6. Wesley J Chun, Core Python Programming, 2nd Edition, Pearson, 2007
7. Kenneth A. Lambert, Fundamentals of Python, 1st Edition, Cengage Learning, 2015
8. J. Jose, Introduction to Computing and Problem Solving with Python, 1st Edition, Khanna Publications,2019

NARAYANA ENGINEERING COLLEGE:GUDUR								
20ES1512	PYTHON PROGRAMMING LAB							R20
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
II	0	0	2	32	1	40	60	100
Pre-requisite: Programming Knowledge								
Course Objectives: 1. To gain knowledge on python programs basics 2. To prepare students for solving the programs on functions, data structures, Files 3. To prepare students for solving the programs on Classes, Exception Handling, Regular Expressions and Multi-threading								
Course Outcomes: After successful completion of the course, the student will be able to:								
CO1	Understanding and use of python- Basic Concepts**(BL -2)**							
CO2	Solve the concepts of python functions and data structures**(BL -3)**							
CO3	Understand the concepts of files, modules, multithreading and regular expressions **(BL -2)**							
CO4	Solve the concepts of class and exception handling **(BL -3)**							

CO-PO Mapping														
CO	**PO**												**PSO**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	1	1	2										1	
CO2	2	3	2	2									2	1
CO3	2	2	3	2	2								3	2
CO4	2	2	2	1	1								3	2
1-Low, 2-Medium, 3- High														

COURSE CONTENT	**CO**
Task-1 - Python Basics (4 H)	
1. Running instructions in Interactive interpreter and a Python Script 2. Write a program to purposefully raise Indentation Error and Correct it 3. Write a program to compute distance between two points taking input from the user (Pythagorean Theorem) 4. Write a program to convert a Binary number to Decimal number and verify if it is a Perfect number.	CO 1
Task-2 - Conditional Statements (2 H)	
1. Write a program to determine if a given string is a Palindrome or not 2. Write a program for Fibonacci sequence is generated by adding the previous two terms by starting with 1 and 2, the first 10 terms will be: 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, ...	CO 1
Task-3 - Functions (2 H)	
1. Write a function ball_collide that takes two balls as parameters and computes if they are colliding. Your function should return a Boolean representing whether or not the balls are colliding. Hint: Represent a ball on a plane as a tuple of (x, y, r), r being the radius. If (distance	CO 2

between two balls centers) <= (sum of their radii) then (they are colliding)	
TASK-4 - Functions Continued (2 H)	
1. Write a function that draws a Pyramid with # symbols  2. Choose any five built-in string functions of C language. Implement them on your own in Python. You should not use string related Python built-in functions.	CO 2
TASK-5 - Strings (4 H)	
1. Write a program to use split and join methods in the string and trace a birthday with Diction b array data structure. 2. Write a program using map, filter and reduce functions	CO 2
TASK-6 - Lists (4 H)	
1. Write program which performs the following operations on list's. Don't use built-in functions a) Updating elements of a list b) Concatenation of list's c) Check for member in the list d) Insert into the list e) Sum the elements of the list f) Push and pop element of list g) Sorting of list h) Finding biggest and smallest elements in the list i) Finding common elements in the list	CO 2
TASK-7 - Files (2 H)	
1. Write a program to print each line of a file and count the number of characters, words and lines in a file. 2. Write a program that allows you to replace words, insert words and delete words from the file.	CO 3
TASK-8 - Modules and Packages (2 H)	
1. Write a program for creating a module and import a module 2. Write a program to perform any two operations using Numpy and pandas	CO 3
TASK-9 - Class and Objects (4 H)	
1. Write a program for Class variables and instance variable and illustration of the self variable i) Robot ii) ATM Machine	CO 4
TASK-10 - Exception Handling (2 H)	
1. Write a program of exception handling to open a file while do not have write permissions	CO 4

2. Write a Program to handle multiple errors with one except statement.	
TASK-11 - Regular Expressions (2 H)	
1. Write a Python program to remove the parenthesis area in a string. Sample data : ["example (.com)", "w3resource", "github (.com)", "stackoverflow (.com)"] 2. Write a program to match the name phone , emails, passwords and phone numbers using pattern matching	CO 3
TASK-12 - Turtle (2 H)	
1. Write a turtle program to construct a clock dial 2. Write a turtle program to produce a flower in different colours	CO 3

Additional Experiments:	
TASK-1	
1. Write a python program to find the resolution of an image 2. Write a python program to count the number of vowels and consonants 3. Write a python program to print the ASCII value of a character	

Virtual Labs:

Python Lab (IIT Bombay) : http://vlabs.iitb.ac.in/vlabs-dev/labs/python-basics/experimentlist.html

List of Experiments

1. Arithmetic Operations	6. Classes and Objects
2. Built-in Functions	7. Built-in Modules
3. Loops	8. Constructors and Inheritance
4. Data Types	9. File Operators
5. Strings	

Text Book(s):

1. Vamsi Kurama, Python Programming: A Modern Approach, Pearson, 2017
2. Mark Lutz, Learning Python, 5th Edition, Orielly, 2013

Reference Book(s):

1. R. Nageswara Rao, Core Python Programming, 2nd edition, Dreamtech Press, 2019.
2. Allen B. Downey, "Think Python", 2nd Edition, SPD/O'Reilly, 2016
3. Martin C. Brown, The Complete Reference: Python, McGraw-Hill, 2018.
4. Python Programming: Using Problem Solving Approach, Reema Thareja, First Edition, Oxford University Press; 2017.
5. Allen Downey, Think Python, 2nd Edition Green Tea Press.
6. Wesley J Chun, Core Python Programming, 2nd Edition, Pearson, 2007
7. Kenneth A. Lambert, Fundamentals of Python,1st Edition, Cengage Learning, 2015
8. J. Jose, Introduction to Computing and Problem Solving with Python, 1st Edition, Khanna Publications, 2019.

NARAYANA ENGINEERING COLLEGE:GUDUR								
20ES1505	ENGINEERING & ITWORK SHOP							R20
PART – A ENGINEERING WORK SHOP								
Semester	Hours / Week			Total hrs	Credits	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
II	0	0	4	64	2	40	60	100

PART-B IT WORKSHOP LAB	
Course Objectives: 1. To provide Technical training on Productivity tools like Word processors, Spreadsheets, Presentations. 2. To make the students know about the internal parts of a computer, assembling, installing the operating system. 3. To teach connecting two or more computers.	
Course Outcomes: After successful completion of the course, the student will be able to:	
CO 1	Understand functionalities of a computer and operating system. (BL-2)
CO 2	Practice Word processors, Presentation and Spreadsheet tool. (BL-2)
CO 3	Connect computer using wired and wireless connections. (BL-2)

CO-PO Mapping														
	PO												PSO	
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1													
CO2	1													
CO3	1													
1: Low, 2-Medium, 3- High														

COURSE CONTENT	CO
Task-1 Learn about Computer (4H)	
Identify the internal parts of a computer and its peripherals. Represent the same in the form of diagrams including Block diagram of a computer. Write specifications for each part of a computer including peripherals and specification of Desktop computer. Submit it in the form of a report.	CO 1
Task -2 Assembling a Computer (4H)	
Disassemble and assemble the PC back to working condition. Troubleshoot the computer and identify working and non-working parts. Identify the problem correctly by various methods available (eg: beeps). Record the process of assembling and trouble-shooting a computer.	CO 1
Task-3 Install Operating system (2H)	CO 1
Install Linux, any other operating system (including proprietary software) and make the system dual boot or multi boot. Record the entire installation process.	
TASK-4 Operating system features (2H)	CO 1
Record various features that are supported by the operating system(s) installed. Submit a report on it. Access CD/DVD drives, write CD/DVDs, access pen drives, print files, etc. Install new application software and record the installation process.	
TASK-5 Word Processor (6H)	CO 2
Create documents using the word processor tool. Tasks to be performed are inserting and deleting the characters, words and lines, Alignment of the lines, Inserting header and Footer, changing the font, changing the colour, including images and tables in the word file, making page setup, copy and paste block of text, images, tables, linking the images which are present in other directory, formatting paragraphs, spell checking, etc. Prepare project cover pages, content sheet and chapter pages at the end of the task using the features studied. Submit a report of the word processor considered. Create documents using the word processor tool. Mail Merge in word processor for creating appointment orders for 10 employee records in excel.	
TASK-6 Spreadsheet (4H)	CO 2
To create, open, save the spreadsheet and format them as per the requirement. Some of the tasks to be practiced are Managing the worksheet environment, creating cell data, inserting and deleting cell data, format cells, adjust the cell size, applying formulas and functions, preparing charts, sorting cells, working with pivot tables and charts. Submit a report of the Spreadsheet application considered.	
TASK-7 Presentations (6H)	CO 2
To create, open, save and run the presentations, Select the style for slides, format the slides with different fonts, colors, create charts and tables, insert and delete text, graphics and animations, bulleting and numbering, hyperlink, set the time for slide show, Record slide show. Submit a report of the Presentation tool considered.	
TASK-8 Wired network & Wireless network (4H)	CO 3
Select a LAN cable, Identify the wires in the cable, Define the purpose of each wire, Study the RJ45 connecter, Use crimping tool to fix the cable to the connecter, Test the cable using LAN tester, Connect two or more computers using cross and straight cables, Configure the computers, share the data between the computers.	

Additional Experiments:	
TASK -1 IoT	CO 3
Raspberry Pi Study the architecture of Raspberry pi, configure software, Install SD card, Connect the cables, Install Raspbian (or any other) operating system, Configure Wi-Fi, remotely connect to your Raspberry Pi.	
TASK -2 OUTLOOK, MACROS	CO 3
Practice the following tasks and submit report A. Configure outlook and access mails. B. Create Macros in word and spreadsheet tools	

Text Book(s):

1. B. Govindarajulu, "IBM PC and Clones Hardware Trouble shooting and Maintenance",2nd edition, Tata McGraw-Hill, 2002
2. "MOS study guide for word, Excel, Power point & Outlook Exams", Joan Lambert, Joyce Cox, PHI.
3. "Introduction to Information Technology", ITL Education Solutions limited, Pearson Education.

Reference Book(s):

1. Rusen, "Networking your computers and devices", PHI
2. Bigelows, "Trouble shooting, Maintaining & Repairing PCs", TMH.

SEMESTER - III

NARAYANA ENGINEERING COLLEGE::GUDUR								
20ES1012	**DATA STRUCTURES AND ALGORITHMS**							**R20**
Semester	**Hours / Week**			**Total hrs**	**Credit**	**Max Marks**		
	L	**T**	**P**		**C**	**CIE**	**SEE**	**TOTAL**
III	3	0	0	48	3	40	60	100

Pre-requisite: Knowledge of Mathematics, Computer Programming, Analytical & Logical Skills

Course Objectives:

1. To explain efficient storage mechanisms of data for an easy access.
2. To design and implementation of various basic and advanced data structures.
3. To introduce various techniques for representation of the data in the real world.
4. To develop applications using data structures.
5. To pertain knowledge on improving the efficiency of algorithm by using suitable data structure.

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

CO 1	Analyze the data structure algorithms to evaluate the time & space complexities. (BL-4)
CO 2	Apply the knowledge of stack and queues for various applications. (BL - 3)
CO 3	Construct the linked lists for various applications. (BL - 3)
CO 4	Apply the knowledge of tree data structures for various applications. (BL - 3)
CO 5	Develop the graph models of the given problem through graph concepts(BL - 3)

CO-PO Mapping

CO	PO												PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	3	2										2	3
CO 2	3	3	3	2									2	2
CO 3	1	2	3	3									2	2
CO 4	2	2	2	2									2	2
CO 5	2	1	3	1									3	2

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1	Introduction to Data Structures	9H

Introduction: Overview of Data Structures, Implementation of Data Structures, Algorithm Specifications, Analysis of an Algorithm, Asymptotic Notations, Time-Space trade off, Arrays. **Searching:** Introduction, Basic Terminology, Linear Search and Binary Search Techniques and their complexities.

At the end of the Module 1, students will be able to:

1. Understand the linear and non-linear data structures. (BL - 2)
2. Understand the time and space complexities of an algorithm. (BL - 2)
3. Illustrate representation of data using Arrays. (BL - 2)

4. Explain searching techniques. (BL - 2)

MODULE -2	Stacks and Queues	9H

Stacks: Introduction, Representation of a Stack, Stack Operations, Applications of Stacks.
Queues: Introduction, Representation of a Queue, Queue Operations, Various Queue Structures: Circular Queue, Double Ended Queue, Priority Queue, Applications of Queues.

At the end of the Module 2, students will be able to:

1. Explain stack ADT and its operations. (BL - 2)
2. Understand the expression evaluation using stacks. (BL - 2)
3. Implement various queue structures. (BL - 3)

MODULE-3	Linked Lists and Sorting	10H

Introduction, Singly linked lists, Doubly Linked Lists, Circular Linked Lists, Linked Stacks and Queues, Applications of Linked Lists.
Sorting: Introduction, Bubble Sort, Selection Sort, Insertion Sort, Merge Sort, Quick Sort

At the end of the Module 3, students will be able to:

1. Understand basics concepts of linked lists. **(BL - 2)**
2. Illustrate various structures of linked lists. **(BL - 2)**
3. Understand the concept of sorting. **(BL - 2)**

MODULE-4	Trees	10H

Introduction, Basic Terminologies, Definition and concepts, Representation of Binary Tree, operations on a BinaryTree, Binary Search Tree, Height balanced BinaryTree, B Trees.

At the end of the Module 4, students will be able to:

1. Understand the concept of trees. **(BL - 2)**
2. Compare different tree structures. **(BL - 2)**
3. Apply trees for indexing. **(BL - 3)**

MODULE-5	Graphs& Hashing	10H

Graphs: Introduction, Graph Terminologies, Representation of Graphs, Graph Operations, Shortest Paths, Topological Sorting, Minimum Spanning Trees – Kruskal's and Prim's algorithms. **Hashing:** Introduction to Hash Table, Static Hashing, Dynamic Hashing.

At the end of the Module 5, students will be able to:

1. Explain the importance of Graphs for solving problems. **(BL - 2)**
2. Understand graph traversal methods. **(BL - 2)**
3. Implement algorithms to identify shortest path. **(BL - 3)**

Total hours:	**48 hours**

Content beyond syllabus:

- Activation Record Management
- Optimum Sorting Algorithms

Reference Book(s):

1. Data Structures A Pseudo code Approach with C, Second Edition by Richard F. Gilberg, Behrouz A. Forouzan, Cengage Learning.
2. Data Structures and Algorithms Using C++ by Ananda Rao Akepogu, Radhika Raju Palagiri, Pearson, 2010.
3. Data Structures and Algorithms Made Easy by Narasimha Karumanchi, Careermonk

Publications, 2016
4. Peter Bras, “Advanced Data Structures”, Cambridge University Press, 2014
5. Data Structures, RS Salaria, Khanna Publishing House, 3rd Edition, 2017
6. Data Structures through C, Yashwant Kanetkar, BPB Publications, 3rd Edition, 2019
7. Expert Data Structures with C, RB Patel, Khanna Publications, 2019

NARAYANA ENGINEERING COLLEGE:: GUDUR								
20CS2001	**COMPUTER ORGANIZATION & ARCHITECTURE**							**R20**
Semester	**Hours / Week**			**Total hrs**	**Credit**	**Max Marks**		
	L	**T**	**P**		**C**	**CIE**	**SEE**	**TOTAL**
III	3	0	0	48	3	40	60	100

Pre-requisite: Computer fundamentals and Digital Logic Design.

Course Objectives:

1. To learn the fundamentals of computer organization and its relevance to classical and modern problems of computer design.
2. To understand the structure and behavior of various functional modules of a computer.
3. To design logical expressions and corresponding integrated logic circuits for a variety of problems.
4. To understand the internal organization and operations of a computer.
5. To introduce the concepts of processor logic design and control logic design.

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

CO1	Describe the concepts of Functional Architecture and Basic Operations of Computing System. (BL-2)
CO2	Interpret there presentation of Fixed and Floating point numbers stored in digital computer. (BL-3)
CO3	Illustrate the basics of Instruction set and design of control units to execute Computer instruction. (BL - 3)
CO4	Analyze the Memory System and their impact on Computer cost & performance. (BL - 4)
CO5	Demonstrate the basic knowledge of I/O devices and Interfacing of I/O devices with computer.(BL - 3)

CO-PO Mapping

CO	**PO**												**PSO**	
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3											3	2
CO2	2	3											3	3
CO3	2	3											3	3
CO4	3	2											2	2
CO5	3	3											3	3

1: Low, 2-Medium, 3- High

COURSE CONTENT		
MODULE – 1	**Introduction of computer architecture**	**10H**
Basic Structure of Computer: Computer Types, Functional Units, Basic operational Concepts, Bus Structure, Performance, Multiprocessors and Multicomputer, Numbers, Arithmetic Operations and Programs, Instructions and Instruction Sequencing, Addressing Modes, Basic Input/output Operations, Stacks and Queues, Subroutines.		
At the end of the Module 1, students will be able to: 1. Illustrate the basic functional units and different ways of interconnecting to form a computer system. (BL 2). 2. Compare Multiprocessors and Multicomputer. (BL 2). 3. Explain addressing modes for accessing register and memory operands.(BL 2). 4. DefineInput/output Operations. (BL 1).		
MODULE – 2	**Data representation and computer Arithmetic**	**9H**
Fixed point representation of numbers: Algorithms for arithmetic operations, multiplication: Booths, Modified Booths, division: restoring and non-restoring. **Floating point representation:** IEEE standards and algorithms for common arithmetic operations, Representation of character codes.		
At the end of the Module 2, students will be able to: 1. Explain fixed point and floating point representation of numbers. (BL 2). 2. Make use of IEEE standards to perform operations on floating point numbers. (BL 3). 3. Apply Booths algorithm to multiply two signed numbers. (BL 3).		
MODULE-3	**Concepts of Computer Architecture**	**9H**
Introduction to ISA (Instruction Set Architecture): Machine Instruction Characteristics, Types of operands, Instruction formats, Instruction types and addressing modes.**Basic Processing Unit:** Fundamental Concepts, Execution of a Complete Instruction, Multiple Bus Organization, Hardwired Control, Micro programmed Control.		
At the end of the Module 3, students will be able to: 1. Discuss the Machine Instruction Characteristics. (BL 2). 2. Explain Instruction types and addressing modes. (BL 2). 3. Define the concept of Multiple Bus Organization (BL 1). 4. Compare hardwired and micro programmed control units. (BL 2).		
MODULE-4	**Memory Organization**	**10H**
Basic concepts, Semiconductor RAM memories, Read only memories, speed, size and cost, Cache memories, performance considerations, Virtual memory, Memory management requirements, Secondary storage .Forms of Parallel Processing, Array Processors, The Structure of General-Purpose multiprocessors, Interconnection Networks, Data &Instruction Hazards.		
At the end of the Module 4, students will be able to: 1. Recognize the various types of memories. (BL 1). 2. Understand the concept of memory organization. (BL 2).		

3. Explain the concept of Multiple Bus Organization. (BL 2).
4. Compare the performance of cache memory and virtual memory. (BL 2).
5. Understand the Interconnection Networks structure and hazards of the system (BL2).

MODULE-5	**Input/Output Organization**	**10H**

I/O Basics: Accessing I/O Devices, Interrupts: Interrupt Hardware, Enabling and Disabling Interrupts, Handling Multiple Devices, Direct Memory Access (DMA).**Buses:** Synchronous Bus, Asynchronous Bus, Interface Circuits, Standard I/O Interface, Peripheral Component Interconnect (PCI) Bus, Universal Serial Bus (USB).

At the end of the Module 5, students will be able to:

1. Understand I/O Devices and buses. (BL 2).
2. Make use of interrupt handling mechanisms for various processors. (BL 3).
3. Describe the concept of DMA. (BL 2).
4. Understand Interface Circuits and Standard I/O Interface. (BL 2).

Total Hours	**48H**

Content beyond syllabus:

1. Signed magnitude numbers addition on various numbers.
2. PLA control.

Text Book(s):

1. Carl Hamacher, ZvonkoVranesic, SafwatZaky, “Computer Organization”, 5th Edition, McGraw Hill Education, 2013.
2. David A. Patterson and John L. Hennessy Computer Organization and Design-The Hardware/Software Interface 5th edition, Morgan Kaufmann, 2013.

Reference Book(s):

1. Mano M. M., Digital Logic & Computer Design, 4/e, Pearson Education, 2013.
2. W. Stallings, Computer organization and architecture, 8th edition, Prentice-Hall, 2013.
3. Patterson D.A. and J. L. Hennessey, Computer Organization and Design, 5/e, Morgan Kauffmann Publishers, 2013.
4. William Stallings, Computer Organization and Architecture: Designing for Performance, 9/e, Pearson, 2013.
5. Chaudhuri P., Computer Organization and Design, 2/e, Prentice Hall, 2008.

NARAYANA ENGINEERING COLLEGE:: GUDUR							
20CS2002	**DATABASE MANAGEMENT SYSTEMS**						**R20**
Semester	**Hours / Week**			**Total hrs**	**Credit**	**Max Marks**	
	L	**T**	**P**		**C**	**CIE**	**SEE**	**TOTAL**
III	3	0	0	48	3	40	60	100

Pre-requisite: Knowledge of File Structures, Data Structures

Course Objectives:

1. To teach the role of database management system in an organization.
2. To design databases using data modeling and Logical database design techniques.
3. To construct database queries using relational algebra and calculus and SQL.
4. To explore implementation issues in database transaction.
5. To familiarize database security mechanisms.

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

CO 1	Describe database technologies and database design. (BL-2)
CO 2	Understand Relational Database Management Systems. (BL-2)
CO 3	Construct queries, procedures for database creation in RDBMS.(BL-3)
CO 4	Apply normalization on database design. (BL-3)
CO 5	Demonstrate concurrency control techniques and techniques for database recovery. (BL-2)

CO-PO Mapping

CO	**PO**												**PSO**	
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	**3**	**3**	**3**										**3**	**3**
CO2	**3**	**3**	**2**		**3**								**3**	**2**
CO3	**3**	**2**	**2**		**2**								**2**	**3**
CO4	**3**	**2**	**3**		**3**								**2**	**3**
CO5	**2**	**3**	**3**										**3**	**2**

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1	**Introduction to Database concepts and Modeling**	**8H**

Introduction to Data bases, Purpose of Database Systems, View of Data, Data Models, Database Languages, Database Users, Database Systems architecture.Overview of Database Design, Beyond ER Design, Entities, Attributes and Entity sets, Relationships and Relationship sets, Conceptual Design with the ER Model.

At the end of the Module 1, students will be able to:

1. Understand the Purpose of Database Systems, Data Models, and View of Data.(BL-2)
2. Summarize the concept of Database Languages, Users and Architecture. (BL-2)
3. Design ER diagrams for given database. (BL-2)
4. Explain conceptual design for enterprise systems (BL-2)

MODULE – 2	**Relational Model, Relational Algebra**	**8H**

Introduction to the Relational Model – Integrity Constraints over Relations, Enforcing Integrity constraints, querying relational data, Logical data base Design, Views. Introduction to Relational algebra, selection and projection, set operations, renaming, joins, division.

At the end of the Module 2, students will be able to:

1. Understand Basics of Relational Model. (BL-2)
2. Describe phases of Logical Database Design.(BL-2)
3. Explain the relational algebra operations on relations. (BL-2)

MODULE – 3	**SQL**	**8H**

SQL: Basic form of SQL Query, DDL, DML, Views in SQL, Joins, Nested & Correlated queries, Operators, Aggregate Functions, integrity and security, Functions & Procedures, Packages, Triggers, Cursors, PL/SQL principles and examples.

At the end of the Module 3, students will be able to:

1. Construct SQL queries in RDBMS. (BL-3)
2. Understand integrity and security Constraints in SQL (BL-2)
3. Construct PL/SQL programs in RDBMS. (BL-3)

MODULE – 4	**Normalization &Transaction Management**	**12H**

Introduction, Functional Dependencies (FDs), Normalization for relational databases: 1NF, 2NF,3NF and BCNF, Basic definitions of Multi Valued Dependencies, 4NF and 5NF.Transaction processing, Transaction Concept, Transaction State, Implementation of Atomicity and Durability, Concurrent Executions.

At the end of the Module 4, students will be able to:

1. Analyze functional dependencies. (BL-3)
2. Apply normal forms on functional dependencies. (BL-3)
3. Understand Atomicity and Durability, Concurrent Executions. (BL-2)

MODULE – 5	**Concurrency Control &Recovery and Indexing**	**12H**

Lock-Based Protocols, Timestamp- Based Protocols, Validation-Based Protocols, Multiple Granularity. Failure Classification, Recovery and Atomicity, Log-Based Recovery.
Introduction to Index data structures, Hash-Based, Tree Based Indexing.

At the end of the Module 5, students will be able to:

1. Discuss the Concurrency Control and various Protocols. (BL-2)
2. Understand reasons for system failures. (BL-2)
3. Understand Ordered Indices, B+ Tree Index Files. (BL-2)

	Total hours:	**48 Hours**

Content beyond syllabus:

1. Embedded SQL
2. Client/Server Database environment
3. Web Database environment

Text Book(s):

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, Database System Concepts, 6th Edition, Tata McGraw-Hill Publishing Company,2017.
2. Raghu Ramakrishnan, Database Management System, 3rd Edition, Tata McGraw-Hill Publishing Company, 2014.

Reference Book(s):

1. Peter Rob, A.Ananda Rao, Corlos Coronel, Database Management Systems (for JNTU), Cengage Learning, 2011.
2. Hector Garcia Molina, Jeffrey D. Ullman, Jennifer Widom, Database System Implementation, 1st Edition, Pearson Education, United States, 2000.
3. E. Ramez and Navathe, Fundamental of Database Systems, 7th Edition, Pearson Education
4. R.P. Mahapatra & Govind Verma, Database Management Systems, Khanna Publishing House, 2016.
5. Carlos Coronel and Steven Morris, Database Systems: Design, Implementation, and Management, 12th edition, Cengage Learning,2016.
6. John V. ,Absolute beginner's guide to databases, Petersen, QUE

NARAYANA ENGINEERING COLLEGE:: GUDUR								
20CS2003	**MATHEMATICAL FOUNDATION FOR COMPUTER SCIENCE**							**R20**
Semester	**Hours / Week**			**Total hrs**	**Credit**	**Max Marks**		
	L	**T**	**P**		**C**	**CIE**	**SEE**	**TOTAL**
III	3	0	0	49	3	40	60	100

Pre-requisite: Student need to have knowledge in mathematical basics in computers

Course Objectives:

- To convert the statements logical expressions and logical theorem proving.
- Understand the basics to design the hasse diagrams.
- Understand the homomorphism and Isomorphism concepts by algebraic structures.
- To understand the basics of counting methods.
- Understanding the recurrence relations and generating functions by mathematical induction.
- To understand of basics of trees and graphs.

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

CO 1	Understand the concepts associated with Mathematical Logic and Predicate calculus.
CO 2	Learn The Basic Concepts About Relations, Functions, Algebraic Structures And To Draw Different Diagrams Like Lattice, Hasse Diagrams.
CO 3	Understand The Elementary Combinatory And Pigeon-Hole Principle
CO 4	Describe Functions, Various Types Of Recurrence Relations And The Methods To Find Out Their Solutions.
CO 5	Understand The Basic Concepts Associated With Graphs And Trees.

CO-PO Mapping														
CO	**PO**												**PSO**	
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	**2**	**2**											**2**	
CO2	**2**	**3**	**1**											
CO3	**3**	**3**												
CO4	**3**	**3**	**2**											
CO5	**3**	**1**	**3**											
1: Low, 2-Medium, 3- High														

COURSE CONTENT		
MODULE – I	**STATEMENTS AND PREDICATE CALCULUS**	**10 Hrs**
Statements and notations, connectives, well-formed formulas, truth tables, tautology, Equivalence implication; Normal forms: Disjunctive normal forms, Conjunctive normal forms, Principle Disjunctive normal forms, Principle Conjunctive normal forms .Predicative logic, Free & Bound variables, Rules of inference, Consistency, proof of contradiction, Automatic Theorem Proving.		
At the end of this Module students will be able: 1. To understand the concepts associated with Mathematical Logic and Predicate calculus.		
MODULE- II	**SET THEORY**	**11Hrs**
Properties of binary relations, equivalence, compatibility and partial ordering relations, lattices, Hasse diagram. Inverse function, composition of functions, recursive functions. Lattices as partially ordered sets; Definition and examples, properties of lattices. Algebraic systems, Examples and general properties, Semi groups and Monoids, groups, and sub groups, Homomorphism, Isomorphism.		
At the end of this Module students will be able: 1. To learn the basic concepts about relations, functions and to draw different diagrams like Lattice, Hasse diagrams. 2. To understand the concepts of Algebraic Structures and combinatorics.		
MODULE- III	**ELEMENTARY COMBINATORICS**	**9 Hrs**
Basics of counting, Permutations and Combinations, permutations and combinations with repetitions, the binomial theorem, multinomial theorem, generalized Inclusion-Exclusion principle, Pigeon-hole principle and its applications.		
At the end of this Module students will be able: **1.** To understand the Elementary Combinatorics and Pigeon-hole principle.		
MODULE- IV	**GENERATING FUNCTIONS &RECURRENCE RELATIONS**	**9 Hrs**
Function of Sequences, Calculating Coefficients of generating functions. Recurrence relations, Solving recurrence relation by substitution and Generating functions, the method of Characteristic roots, solution of Inhomogeneous Recurrence Relations.		

At the end of this Module students will be able:

1. To describe various types of recurrence relations and the methods to find out their solutions.

MODULE- V	**GRAPH THEORY**	**10 Hrs**

Basic concepts of graphs, isomorphic graphs, Euler graphs, Hamiltonian graphs, planar graphs, graph coloring, digraphs, directed acyclic graphs, weighted graphs, Chromatic numbers. Trees, BFS, DFS, Spanning trees, Minimal spanning trees.

At the end of this Module students will be able:

1. To understand the basic concepts associated with Graphs and Trees.

Total hours:	**49 Hours**

Content beyond syllabus:

Finding Minimal cost Spanning Tree using Prim's Algorithm.

Text Book(s):

1. Discrete Mathematical Structures with Applications to Computer Science, J.P.Tremblay, R.Manohar, Mc.Grahill, 2001.
2. Discrete Mathematics and its Applications, Kenneth H.Rosen, 6th edition, TMH.
3. Mathematical Foundations of Computer Science, P.Chandrasekharaiah, Prism publications.

Reference Book(s):

1. Discrete Mathematics for Computer Scientists & Mathematicians, second edition, J.L.Mott, A. Kandel, T.P. Baker, PHI
2. Discrete Mathematical Structures, Mallik and Sen, Cengage Learning.
3. Discrete Mathematical Structures, BernandKolman, Robert C. Busby, Sharon Cutler Ross, PHI/ Pearson Education.

NARAYANA ENGINEERING COLLEGE:: GUDUR								
20CS2004	**OBJECT ORIENTED PROGRAMMING USING JAVA**							R20
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
III	3	0	0	48	3	40	60	100

Pre-requisite: Basic knowledge of programming.

Course Objectives:

1. To acquire knowledge on preliminaries of Java.
2. To provide sufficient knowledge on developing real world problems.
3. To demonstrate the principles of packages, inheritance and interfaces.
4. To understand exception handling and Multi threading.
5. To understand the concepts of Applets and I/O Files.

Course Outcomes: After successful completion of the course, Student will be able to:

CO1	Implement basic Programming concepts. (BL-3)
CO2	Understand the concepts of Arrays and Strings. (BL-2)
CO3	Construct programs on classes, inheritance, polymorphism and interfaces. (BL-3)
CO4	Develop packages, handling of Exceptions and Applets. (BL-3)
CO5	Construct programs using multi-threading. (BL-3)

CO-PO Mapping

CO	PO												PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2									1	3	2
CO2	2	2	2		1							1	1	2
CO3	2	2	2	2	1				1			2	1	2
CO4	2	2	2	1								3	1	1
CO5	2	2		2					1			3	2	1

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1	Basic concepts of java	9H

The History and Evolution of java: History of java, The java Buzz words, The Evolution of java, Lexical issues. Data types, variables: Data types, Variables, The Scope and Life time of variables, Operators, Expressions, Control statements, Type conversion and casting, Command Line Arguments.

At the end of the Module 1, students will be able to:

1. Explain the importance of java. (BL-2)
2. Identify various basic components of java. (BL-2)
3. Implement programs on fundamental concepts of java. (BL-3)

MODULE -2	Arrays and Strings	9H

Declaration, Initialization and accessing values, One-Dimensional Arrays, Multi-dimensional arrays, Alternative Array Declaration Syntax, var-arg methods, Wrapper Classes. String, StringBuffer and StringBuilder classes.

At the end of the Module 2, students will be able to:

1. Understand Arrays and accessing array values.(BL-2)
2. Demonstrate 1-D and Multi-dimensional arrays.(BL-2)

3. Explain the String, StringBuffer, StringBuilder Classes.(BL-2)

MODULE-3	OOPs Concepts	10H

Class fundamentals. Declaration objects, Assigning object reference variables, Introducing Methods, Constructors, this keyword, Garbage collection, Inheritance basics, Types of inheritance, Benefits, Member access rules, Constructor and calling sequence, Abstract Classes, Super and final keywords**.** Method overloading and overriding, Defining an interface, Implementing interface, Accessing interface properties.

At the end of the Module 3, students will be able to:

1. Understand the basic syntax for class fundamentals.(BL-2)
2. Explain Access modifiers in Inheritance.(BL-2)
3. Compare and Contrast Method overloading and Method overriding.(BL-3)
4. Explain interface and its implementation.(BL-2)

MODULE-4	Packages , Exception Handling and Applets	10H

Packages: Defining Package, finding packages and class path, accessing Protection.
Exception Handling: Exception handling Fundamentals, exception types, Built-in Exceptions, Using try-catch-finally throw- throws keywords, creating your own Exceptions.
Applets: Introduction to Applets, Applet Life Cycle methods.

At the end of the Module 4, students will be able to:

1. Develop user defined packages.(BL-3)
2. Implement Exception Handling.(BL-3)
3. Write our own Exceptions (BL-1)
4. Implement Applet Life Cycle Methods. (BL-3)

MODULE-5	Multi-Threaded Programming and Files	10H

Multi-Threaded Programming: The java thread model, Thread Life Cycle, The main() thread, creating a Thread, Creating Multiple Threads, Using isalive() and join(), Thread Priorities, Synchronization. I/O Files: Byte Oriented and Character oriented classes, RandomAccess Files.

At the end of the Module 5, students will be able to:

1. Explain the concept of multi threaded concept.(BL-2)
2. Discuss thread states and its priorities.(BL-3)
3. Understand the concept of Synchronization.(BL-2)
4. Demonstrate input/output Files.(BL-3)

Total hours:	**48 Hours**

Content beyond syllabus:

1. Event Handling Mechanism
2. GUI Programming in JAVA

Text Book(s):

1. Herbert Scheldt, “Java The complete reference”, 9th edition, McGraw Hill Education (India) Pvt. Ltd.
2. Ivor Horton, Beginning Java 2, JDK 5th Edition, Wiley Dreamtech.

Reference Book(s):

1. R A. Johson-Thomson,An introduction to java programming and object oriented application development,

2. Y Daniel liang, Introduction to java programming 6th Edition, Pearson Education.
3. C.Xavier, Java programming: A practical approach, First edition,TMH, 2011.
4. Bruce Eckel, Thinking in Java, 2nd Edition, Pearson Education
5. H.M Dietel and P.J Dietel, Java How to Program, 6th Edition, Pearson Ed.
6. Y. Daniel Liang, Introduction to Java programming-comprehensive, 10E, Pearson ltd 2015.
7. E Balagurusamy, Programming With Java: A Primer 5th Edition Tata McGraw Hill.

NARAYANA ENGINEERING COLLEGE::GUDUR								
20ES1515	**Data Structures and Algorithms Lab**							**R20**
Semester	**Hours / Week**			**Total hrs**	**Credit**	**Max Marks**		
	L	**T**	**P**		**C**	**CIE**	**SEE**	**TOTAL**
III	0	0	3	48	1.5	40	60	100
Pre-requisite: Knowledge of Mathematics, Computer Programming, Analytical & Logical Skills								
Course Objectives: 1. To introduce various data structures. 2. To elucidate how the data structure selection influences the algorithm complexity. 3. To explain the different operations that can be performed on data structures. 4. To introduce to the search and sorting algorithms.								
Course Outcomes: After successful completion of the course, Student will be able to:								
CO 1	Apply the Arrays and linked lists for solving the problems. (BL -3)							
CO 2	Apply the stacks and queues for solving the given applications. (BL -3)							
CO 3	Implement operations on binary trees and binary search trees for given applications. (BL -3)							
CO 4	Implement searching and sorting algorithms for given applications. (BL -3)							

CO-PO Mapping														
	PO												**PSO**	
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	**3**	**3**	**3**						**2**	**2**			**2**	**2**
CO2	**3**	**3**	**3**						**2**	**2**			**2**	**2**
CO3	**3**	**2**							**2**	**2**			**2**	**2**
CO4	**3**	**3**	**3**		**2**				**2**	**2**			**2**	**2**
1: Low, 2-Medium, 3- High														

COURSE CONTENT	**CO**
TASK-1	**(3H)**
1. Write a Program to Implement the following Searching Algorithms: a) Linear Search b) Binary Search	CO1
TASK-2	**(6H)**
1. Implement the following using arrays: A. Write a Program to Implement Stack Operations B. Write a Program to convert a given infix expression into its Postfix using stack. C. Write a Program to evaluate the Postfix Expression using stack	CO1
TASK-3	**(3H)**
1. Write a Program to Implement Queue Operations using Arrays 2. Write a Program to Implement Circular Queue Operations using Arrays	CO2
TASK-4	**(6H)**
1. Write a Program to implement the operations of Singly Linked List 2. Write a Program to implement the operations of Doubly Linked List	CO2

TASK-5	(6H)
1. Write a Program to implement stack operations using linked list 2. Write a Program to implement the operations of Circular Singly Linked List	CO3
TASK-6	**(3H)**
1. Write a Program to Sort the set of elements: a) Insertion Sortb) Quick Sort	C04
TASK-7	**(3H)**
Write a Program to Sort the set of elements: a) Merge Sort b) Heap Sort	C04
TASK-8	**(6H)**
1. Write a Program to implement the following on trees a) Insertion and deletion operations b) Traversals 2. Write a Program to implement Binary Search Tree Operations.	CO3
TASK-9	**(6H)**
1. Write a Program to implement the following Graph Traversal Algorithms: a) Depth first traversal b) Breadth first traversal	CO4
TASK-10	**(6H)**
1. Write a Program to implement the following Minimum Spanning Tree Algorithms: a) Kruskal's Algorithm b) Prim's Algorithm	CO4

Additional Experiments:	
TASK-1	
1. Write Program to Implement Fibonacci Search 2. Write a Program to Implement Double Ended Queue Operations by using Array	CO4
TASK-2	
1. Write a Program to Implement Tree traversal Techniques 2. Write a Program to Implement Radix Sort	CO4

Virtual Labs:

1. Data Structures – 1 (IIIT HYDERABAD) : https://ds1-iiith.vlabs.ac.in/data-structures-1/

List of Experiments

Sorting

1. Bubble Sort
2. Merge Sort
3. Heap Sort
4. Quick Sort

Graphs

1. Depth First Search
2. Breadth First Search

Trees

1. Tree Traversal
2. Binary Search Trees

Stacks and Queues

1. Stacks and Queues
2. Infix to Postfix

Searching

1. Unsorted Arrays
2. Hashtables

Linked Lists

1. Linked lists
2. Polynomial Arithmetic using linked lists

2. Data Structures – 2 (IIIT HYDERABAD) : https://ds2-iiith.vlabs.ac.in/data-structures-2/

List of Experiments

Sorting

1. Selection Sort
2. Radix Sort

Graphs

1. Topological Sort
2. Minimum Spanning Trees
3. Path algorithms: Dijkstra's shortest path

Search Trees

1. 2-3 Tree
2. Red Black Tree

Strings

1. Tries and Suffix Trees
2. Substring search: KMP algorithm

Text Book(s):

1. D. Samanta, "Classic Data Structures", 2nd Edition, Prentice-Hall of India, Pvt. Ltd., India, 2012.
2. Horowitz Sahni and Anderson-Freed —Fundamentals of Data Structures in C. 2nd Edition, Universities Press, 2008.

Reference Book(s):

1. Richard F. Gilberg& B. A. Forouzan —Data Structures A Pseudocode Approcah with C, Second Edition, CENGAGE Learning.
2. Ananda Rao,Data Structures and Algorithms Using C++,Akepogu, Radhika Raju Palagiri, Pearson, 2010.
3. Mark Allen Weiss, Data structure and Algorithm Analysis in C. Addison Wesley Publication. 2006.
4. Jean Paul Trembley and Paul G. Sorenson, An Introduction to Data Structures with Applications, 2ndEdition, McGraw Hill Education, 2017
5. Thomas Cormen, C. Leiserson, R. L. Rivest and C. Stein, —Introduction to Algorithms, 2nd Edition, PHI, 2010
6. Narasimha Karumanchi, Data Structures and Algorithms Made Easy, Careermonk Publications, 2016
7. Peter Bras, Advanced Data Structures, Cambridge University Press, 2014
8. Data Structures, RS Salaria, Khanna Publishing House, 3rd Edition, 2017
9. Data Structures through C, Yashwant Kanetkar, BPB Publications, 3rd Edition, 2019
10. Expert Data Structures with C, RB Patel, Khanna Publications, 2019

NARAYANA ENGINEERING COLLEGE:: GUDUR								
20CS2501	**DATABASE MANAGEMENT SYSTEMS LAB**							R20
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
III	0	0	3	48	1.5	40	60	100

Pre-requisite: Knowledge of Computer Programming, Data Structures and Algorithms

Course Objectives:

1. To populate and query a database using SQL DDL/DML Commands.
2. To design real-world entities with Entity-Relationship diagrams.
3. To apply integrity constraints over relational databases.
4. To construct queries using advanced concepts of SQL
5. To demonstrate programs in PL/SQL

Course Outcomes: After successful completion of the course, Student will be able to:

CO 1	Use SQL for creating database and performing data manipulation operations. (BL-3)
CO 2	Examine integrity constraints to build efficient databases. (BL-3)
CO 3	Sketch PL/SQL programs including procedures, functions, cursors and triggers.(BL-3)
CO 4	Apply queries using advanced database design and Normalization. (BL-3)

CO-PO Mapping

CO	PO												PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3						2	2			2	2
CO2	3	3	3						2	2			2	2
CO3	3	2							2	2			2	2
CO4	3	3	3		2				2	2			2	2

1: Low, 2-Medium, 3- High

COURSE CONTENT	CO
Task - 1 BASIC CONCEPTS (3H)	
1. Create a table called Employee with the following structure. **Name Type** Empno Number Ename Varchar2(20) Job Varchar2(20) Mgr Number Sal Number a. Add a column commission with domain to the Employee table. b. Insert any five records into the table. c. Update the column details of job d. Rename the column of Employ table using alter command. e. Delete the employee whose empno is19. 2. Create department table with the following structure. **Name Type** Deptno Number Deptname Varchar2(20) location Varchar2(20) a. Add column designation to the department table. b. Insert values into the table. c. List the records of emp table grouped by dept no. d. Update the record where dept no is 9. e. Delete any column data from the table 3. Create a table called Customer table **Name Type** Custname Varchar2(20) Custstreet Varchar2(20) Cust city Varchar2(20) a. Insert records into the table. b. Add salary column to the table. c. Alter the table column domain. d. Drop salary column of the customer table. e. Delete the rows of customer table whose Cust_city is 'hyd'. f. Create a table called branch table. **Name Type** Branch name Varchar2(20) Branch city Varchar2(20) asserts Number	CO 1

4. Increase the size of data type for asserts to the branch. a. Add and drop a column to the branch table. b. Insert values to the table. c. Update the branch name column d. Delete any two columns from the table 5. Create a table called sailor table **Name** **Type** Sid Number Sname Varchar2(20) rating Varchar2(20) a. Add column age to the sailor table. b. Insert values into the sailor table. c. Delete the row with rating>8. d. Update the column details of sailor. e. Insert null values into the table. 6. Create a table called reserves table **Name** **Type** Boatid Integer sid Integer day Integer a. Insert values into the reserves table. b. Add column time to the reserves table. c. Alter the column day data type to date. d. Drop the column time in the table. e. Delete the row of the table with some condition.	
Task 2 - QUERIES USING DDL AND DML(6H)	
1. a. Create a user and grant all permissions to the user. b. Insert the any three records in the employee table and use rollback. Check the result. c. Add primary key constraint and not null constraint to the employee table. d. Insert null values to the employee table and verify the result. 2. a. Create a user and grant all permissions to the user. b. Insert values in the department table and use commit. . Add constraints like unique and not null to the department table. . Insert repeated values and null values into the table. 3. a. Create a user and grant all permissions to the user. b. Insert values into the table and use commit.	CO 1

c. Delete any three records in the department table and use rollback. . Add constraint primary key and foreign key to the table. 4. a. Create a user and grant all permissions to the user. b. Insert records in the sailor table and use commit. c. Add save point after insertion of records and verify save point. d. Add constraints not null and primary key to the sailor table. 5. a. Create a user and grant all permissions to the user. b. Use revoke command to remove user permissions. c. Change password of the user created. d. Add constraint foreign key and notnull. 6. a. Create a user and grant all permissions to the user. b. Update the table reserves and use save point and rollback. c. Add constraint primary key, foreign key and not null to the reserves table . Delete constraint not null to the table column	
Task -3QUERIES USING AGGREGATE FUNCTIONS(3H)	
1. a. By using the group by clause, display the names who belongs to dept no 10 along with average salary. b. Display lowest paid employee details under each department. c. Display number of employees working in each department and their department number. d. Using built in functions, display number of employees working in each department and their department name from dept table. Insert dept name to dept table and insert dept name for each row, do the required thing specified above. e. List all employees which start with either B or C. f. Display only these ename of employees where the maximum salary is greater than or equal to 5000. 2. a. Calculate the average salary for each different job. b. Show the average salary of each job excluding manager. c. Show the average salary for all departments employing more than three people. d. Display employees who earn more than thelowest salary in department 30 e. Show that value returned by sign (n)function. f. How many days between day of birth to current date 3. a. Show that two substring as single string. b. List all employee names, salary and 15% rise in salary. c. Display lowest paid emp details under each manager d. Display the average monthly salary bill for each deptno. e. Show the average salary for all departments employing more than two people. f. By using the group by clause, display the eid who belongs to dept no 05 along with average salary.	CO2

4. a. Count the number of employees in department20 b. Find the minimum salary earned by clerk. c. Find minimum, maximum, average salary of all employees. d. List the minimum and maximum salaries for each job type. e. List the employee names in descending order. f. List the employee id, names in ascending order by empid. 5. a. Find the sids, names of sailors who have reserved all boats called "INTERLAKE Find the age of youngest sailor who is eligible to vote for each rating level with at least two such sailors. b. Find the sname, bid and reservation date for each reservation. c. Find the ages of sailors whose name begin and end with B and has at least 3characters. d. List in alphabetic order all sailors who have reserved red boat. e. Find the age of youngest sailor for each rating level. 6. a. List the Vendors who have delivered products within 6 months from orderdate. b. Display the Vendor details who have supplied both Assembled and Subparts. c. Display the Sub parts by grouping the Vendor type (Local or Non Local). d. Display the Vendor details in ascending order. e. Display the Sub part which costs more than any of the Assembled parts. f. Display the second maximum cost Assembled part	
TASK-4PROGRAMS ON PL/SQL(6H)	
1. a. Write a PL/SQL program to swap two numbers. b. Write a PL/SQL program to find the largest of three numbers. 2. a. Write a PL/SQL program to find the total and average of 6 subjects and displaythegrade. b. Write a PL/SQL program to find the sum of digits in a given umber. 3. a. Write a PL/SQL program to display the number in reverse order. b. Writea PL/SQLprogram to check whether the given number is prime or not. 4. a. Write a PL/SQL program to find the factorial of a given number. b. Write a PL/SQL code block to calculate the area of a circle for a value of radiusvarying from 3 to 7. Store the radius and the corresponding values of calculated area inan empty table named areas, consisting of two columns radius and area. 5. a. Write a PL/SQL program to accept a string and remove the vowels from the string.(When 'hello' passed to the program it should display 'Hll' removing e and o from theworldHello). b. Write a PL/SQL program to accept a number and a divisor. Make sure the divisor is lessthan or equal to 10. Else display an error message. Otherwise Display the remainder inwords.	CO 3

TASK-5 PROCEDURES AND FUNCTIONS(3H)	
1. Write a function to accept employee number as parameter and return Basic +HRA together as single column. 2. Accept year as parameter and write a Function to return the total net salary spent for a given year. 3. Create a function to find the factorial of a given number and hence find NCR. 4. Write a PL/SQL block to print prime Fibonacci series using local functions. 5. Create a procedure to find the lucky number of a given birth date. 6. Create function to the reverse of given number	CO 3
TASK-6 TRIGGERS(3H)	
1.Create a row level trigger for the customers table that would fire for INSERT or UPDATE or DELETE operations performed on the CUSTOMERS table. This trigger will display the salary difference between the old values and new values: CUSTOMERS table: **ID NAME AGE ADDRESS SALARY** 1 Alive 24 Khammam 2000 2 Bob 27 Kadapa 3000 3 Catri 25 Guntur 4000 4 Dena 28 Hyderabad 5000 5 Eeshwar 27 Kurnool 6000 6 Farooq 28 Nellore 7000 2. Creation of insert trigger, delete trigger, update trigger practice triggers using the passenger database. Passenger (Passport_ id INTEGER PRIMARY KEY, Name VARCHAR (50) NotNULL, Age Integer Not NULL, Sex Char, Address VARCHAR (50) NotNULL); a. Write a Insert Trigger to check the Passport_id is exactly six digits ornot. b. Write a trigger on passenger to display messages ‘1 Record is inserted’, ‘1 record is deleted’, ‘1 record is updated’ when insertion, deletion and updation are done on passenger respectively. 3. Insert row in employee table using Triggers. Every trigger is created with name any trigger has same name must be replaced by new name. These triggers can be raised before insert, update or delete rows on data base. The main difference between a trigger and a stored procedure is that the former is attached to a table and is only fired when an INSERT, UPDATE or DELETE occurs. 4. Convert employee name into uppercase whenever an employee record is inserted or updated. Trigger to fire before the insert or update. 5. Trigger before deleting a record from emp table. Trigger will insert the row to be deleted into table called delete _emp and also record user who has deleted the record and date and time of delete. 6. Create a transparent audit system for a table CUST_MSTR. The system must keep track of the records that are being deleted or updated	CO 3

TASK-7 BOOK PUBLISHING COMPANY(6H)	
A publishing company produces scientific books on various subjects. The books are written by authors who specialize in one particular subject. The company employs editors who, not necessarily being specialists in a particular area, each take sole responsibility for editing oneor more publications. A publication covers essentially one of the specialist subjects and is normally written by a single author. When writing a particular book, each author works with on editor, but may submit another work for publication to be supervised by other editors. To improve their competitiveness, the company tries to employ a variety of authors, more than one author being a specialist in a particular subject for the above case study, do the following: 1. Analyze the data required. 2. Normalize the attributes. 3. Create the logical data model using E-R diagrams	CO 3
TASK-8 GENERAL HOSPITAL(6H)	
A General Hospital consists of a number of specialized wards (such as Maternity, Pediatric, Oncology, etc.). Each ward hosts a number of patients, who were admitted on the recommendation of their own GP and confirmed by a consultant employed by the Hospital. On admission, the personal details of every patient are recorded. A separate register is to be held to store the information of the tests undertaken and the results of a prescribed treatment. A number of tests may be conducted for each patient. Each patient is assigned to one leading consultant but may be examined by another doctor, if required. Doctors are specialists in some branch of medicine and may be leading consultants for a number of patients, not necessarily from the same ward. For the above case study, do the following. 1. Analyze the data required. 2. Normalize the attributes. Create the logical data model using E-R diagrams	CO 3
TASK -9CAR RENTAL COMPANY(6H)	
A database is to be designed for a car rental company. The information required includes a description of cars, subcontractors (i.e. garages), company expenditures, company revenues and customers. Cars are to be described by such data as: make, model, year of production, engine size, fuel type, number of passengers, registration number, purchase price, purchase date, rent price and insurance details. It is the company policy not to keep any car for a period exceeding one year.	CO 4

All major repairs and maintenance are done by subcontractors (i.e. franchised garages), with whom CRC has long-term agreements. Therefore, the data about garages to be kept in the database includes garage names, addresses, range of services and the like. Some garages require payments immediately after a repair has been made; with others CRC has made arrangements for credit facilities. Company expenditures are to be registered for all outgoings connected with purchases, repairs, maintenance, insurance etc. Similarly, the cash inflow coming from all sources: Car hire, car sales, insurance claims must be kept of file. CRC maintains a reasonably stable client base. For this privileged category of customers special credit card facilities are provided. These customers may also book in advance a particular car. These reservations can be made for any period of time up to one month. Casual customers must pay a deposit for an estimated time of rental, unless they wish to pay by credit card. All major credit cards are accepted. Personal details such as name, address, telephone number, driving license, number about each customer are kept in the database. For the above case study, do the following: 1. Analyze the data required. 2. Normalize the attributes. Create the logical data model using E-R diagrams	
TASK -10 STUDENT PROGRESS MONITORING SYSTEM(6H)	
A database is to be designed for a college to monitor students' progress throughout their course of study. The students are reading for a degree (such as BA, BA (Hons) M.Sc., etc)within the framework of the modular system. The college provides a number of modules, each being characterized by its code, title, credit value, module leader, teaching staff and the department they come from. A module is coordinated by a module leader who shares teaching duties with one or more lecturers. A lecturer may teach (and be a module leader for) more than one module. Students are free to choose any module they wish but the following rules must be observed: Some modules require pre- requisites modules and some degree programs have compulsory modules. The database is also to contain some information about students including their numbers, names, addresses, degrees they read for, and their past performance i.e. modules taken and examination results. For the above case study, do the following: 1. Analyze the data required. 2. Normalize the attributes. 3. Create the logical data model i.e., ER diagrams. 4. Comprehend the data given in the case study by creating respective tables withprimary keys and foreign keys where ever required. 5. Insert values into the tables created (Be vigilant about Master- Slavetables).	CO 4

6. Display the Students who have taken M.Sc course 7. Display the Module code and Number of Modules taught by each Lecturer. 8. Retrieve the Lecturer names who are not Module Leaders. 9. Display the Department name which offers ‘English’ module. 10. Retrieve the Prerequisite Courses offered by every Department (with Department names). 11. Present the Lecturer ID and Name who teaches ‘Mathematics’. 12. Discover the number of years a Module is taught. 13. List out all the Faculties who work for ‘Statistics’ Department. 14. List out the number of Modules taught by each Module Leader. 15. List out the number of Modules taught by a particular Lecturer. 16. Create a view which contains the fields of both Department and Module tables. (Hint- The fields like Module code, title, credit, Department code and its name). 17. Update the credits of all the prerequisite courses to 5. Delete the Module ‘History’ from theModule table.	

Additional Experiments:	
TASK -1PROCEDURES	
1. Create the procedure for palindrome of given number. 2. Create the procedure for GCD: Program should load two registers with two Numbers andthen apply the logic for GCD of two numbers. GCD of two numbers is performed bydividing the greater number by the smaller number till the remainder is zero. If it is zero,the divisor is the GCD if not the remainder and the divisors of the previous division arethe new set of two numbers. The process is repeated by dividing greater of the twonumbers by the smaller number till the remainder is zero and GCD is found. 3. Write the PL/SQL programs to create the procedure for factorial of given number. 4. Write the PL/SQL programs to create the procedure to find sum of N natural number. 5. Write the PL/SQL programs to create the procedure to find Fibonacci series. 6. Write the PL/SQL programs to create the procedure to check the given number is perfect or not	CO 1
TASK -2CURSORS	
1. Write a PL/SQL block that will display the name, dept no, salary of fist highest paidemployees**.** **2.** Update the balance stock in the item master table each time a transaction takes place in the item transaction table. The change in item master table depends on the item id is already present in the item master then update operation is performed to decrease the balance stock by the quantity specified in the item transaction in case the item id is not present in the item master table then the record is inserted in the item master table. **3.** Write a PL/SQL block that will display the employee details along with salary using cursors. **4.** To write a Cursor to display the list of employees who are working as a Managers or Analyst. **5.** To write a Cursor to find employee with given job and dept no. **6.** Write a PL/SQL block using implicit cursor that will display message, the salaries of all the employees in the ‘employee’ table are updated. If none of the employee’s salary are updated, we geta message 'None of the salaries were updated'. Else we get a message like for example, 'Salaries for 1000 employees are updated' if there are 1000 rows in ‘employee’ table	CO 3

Virtual Labs:

http://vlabs.iitb.ac.in/vlabs-dev/labs/dblab/labs/explist.php

List of Experiments with Description:

1. Data Definition Language(DDL) Statements: (Create table, Alter table, Drop table)

   Aim: To Understand and Implement Data Defining Language (DDL) Statements.

   Objective: To understand the various aspects of Data definition language commands like:

   Creating a table, with or without constraints.

   Understanding Data types.

Altering the structure of the table like adding attributes at later stage, modifying size of attributes or adding constraints to attributes.

Removing the table created, i.e Drop table in SQL.

2. Data Manipulation Language(DML) Statements

   Aim: To understand the concept of implementing Data Manipulation Language(DML) statements.

   The objective of the experiment is to understand various aspects of Data Manipulation Commands like:

   Inserting Data into the table, (inserting all attributes in a table or inserting selected attributes in a table).

   Updating Data into the table (updating all tuples in a table or updating selected tuples in a table).

   Deleting Data from the table (deleting all tuples from the table(not advisable) or deleting selected tuples from the table).

3. Data Query Language(DQL) Statements: (Select statement with operations like Where clause, Order by, Logical operators, Scalar functions and Aggregate functions)

   Aim: To understand various aspects of Data Query Language Commands like

   Displaying all the attributes and tuples from the table.

   Displaying selected attributes/tuples from the table.

   Using Logical and comparison operators.

   Using aggregate functions.

   Using Scalar functions.

   Sorting Data.

4. Transaction Control Language(TCL) statements: (Commit(make changes permanent), Rollback (undo)

Aim:To understand and implement Transaction Control Language (TCL) Statements.

Objective: To Provide the students a practical experience of how transactions could be made permanent in memory or how are they revoked.

5. Describe statement: To view the structure of the table created

Aim:To understand and Implement Describe Statement which can be used to view the structure of the table created by the user.

Procedure:

The Describe command is used to view the structure of the table created.

To use the describe statement , you should have at least one table in your schema.

The syntax for describe is desc<table_name>

Example : If you would like to view Employee table, then Desc emp;

Write Query in the Query Editor and click on Execute Query button.

If you are existing user and want to save/restore your data, use Credentials.

Text Book(s):

1. A.Silberschatz, H.F.Korth, S.Sudarshan, “Database System Concepts”, 6/e, TMH 2019
2. Raghurama Krishnan, Johannes Gehrke, “Database Management Systems”, 3/e, TMH

Reference Book(s):

1. RamezElmasri, Shamkant, B. Navathe, “Database Systems”, Pearson Education, 6/e, 2013.
2. Peter Rob, Carles Coronel, “Database System Concepts”, Cengage Learning, 7/e,2008.Rick F Vander Lans, “Introduction to SQL”, 4/e, Pearson Education, 2007
3. Nilesh Shah, "Database Systems Using Oracle”, PHI, 2007

NARAYANA ENGINEERING COLLEGE:GUDUR								
20CS2502	**OBJECT ORIENTED PROGRAMMING USING JAVA LAB**							R20
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
III	0	0	3	48	1.5	40	60	100

Pre-requisite: Programming knowledge

Course Objectives:

1. To understand fundamentals of programming such as variables, conditional and iterative execution, methods, etc.
2. To develop programs on object-oriented programming concepts through java.
3. To create programs for multi-threading concepts.
4. To understand fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries, etc.

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

CO 1	Apply the fundamental elements of java programming to solve given problems.(BL-3)
CO 2	Implement the concepts of object oriented programming to solve the applications. (BL-3)
CO 3	Apply the Method overloading and exception handling mechanisms to solve given problems. (BL-3)
CO 4	Apply the Multithreading and packages to improve the system performance. (BL-3)

CO-PO Mapping														
CO	**PO**												**PSO**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	3	3										3	3
CO2	3	3	2		3								3	2
CO3	3	2	2		2								2	3
CO4	3	2	3		3								2	3
1: Low, 2-Medium, 3- High														

COURSE CONTENT	**CO**
Task 1 - Basics (6H)	
a). Write a JAVA program to display default value of all primitive data type of JAVA? b). Write a java program that display the roots of a quadratic equation ax2+bx=0. Calculate the discriminate D and basing on value of D, describe the nature of root. ? c). Five Bikers Compete in a race such that they drive at a constant speed which may or may not be the same as the other. To qualify the race, the speed of a racer must be more than the average speed of all 5 racers. Take as input the speed of each racer and print back the speed of qualifying racers. ? d) Write a case study on public static void main(250 words) ?	CO 1

Task -2 Operations, Expressions, Control-flow, Strings (4H)	
a). Write a JAVA program to search for an element in a given list of elements using binary search mechanism. ? b). Write a JAVA program to sort for an element in a given list of elements using bubble sort? (c). Write a JAVA program to sort for an element in a given list of elements using merge sort. ? (d) Write a JAVA program using String Buffer to delete, remove character. ? (e) Write a program to perform the following operations on strings through interactive input. 1) Sort given strings in alphabetical 2) Convert the strings to uppercase. ?	CO 1
Task -3 Class, Objects (4H)	
a). Write a JAVA program to implement class mechanism. – Create a class, methods and invoke them inside main method. ? b). Write a JAVA program to implement constructor. ?	CO 2
TASK-4 Methods (4H)	
a). Write a JAVA program to implement constructor overloading. ? b). Write a JAVA program implement method overloading. ?	CO 2
TASK-5 Inheritance (6H)	
a). Write a JAVA program to implement Single Inheritance? b). Write a JAVA program to implement multi level Inheritance? c). Write a java program for abstract class to find areas of different shapes?	CO 3
TASK-6 Interfaces (6H)	
a). Write a JAVA program give example for “super” keyword. ? b). Write a JAVA program to implement Interface. What kind of Inheritance can be achieved? c). Write a JAVA program to implement multiple inheritance access in java? d). Write a JAVA program by using extends and implements keywords?	CO 3
TASK-7 Exceptions (4H)	
a).Write a JAVA program that describes exception handling mechanism. ? b).Write a JAVA program Illustrating Multiple catch clauses?	CO 3
TASK-8 Runtime Polymorphism (4H)	
a). Write a JAVA program that implements Runtime polymorphism? b). Write a Case study on run time polymorphism, inheritance that implements in above problem?	CO 4
TASK-9 User defined Exception (6H)	
a). Write a JAVA program for creation of Illustrating throw? b). Write a JAVA program for creation of Illustrating finally? c). Write a JAVA program for creation of Java Built-in Exceptions? d).Write a JAVA program for creation of User Defined Exception?	CO 4
TASK -10 Threads (4H)	
a). Write a JAVA program that creates threads by extending Thread class .First	CO 4

thread display “Good Morning “every 1 sec, the second thread displays “Hello “every 2 seconds and the third display “Welcome” every 3 seconds ,(Repeat the same by implementing Runnable) ? b). Write a program illustrating is Alive and join ()? c). Create two threads such that one of the thread print even no’s and another prints odd no’s up to a given range. ?	
TASK-11 Threads continuity (4H)	
a).Write a JAVA program Producer Consumer Problem? b).Write a case study on thread Synchronization after solving the above producer consumer problem?	CO 4
TASK-12 Packages (4H)	
a). Write a JAVA program illustrate class path? b). Write a case study on including in class path in your OS environment of your package.? c). Write a JAVA program that import and use the defined your package in the previous Problem? d). Write a Java Program to Create a package called “Arithmetic” that contains methods to deal with all arithmetic operations. Also, write a program to use the package.?	CO 4

Additional Experiments:	
TASK-1 Applet	
a).Write a JAVA program to paint like paint brush in applet. ? b) Write a JAVA program to display analog clock using Applet. ? c). Write a JAVA program to create different shapes and fill colors using Applet. ? d). Write an applet illustrating sequence of events in an applet. ?	
TASK -2 Event Handling	
a).Write a JAVA program that display the x and y position of the cursor movement using Mouse. ? b).Write a JAVA program that identifies key-up key-down event user entering text in a Applet. ?	
Virtual Labs: 1. http://cse02-iiith.vlabs.ac.in/ 2. http://vlabs.iitb.ac.in/vlabs-dev/labs/java-iitd/experiments/java-intro-iitd/simulation.html	
Text Book(s): 1. Herbert Schildt “Java The complete reference”, 9th edition, McGraw Hill Education (India) Pvt. Ltd. 2. Ivor Horton, Beginning Java 2, JDK 5th Edition, Wiley dreamtech.	

Reference Book(s):

1. R AJohson-Thomson,An introduction to java programming and object oriented application development,
2. Y Daniel liang, Introduction to java programming 6th Edition, Pearson Education.
3. C.Xavier, Java programming: A practical approach, First edition,TMH, 2011.
4. Bruce Eckel, Thinking in Java, 2nd Edition, Pearson Education
5. H.M Dietel and P.J Dietel, Java How to Program, 6th Edition, Pearson Ed.
6. Y. Daniel Liang, Introduction to Java programming-comprehensive, Tenth Edition, Pearson ltd 2015.
7. E Balagurusamy, Programming With Java : A Primer 5th Edition Tata McGraw Hill.

NARAYANA ENGINEERING COLLEGE :: GUDUR							
Career Competency Development I							
B.Tech (CSE,ECE,EEE)	**Hours/Week**			**Total Hours**	**Maximum Marks**		
	L	**T**	**P**		**CIE**	**SEE**	**Total**
Semester III	0	0	2	36	40	60	100
Objective(s)	To enhance employability skills and to develop career competency						

MODULE 1: Aptitude-1 (7h)

Number System, Clocks, Advanced Algebra, LCM & HCF, BODMAS, Order of Arithmetic Operations, Ratio & Proportion

MODULE 2: Reasoning-1 (6h)

Deductive Logic, Blood Relations, Puzzles, Coding & Decoding, Number Series

MODULE 3: Verbal-1 (7h)

Word formation: Prefix, suffix, synonyms, antonyms, odd words, homophones, spelling test andcontextual vocabulary. Parts of speech: Nouns, adjectives, prepositions, gerunds. Sentence structures: Identifying the sentences, sentence pattern, sentence completion, sentence arrangement, joining sentences.

MODULE 4: Technical Skills-1 (8h)

Problems and Logic Building: Study of Various problems and Logic Building: Algorithms andPseudo codes; various problems using Number Series, Arrays and Strings.

Students must do the following Tasks using any online platforms of **C / Python**(Write proper Pseudo codes and Algorithms also for the given problems): **Number Series:**

Task1: Prime series (**Hint**: Find Prime Series up to n)

Task2: Fibonacci Series (**Hint**: Find Fibonacci sequence up to n)

Arrays-

Task3: Find duplicates in an array (**Hint**: Same elements which are duplicated must identify) **Task4**: Find the K^{th} largest and K^{th} smallest number in an array (**Hint**: Finding largest andsmallest number of kth position)

Strings-

Task5: Find the N^{th} character (**Hint**: Finding the given character position)

Task6: Rotation of String (**Hint**: Rotating the characters either left or right side rotation)

MODULE 5: Technical Skills-2 (8h)

Recursion and Hashing: Recursion and Backtracking. Hashing Techniques. Students must do the following Tasks using any online platforms of **C / Python**:(Write suitable pseudo codes and algorithms for the given tasks)

Recursion and Backtracking

Task1: Largest Element in an array

Task2: Convert Decimal to Binary Number

Task3: subset sum (**Hint**: Find Subsets for the given array and calculate the sum).

Task4: Word Break Problem (**Hint:** The given sentence must be broken into number wordsbased various delimiters).

Hashing -

Task5: Pair with given sum in an Array (**Hint**: Array elements must pair with given constraintand find the sum)

Task6: Count Distinct absolute values in a sorted array (**Hint**: Convert into absolute values andfind distinct count in a sorted array)

EVALUATION:

Continuous Internal Evaluation (CIE)		
Sl.No	**Test/Evaluation**	**Marks**
1	Assignment test in class from Module 1(Evaluation for 10 marks)	8 marks
2	Assignment test in class from Module 2(Evaluation for 10 marks)	8 marks
3	Assignment test in class from Module 3(Evaluation for 10 marks)	8 marks
4	Assignment test in Lab from Module 4(Evaluation for 10 marks)	8 marks
5	Assignment test in Lab from Module 5(Evaluation for 10 marks)	8 marks
	Total	40 marks

Semester End Examination (SEE)		
Sl.No	**Test/Evaluation**	**Marks**
1	Written test - from the syllabus of Module 1, 2 and 3	36 marks
2	Evaluation from Module 4 and Module 5	24 marks
	Total	60 marks

Text / Reference Books:

1. Aptitude & Reasoning by RS Agarwal
2. Aptitude & Reasoning by Arun Sharma
3. Aptitude & Reasoning by S Chand
4. Contemporary English Grammar by Jayanthi Dakshina murthy
5. Verbal Ability by Parsons
6. R.G. Dromey, "How to Solve it by Computer". Pearson, 2014.
7. Fundamentals of Python First Programs, Kenneth. A. Lambert, Cengage.

SEMESTER –IV

NARAYANA ENGINEERING COLLEGE::GUDUR								
20MA1007	**STATISTICAL ANALYSIS AND TECHNIQUES USING R**							R20
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
IV	3	0	0	48	3	40	60	100

Pre-requisite: Engineering Mathematics, Computer Programming.

Course Objectives:

1. To understand the fundamentals of 'R' programming
2. To identify appropriate statistical tests.
3. To implement commonly used statistical methods
4. To perform graphical analysis in R
5. To explore data-sets for generating testable hypotheses

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

CO 1	Illustrate the fundamental knowledge of R-Programming concepts for solving the engineering applications (BL-2)
CO 2	Apply data objects & probability commands for data manipulations (BL-3)
CO 3	Apply descriptive statistics and data distribution commands for statistical analysis (BL-3)
CO 4	Analyze hypothesis testing & graphical analysis on different data-sets for testable hypothesis and virtualization (BL-4)
CO 5	Analyze complex analytical models using formula syntax and regression for data analysis (BL-4)

CO-PO Mapping

CO	PO												PSO	
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	3	2										2	
CO2	3	3	3	1									1	
CO3	2	3	3	1									2	
CO4	1	3	3	3	2								2	
CO5	2	3	3	3	1	1							2	

1: Low, 2-Medium, 3- High

COURSE CONTENT		
MODULE – 1	**Introduction to R Programming**	**10H**
Reading and Getting Data into R, Viewing Named Objects, Types of Data Items, The Structure of Data Items, Working with History Commands, Saving your Work in R. Control Statements, Arithmetic and Boolean Operators, Functions, Return Values, Environment and Scope Issues, Recursion.		
At the end of the Module 1, students will be able to: 5. Understand the basics of R programming. (BL-2) 6. Demonstrate the working environment of R Programming. (BL-2) 7. Understand R programming structures. (BL-2)		
MODULE – 2	**Objects in R and Probability methods**	**10H**
Manipulating Objects, Viewing Objects within Objects, Constructing Data Objects, Forms of Data Objects: Testing and Converting. Sample Spaces, Events, Properties of Probability, Counting Methods, Conditional Probability, Independent Events, Bayes' Rule, Random Variables.		
At the end of the Module 2, students will be able to: 4. Create data objects from the keyboard, clipboard, or external data files. (BL-2) 5. Demonstrate various commands for probability formulae. (BL-2) 6. Apply probability functions for problem solving in R. (BL-3)		
MODULE – 3	**Descriptive statistical analysis**	**10H**
Summary Commands, Summarizing Samples, Summary Tables. Creating Data for Complex Analysis, Summarizing Data. Stem and Leaf Plot, Histograms, Density Function, Types of Data Distribution, The Shapiro-Wilk Test for Normality, The Kolmogorov-Smirnov Test, Quantile-Quantile Plots		
At the end of the Module 3, students will be able to: 4. Demonstrate summary commands on data, Stem and Leaf Plot & Histograms. (BL-2) 5. Create data for complex analysis and summarize the data. (BL-2) 6. Describe various types of distribution of data. (BL-2) 7. Demonstrate the Kolmogorov-Smirnov Test in R programming. (BL-3)		
MODULE – 4	**Hypothesis Testing & Graphical Analysis**	**9H**
Using the Student's t-test, The Wilcoxon U-Test (Mann-Whitney), Paired t- and U-Tests, Correlation and Covariance, Tests for Association. Box-whisker Plots, Scatter Plots, Pairs Plots (Multiple Correlation Plots) Line Charts, Pie Charts, Cleveland Dot Charts, Bar Charts, Copy Graphics to Other Applications.		
At the end of the Module 4, students will be able to: 5. Explain shorthand way of describing and summarizing data using summary statistics. (BL-2) 6. Create summary tables, cross-tabulate. (BL-2) 7. Conduct test for non-parametric data, paired tests for parametric and non-parametric data. (BL-2) 8. Describe generating correlation and covariance matrices. (BL-2)		
MODULE – 5	**Complex Statistical analysis and Regression**	**9H**
Examples of Using Formula Syntax for Basic tests, Formula Notation in Graphics, Analysis of Variance (ANOVA).Simple Linear Regression, Multiple Regression, Curvilinear Regression, Plotting Linear Models and Curve Fitting, Summarizing Regression Models.		

At the end of the Module 5, students will be able to:

1. Create a range of graphs to summarize your data and results. (BL-2)
2. Illustrate box-whisker plots, scatter plots, including multiple correlation plots. (BL-3)
3. Move graphs from R to other programs and save graphs as files on disk. (BL-2)
4. Explain formula notation for simple hypothesis tests, graphics. (BL-2)

Content beyond syllabus: Linear Algebra Operations on Vectors and Matrices, Set Operations, Writing own scripts, Building R Packages

Text Book(s):

1. Mark Gardener, Beginning R The Statistical Programming language- John Wiley & Sons, Inc, 2016
2. G J KERNS, Introduction to Probability and Statistics Using R, 1st edition, GNU Free Documentation License, 2010

Reference Book(s):

1. Norman Matloff, The Art of R Programming, A Tour of statistical software design, NSP, 2011
2. Michael J. Crawley, The R Book, WILEY, 2012.
3. John Maindonald, W. John Braun, Data Analysis and Graphics Using R, Third Edition, Cambridge University Press, 2010
4. Roger D. Peng and Elizabeth Matsui, The Art of Data Science- A Guide for anyone Who Works with Data –Leanpub Publications, 2014
5. Grolemund, Garrett, Hands-On Programming with R Paperback by SPD,2014
6. Prabhanjan Narayanachar Tattar, Suresh Ramaiah, B.G. Manjunath, A Course in statistics with R, 1st edition, Wiley, 2016
7. Braun W. J., Murdoch D. J., A First Course in Statistical Programming with R, Cambridge University Press, 2007

NARAYANA ENGINEERING COLLEGE::GUDUR

20CS2005	**COMPUTER NETWORKS**							R20
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
IV	3	0	0	48	3	40	60	100

Pre-requisite: Knowledge of Information Technology, Computer Organization & Architecture

Course Objectives:

1. To impart the core principles of Information Communication Technology.
2. To deliver background information on the key transmission technologies used in computer networks.
3. To convey dimensions of Network layer through Internet Protocol.
4. To provide an insight into the most widely used Transport Layer protocols
5. To teach the principles of Application Layer and its protocols.

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

CO 1	Describe the concepts of Internet in terms of its building blocks, organized layered architecture. (BL-2)
CO 2	Identify the errors in data transfer between source and destination. (BL-2)
CO 3	Demonstrate the skills of sub netting and routing protocols. (BL-3)
CO 4	Illustrate the reliable, unreliable communication on public networks for various applications. (BL-3)
CO 5	Explain the principles of Application Layer and its protocols.(BL-4).

CO-PO Mapping

CO	PO												PSO	
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	2										3	2
CO2	3	3	3										3	2
CO3	3	3	3										3	2
CO4	3	3	3										3	3
CO5	3	3	2										3	3

1: Low, 2-Medium, 3- High

COURSE CONTENT		
MODULE - 1	**Physical Layer**	**(10H)**
Data Communications, Networks, Network Types, Internet History, Standards and Administration, Protocol Layering, TCP/IP Protocol Suite, The OSI Model**.** Data and Signals, Digital Signals, Transmission Impairment, Data Rate Limits, Performance. Transmission Media: Introduction, Guided Media, Unguided Media		
At the end of the Module 1, students will be able to: 1. Understand the basics of computer networks. (BL-2) 2. Describe the picture of data communication with layered architecture. (BL-2) 3. Describe performance issues in data transmission. (BL-2) 4. Classify the elements of physical media used for data transmission. (BL-2)		
MODULE –2	**Data-Link Layer & MAC**	**(9H)**
Introduction, Link-Layer Addressing, Error Detection and Correction: Cyclic Codes, Checksum, Forward Error Correction, Data Link Control (DLC)**:**DLC Services, Data-Link Layer Protocols, Sliding Window Protocols, HDLC, PPP.MAC: Random Access.		
At the end of the Module 2, students will be able to: 1. Explain link layer services. (BL-2) 2. Discuss Error Detection and Correction mechanisms. (BL-2) 3. Describe Data Link Control services and protocols. (BL-2) 4. Illustrate Media Access Control Protocols. (BL-3)		
MODULE –3	**Network Layer**	**(10H)**
Network Layer: Network Layer Design Issues, Routing Algorithms: The Optimality Principle, Shortest Path Algorithm, Flooding, Distance Vector, Link State, Hierarchical, Broadcast, Multicast, Any cast, Congestion Control Algorithms, Quality of Service. Internetworking, IPV4 Addresses, IPV6, OSPF, BGP, IP.		
At the end of the Module 3, students will be able to: 9. Understand design issues of network layer. (BL-2) 10. Explain efficient routing protocols in computer networks. (BL-2) 11. Discuss the concept of internetworking and its implementation issues. (BL-2) 12. Describe the elements of network layer required for data transfer over Internet. (BL-2)		
MODULE –4	**Transport Layer**	**(9H)**
The Transport layer services, Elements of Transport Protocols, Congestion Control in Transport Layer. UDP, TCP, Performance problems in computer networks, Network performance measurement, Real-time interactive protocols.		
At the end of the Module 4, students will be able to: 1. Understand the services provided by transport layer. (BL-2) 2. Describe elements of transport layer required for data transfer over Internet. (BL-2) 3. Demonstrate end to end communication. (BL-3) 4. Discuss performance issues in transport layer. (BL-2)		
MODULE –5	**Application Layer**	**(10H)**
Introduction, Client Server Programming-Iterative communication using UDP, Iterative communication using TCP. Standard Client Server Protocols: WWW, HTTP, Domain Name System, FTP, e-mail, TELNET, Secure Shell.		
At the end of the Module 5, students will be able to: 1. Implement client server communication. (BL-3)		

2. Explain the working of world wide web with HTTP, DNS. (BL-2)
3. Describe the protocols for mail, remote system login. (BL-2)
4. Discuss file transfer, network management protocols. (BL-2)

Total hours:	**48 hours**

Content beyond syllabus:

1. Wired LANs (Ethernet Family), Wireless LANs (802.11 Family)
2. Connecting Devices and VPN
3. Peer-to-Peer paradigm

Text Book(s):

1. Behrouz A. Forouzan, Data communications and networking, 5th edition, Mc Graw Hill Education, 2012.
2. Andrew S. Tanenbaum, Wetherall, Computer Networks, 5th edition, Pearson, 2013.

Reference Book(s):

1. Douglas E. Comer, Internetworking with TCP/IP – Principles, protocolsand architecture-Volume 15th edition, PHI.
2. Kurose James, Ross Keith, Computer Networking: A Top-Down Approach, 6th Edition, Pearson Education
3. Fall, Richard, TCP/IP Illustrated: The Protocols, 2ND edition, Pearson Education
4. Behrouz A. Forouzan, TCP/IP Protocol Suite, 4th edition, Tata McGraw Hill
5. Bhushan Trivedi, Data Communication and Networks, Oxford,2016.
6. Davie, Elsevier,Computer Networks, 5th Edition, Peterson.
7. M. Dave, Computer Networks, Cengage Learning,2012.

NARAYANA ENGINEERING COLLEGE::GUDUR								
20CS2006	**OPERATING SYSTEMS**							R20
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
IV	3	0	0	48	3	40	60	100

Pre-requisite: Fundamentals of computers

Course Objectives:

1. To understand the fundamental principles of the operating system, its services and Functionalities.
2. To illustrate the concepts of inter-process communication, synchronization and scheduling.
3. To understand different types of memory management viz. virtual memory, paging and segmentation.
4. To identify the reasons for deadlock and understand the techniques for deadlock detection, prevention and recovery.
5. To understand the need of Mass storage and protection mechanisms in computer systems.

Course Outcomes: After successful completion of the course, Student will be able to:

CO 1	Illustrate the concepts and design of operating system of a computer. (BL-2)
CO 2	Analyze CPU process scheduling and deadlock handling techniques provided with concurrencies. (BL-4)
CO 3	Analyze the memory management and virtual memory concepts of an application. (BL-4)
CO 4	Demonstrate the structure and implementation of file system for effective storage in a system. (BL-2)
CO 5	Illustrate Mass Storage Structure and Protection Mechanism of a system. (BL-2)

CO-PO Mapping

CO	PO												PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2										3	2
CO2	3	3	3										3	3
CO3	3	3	3										3	3
CO4	3	3	3										3	3
CO5	3	3	3										3	2

1: Low, 2-Medium, 3- High

COURSE CONTENT		
MODULE – 1	**Introduction**	**9H**
Computer system architecture, operating systems structure, operating systems operations; Evolution of operating systems: Simple Batch, multi programmed, time shared, parallel distributed systems, real time systems, special purpose systems, operating system services, user operating systems interface. Types of systems calls, system programs, protection and security, operating system design and implementation, operating systems structure**.**		
At the end of the Module 1, students will be able to: 1. Illustrate the structure of operating system and basic architectural components involved in operating system design. (BL-2) 2. Demonstrate how the computing resources are managed by the operating system. (BL-2) 3. Explain the objectives and functions of operating systems. (BL-2)		
MODULE -2	**Process and CPU scheduling, process coordination**	**10H**
The process, process state, process control block, threads; Scheduling queues, context switch, preemptive scheduling, dispatcher, scheduling criteria, scheduling algorithms. Process synchronization, the critical section problem, synchronization hardware, semaphores and classic problems of synchronization, monitor. Deadlock characterization, methods of handling deadlocks, deadlock prevention, dead lock avoidance, dead lock detection and recovery from deadlock**.**		
At the end of the Module 2, students will be able to: 1. Contrast the process and a thread. (BL-2) 2. Develop applications to run in parallel either using process or thread models of different operating system. (BL-3) 3. Illustrate the various resource management techniques for timesharing and distributed systems. (BL-2) 4. Describe deadlock and deadlock mechanisms.(BL-2)		
MODULE-3	**Memory management and virtual memory**	**10H**
Swapping, contiguous memory allocation, paging, structure of page table. Segmentation with paging, virtual memory, demand paging; Performance of demand paging: Page replacement, page replacement algorithms, allocation of frames, thrashing**.**		
At the end of the Module 3, students will be able to: 1. Demonstrate the virtual memory, entities and attributes. (BL-3) 2. Illustrate the mapping from virtual memory address to physical address and vice-versa. (BL-3) 3. Identify how a shared memory area can be implemented using virtual memory addresses in different processes. (BL-3) 4. Contrast between Paging and Segmentation. (BL-2)		
MODULE-4	**File system interface**	**9H**
The concept of a file, access methods, directory structure, file system mounting, file sharing, protection, file system structure. File system structure, File system implementation, directory implementation, allocation methods, free space management**.**		
At the end of the Module 4, students will be able to:		

5. List the mechanisms adopted for file distribution in applications. (BL-1)
6. Explain the need of memory management in operating systems and understand the limits of fixed memory allocation schemes. (BL-2)
7. Organize file management when designing or developing a new operating system. (BL-3)

MODULE-5	Mass-storage structure	10H

Overview of mass storage structure, Disk structure, Disk attachment, Disk scheduling, Disk management, Swap space management, RAID structure, Stable storage implementation**.** goals of protection, principles of protection, domain of protection, access matrix, implementation of access matrix

At the end of the Module 5, students will be able to:

1. Illustrate the fragmentation in dynamic memory allocation, and identify dynamic allocation approaches.(BL-2)
2. Illustrate how program memory addresses relate to physical memory addresses, memory management in base-limit machines, and swapping.(BL-2)
3. Compare RAID levels of memory.(BL-2)
4. Illustrate various disk scheduling algorithms.(BL-2)
5. Understand the access control and protection mechanisms. (BL-2)

Total hours:	**48 hours**

Content beyond syllabus:

Linux operating systems, Multiprocessor management systems, Unix features, real time operating systems, modern operating systems.

Text Book(s):

1. Abraham Silberschatz, Peter B. Galvin, Greg Gagne, "Operating System Principles",10th Edition, Wiley Student Edition, 2018.
2. William Stallings, "Operating System- Internals and Design Principles", 6th Edition, Pearson Education, 2002.

Reference Book(s):

1. D. M. Dhamdhere, "Operating Systems a Concept based Approach", 2nd Edition, Tata McGraw-Hill, 2006.
2. P.C.P. Bhatt, "An Introduction to Operating Systems", PHI Publishers.
3. G. Nutt, N. Chaki and S. Neogy, "Operating Systems", Third Edition, Pearson Education.
4. Andrew S Tanenbaum, "Modern Operating Systems", 3rd Edition, PHI, 2007.

NARAYANA ENGINEERING COLLEGE::GUDUR								
20CS2007	**SOFTWARE ENGINEERING**							R20
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
IV	3	0	0	48	3	40	60	100
Pre-requisite: Programming Skills								
Course Objectives: 1. To understand the software life cycle models. 2. To understand the software requirements and SRS document. 3. To understand the important of modeling and modeling languages 4. To design and develop correct and robust software products 5. To understand the maintenance of the software.								
Course Outcomes: After successful completion of the course, Student will be able to:								
CO 1	Understand Fundamental concepts of software engineering and analyze process models required to develop a software system.(BL-2)							
CO 2	Analyze software requirements and model requirements for developing the application.(BL-4)							
CO 3	Apply software design and development techniques by understanding software architecture.(BL-3)							
CO 4	Analyze the User interface design techniques to design GUI.(BL-4)							
CO 5	Analyze the testing strategies and techniques for quality software.(BL-4)							

CO-PO Mapping														
CO	**PO**												**PSO**	
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3												2	2
CO2	2	3	3	1									3	2
CO3	3	3											2	2
CO4	3	3	2										3	3
CO5	3	3									3		3	2
1: Low, 2-Medium, 3- High														

COURSE CONTENT

MODULE – 1	**The Software Process**	**10h**

The Nature of Software, The Unique Nature of Web Apps, Software Engineering, The Software Process, Software Engineering Practice, Software Myths**.** A Generic Process Model, Process Assessment and Improvement, Prescriptive Process Models, Specialized Process Models, The Unified Process, Personal and Team Process Models, Process Technology, Product and Process. Agility and the Cost of Change, Agile Process, Extreme Programming, Other Agile Process Models**.**

At the end of the Module 1, students will be able to:

1.Demonstrate the different phases involved in the software development. (BL-3)

2.Classify the various process models. (BL-2)

3. Identify suitable lifecycle model to be used. (BL-3)

4. Identify the need of agility and examine Agile process models (BL-3)

MODULE -2	**Modeling Concepts**	**10h**

Class Diagrams, Deployment Diagrams, Use-Case Diagrams, Sequence Diagrams, Communication Diagrams, Activity Diagrams, State Diagrams. Requirements Engineering, Eliciting Requirements, Developing Use Cases, and Building the requirements model, Negotiating Requirements, Validating Requirements. Requirements Analysis, Scenario-Based Modeling, UML Models that Supplement the Use Case, Data Modeling Concepts, Class-Based Modeling**.**

At the end of the Module 2, students will be able to:

1. Understand the requirements. (BL-2)
2. Solve the problem by defining the computing requirements of the problem. (BL-3)
3. Organize the scenario-based modeling and class based modeling in the design phase (BL-3)
4. Construct SRS for Problems. (BL-3)

MODULE-3	**Design concepts**	**10h**

Design with Context of Software Engineering, The Design Process, Design Concepts, The Design Model. Software Architecture, Architecture Genres, Architecture Styles, Architectural Design, Assessing Alternative Architectural Designs, Architectural Mapping Using Data Flow. Component, Designing Class-Based Components, Conducting Component-level Design, Designing Traditional Components, Component-Based Development**.**

At the end of the Module 3, students will be able to:

1. Identify the basic issues in software design. (BL-3)
2. Illustrate the importance of software architecture. (BL-2)

3. Apply the standard design principles based on suitable Architecture. (BL-3)

MODULE-4	User Interface Design, Coding and Testing	9h

Characteristics of a Good User Interface, Basic Concepts, Types of User Interfaces, Fundamentals of Component-based GUI Development, A User Interface Design Methodology. Coding, Code Review, Software Documentation, Testing, Unit Testing, Black-box Testing, White-Box Testing

At the end of the Module 4, students will be able to:

1. Analyze the architecture styles and build the system from the components. (BL-3)
2. Describe the golden rules in designing and analyzing UI. (BL-2)
3. Explain the user interface design process. (BL-2)
4. Explain the MVC (model-view-controller) design pattern and its importance to sound user interface software design and implementation. (BL-2)

MODULE-5	Software Quality & Product Metrics	9h

Software Quality, Software Quality Management System, ISO 9000, SEI Capability Maturity **Model Product metrics :**Metrics for Requirements Model, Metrics for Design Model, Metrics for source code, Metrics for testing, Metrics for maintenance.

At the end of the Module 5, students will be able to:

1. Illustrate the strategic approach to software testing (BL-2)
2. Describe the art of debugging (BL-2)
3. Explain the various testing strategies (BL-2)
4. Describe the Product metrics inSoftware Quality(BL-2)

Total hours:	**48 hours**

Content beyond syllabus:

Open source software Testing Automation Tools

Text Book(s):

1. Roger S. Pressman, Software engineering A practitioner's Approach, Seventh Edition, McGraw Hill International Education, 2016.
2. Rajib Mall, Fundamentals of Software Engineering, Third Edition, PHI.

Reference Book(s):

1. Ian Somerville, Software Engineering, 9th Edition Pearson Education Asia, 2011.
2. Pankaj Jalote, A concise introduction to software Engineering, Springer
3. PankajJalote, Software Engineering, A Precise Approach, Wiley India,2010
4. Jim Arlow, Ila Neustadt, UML 2 and the Unified Process: Practical Object-Oriented Analysis and Design, 2nd Edition, Pearson, (2005).
5. K.K. Agarwal & Yogesh Singh, Software Engineering, New Age International Publishers, 2007

NARAYANA ENGINEERING COLLEGE::GUDUR								
20MA1501	**STATISTICAL ANALYSIS AND TECHNIQUES USING R LAB**							R20
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
IV	0	0	3	48	1.5	40	60	100

Pre-requisite: Knowledge of Computer Programming, Probability and Statistics

Course Objectives:

6. To setup R tools and get familiarize with commands
7. To Execute commands related to Probability
8. To implement statistical analysis functions.
9. To draw graphs for the results in R Programming

Course Outcomes: After successful completion of the course, Student will be able to:

CO 1	Configure R IDE tools and execute basic programs.(BL-2)
CO 2	Execute commands and built in functions related in R. (BL-2)
CO 3	Implement data distribution and ANNOVA techniques. (BL-2)
CO 4	Construct programs on Manipulating Data and Extracting Components. (BL-2)

CO-PO Mapping

CO	PO												PSO	
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3			2								2	
CO2	2	2			2								1	
CO3	2				2								1	
CO4	3	3			2								2	

1: Low, 2-Medium, 3- High

COURSE CONTENT	CO
TASK -1Installing Packages (3H)	
Installing R tools and Exploring packages in R. Managing user workspace	CO 1
TASK -2 Basic Programs (3H)	
Programs on data types in R. Programs on Creating and manipulating a vector in R.	CO 1
TASK -3 Operations (3H)	
Programs on Creating matrix operations in R Programs on manipulating matrix in R. Programs on Creating and operations on Factors in R.	CO 1
TASK -4 Data Frames and Operators (6H)	

Programs on Data Frames in R. Programs on Operators in R. Programs on Data Sets.	CO 2
TASK -5 Working with Graphs (6H)	
Programs on Customizing and Saving to Graphs in R. Programs on PLOT Function in R to customize graphs Programs for Generating Box plots, and Scatter plots	CO 2
Task - 6 Data distribution (6H)	
Programs on Random Number Generation and Control Programs on Random Numbers and Sampling Programs on Creating Random Data Partitions	CO 3
Task -7 Hypothesis Testing(3H)	
Programs on Simple Hypothesis Testing Programs on Correlation and Covariance.	CO 3
Task -8 ANOVA (6H)	
Simple Programs on Analysis of Variance (ANOVA) Programs on One-Way ANOVA Programs on Two-Way ANOVA	CO3
Task -9 ANOVA(6H)	
Programs for Performing simple Linear Regression. A. Give Me a Number - Regression B. Computing the Root-Mean-Square Error Performing Variable Selection in Linear Regression.	CO 3
Task -10 Data Summary (6H)	
Programs on Extracting Means Programs on Creating Standard Data Summaries Programs on Summary Statistics	CO 4

Additional Experiments: **TASK-1Complex Analysis**	
Programs on Manipulating Data and Extracting Components Programs on Creating Data for Complex Analysis, Summarizing Data.	CO 4
TASK -2Multiple Regression	
Programs on Multiple Regression Building Regression Trees	CO 4

Virtual Labs

1.https://app.cybrary.it/browse/next-tech-course/transfer-learning-r-programming?queryID=4c4829fb170457c5c2c5cff546ef2cf5&objectID=46375

In this virtual lab, you will learn the fundamentals of the R programming language, one of the most common programming languages utilized by data scientists and machine learning engineers. In this introductory lab you will learn the basics of objects, strings, data, and expressions for use in R.

List of Experiments:

1.1Quick Start
1.2Basic Objects
1.3Managing Your Workspace
1.4Basic Expressions
1.5Working with Basic Objects
1.6Working with Strings
1.7Working with Data

2. https://app.cybrary.it/browse/next-tech-course/transfer-exploratory-data-analysis-in-r?queryID=7a61f9add7d43824dbbb5ca78171278c&objectID=46289

In this virtual lab, we will take a deeper dive into R in order to conduct some exploratory data analysis to convert structured data into usable models/charts for analysis. This will cover critical topics in R and data science such as data set extraction, data partitions, and data visualization

List of Experiments:

What's in There - Exploratory Data Analysis
2.2Creating Standard Data Summaries
2.3Extracting a Subset of a Dataset
Splitting a Dataset
Creating Random Data Partitions
Generating Standard Plots, such as Histograms, Boxplots, and Scatterplots
2.7Generating Multiple Plots on a Grid
2.8Creating Plots with the `lattice` Package
2.9Creating Charts that Facilitate Comparisons
2.10Creating Charts That Help to Visualize Possible Causality

3. https://app.cybrary.it/browse/next-tech-course/transfer-regression-analysis-in-r?queryID=655394865504019e0f9b3fb59c3cb66e&objectID=46430

In this virtual lab, you will utilize foundational knowledge of R in order to approach machine learning model driven regression analysis solutions to validate and measure the performance of said models. More specifically, we will cover linear regression, neural networks, regression trees, variable selection, and more.

List of Experiments:

Give Me a Number - Regression
3.2Computing the Root-Mean-Square Error
3.3Building KNN Models for Regression
3.4Performing Linear Regression
3.5Performing Variable Selection in Linear Regression
3.6Building Regression Trees
3.7Building Random Forest Models for Regression
3.8Using Neural Networks for Regression
3.9Performing K-Fold Cross-Validation
3.10Performing Leave-One-Out Cross-Validation to Limit Overfitting

Text Book(s):

1. Beginning R The Statistical Programming language- Mark Gardener, John Wiley &Sons,Inc, 2015
2. The Art of R Programming, A Tour of statistical software design, Norman Matloff, NSP, 2011
3. Introduction to Probability and Statistics Using R, G J KERNS, 1st edition, GNU Free Documentation License, 2010

Reference Book(s):

1. Data Analysis and Graphics Using R, Third Edition, John Maindonald, W. John Braun, Cambridge University Press, 2010
2. Exploratory Data Analysis with R – Roger D. Peng, Leanpub publications, 2015
3. Introduction to Probability and Statistics Using R, G. jay Kerns, First Edition, 2011
4. The Art of Data Science- A Guide for anyone Who Works with Data – Roger D. Peng and Elizabeth Matsui, Leanpub Publications, 2014
5. Hands-On Programming with R Paperback by Grolemund (Author), Garrett (Author), SPD,2014
6. A Course in statistics with R, PrabhanjanNarayanacharTattar, Suresh Ramaiah, B.G. Manjunath, 1st edition, Wiley, 2016
7. A First Course in Statistical Programming with R, Braun W. J., Murdoch D. J., Cambridge University Press, 2007

NARAYANA ENGINEERING COLLEGE:: GUDUR								
20CS2503	**OPERATING SYSTEMS AND COMPUTER NETWORKS LAB**							R20
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
IV	0	0	3	48	1.5	40	60	100

Pre-requisite: Knowledge of Computer Programming, Information Technology.

Course Objectives:

1. To demonstrate the working principle of various communication protocols.
2. To implement data link layer and Network layer protocols.
3. To implement various CPU Scheduling,
4. Deadlock Avoidance and detection Algorithms
5. To implement Page Replacement, File Organization and File Allocation Algorithms.

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

CO 1	Analyze and simulate CPU Scheduling Algorithms like FCFS, Round Robin, SJF, Priority and Dead lock detection, avoidance (BL-3)
CO 2	Implement memory management schemes, page replacement schemes and File Organization techniques (BL-3)
CO 3	Analyze the concept of data link layer to differentiate Error detection and Correction codes for a computer network. (BL - 4)
CO 4	Analyze the concept of Network layer to differentiate various routing protocols for a network. (BL - 4)

CO-PO Mapping

CO	PO												PSO	
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	**2**	**3**	**3**										3	2
CO2		**3**	**3**										**3**	**2**
CO3	3	3	3										3	2
CO4	3	3	3										3	3

1: Low, 2-Medium, 3- High

Operating Systems	
Task -1 (3H)	
Write a C program to simulate the following non-preemptive CPU Scheduling algorithms to find turnaround time and waiting time. (a) FCFS (b) SJF	CO 1
Task -2 (3H)	
Write a C program to simulate the following non-preemptive CPU Scheduling	CO 1

algorithms to find turnaround time and waiting time. (a) Round Robin (b) Priority	
Task -3 (3H)	
Write a C program to simulate Bankers algorithm for the purpose of deadlock avoidance	CO 1
TASK-4 (3H)	
Write a C program to simulate Bankers algorithm for the purpose of deadlock Prevention	CO 1
TASK-5 (3H)	
Write a C program to simulate page replacement algorithms FIFO	CO 2
TASK-6 (3H)	
Write a C program to simulate page replacement algorithms LRU	CO 2
TASK-7 (3H)	
Write a C program to simulate page replacement algorithms LFU	CO 2
TASK-8 (3H)	
Write a C program to simulate the MVT and MFT memory management techniques.	CO 2
TASK -9 (3H)	
Simulate paging technique of memory management	CO 2

Additional Experiments: (Operating Systems)	
TASK -1	
Write a C program to simulate the following file allocation strategies. (a) Sequential (b) Indexed (c) Linked	CO 2
TASK -2	
Write a C program to simulate the following file organization techniques (a) Single level directory (b)Two level directory	CO 2
TASK -3	
Write a C program to simulate the following file organization techniques (a) Hierarchical (b) DAG	CO 2
Virtual Labs: http://vlabs.iitkgp.ernet.in/ant/	

The Advanced Network Technologies Virtual Lab has been developed by keeping in mind the following objectives:

- To impart state-of-the-art knowledge on advanced topics in Computer Networks in an interactive manner through the Web
- Introduce the concept of network simulation to the students
- Involve students in analytical studies of Computer Networks through network simulation

All the while it is intended to present Computer Networks as an interesting subject to the students where learning and fun can go alongside.

http://vlabs.iitb.ac.in/vlabs-dev/vlab_bootcamp/bootcamp/CRUX/labs/index.html

1. Round Robin Process Scheduling Algorithm

http://vlabs.iitb.ac.in/vlabs-dev/vlab_bootcamp/bootcamp/CRUX/labs/exp1/index.html

COURSE CONTENT	CO
Computer Networks	
Task 1 - Framing methods (3H)	
Implement the following data link layer framing methods (a) Bit stuffing. (b) Character stuffing	CO 3
Task - 2 Encoding & Decoding (3H)	
Write a program to compute CRC code for the polynomials CRC-12, CRC-16	CO 3
Task -3 Sliding window protocols (3H)	
Develop a simple data link layer protocol that performs the flow control using the sliding window protocol, and loss recovery using the Go-Back-N mechanism	CO 3
TASK -4 Dijsktra's algorithm (3H)	
Implement Dijsktra's algorithm to compute the shortest path through a network	CO 4
TASK -5 Distance vector routing (3H)	
Implement distance vector routing algorithm for obtaining routing tables at each node	CO 4
TASK-6 Open Shortest Path First (3H)	
Implement distance vector routing algorithm for obtaining routing tables at each node	CO 4
TASK -7 Leaky bucket algorithm (3H)	
Write a program for congestion control using Leaky bucket algorithm.	CO 4
Additional Experiments:	
TASK -1 TCP Client server Programming	
Implement TCP Client server communication	CO 3
TASK -2 UDP Client server Programming	CO 3
Implement UDP Client server communication	

Text Book(s):

3. Behrouz A. Forouzan, Data communications and networking, Mc Graw Hill Education, 5th edition, 2012.
4. Andrew S. Tanenbaum, Wetherall, Computer Networks, Pearson, 5th edition, 2010.

Reference Book(s):

1. Douglas E. Comer, Internetworking with TCP/IP – Principles, protocols, and architecture-Volume 1, 5th edition, PHI
2. P.C.P Bhatt, An Introduction to Operating Systems, 2nd edition, PHI.
3. Douglas E. Comer, TCP/IP Client-Server Programming and Applications-Volume III, 2nd edition, Pearson
4. Kevin r fall, Richard, TCP/IP Illustrated: The Protocols, Volume 1, 2e, 2014, Pearson
5. Andrew S Tanenbaum, Modern Operating Systems 3rd Edition, PHI

NARAYANA ENGINEERING COLLEGE::GUDUR								
20CS2504	SOFTWARE ENGINEERING LAB							R20
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
IV	0	0	3	48	1.5	40	60	100

Pre-requisite: Problem solving skills

Course Objectives:

1. To gain knowledge on various tools for applying it in the software modelling and implementation.
2. To prepare students for performing requirement analysis and design of variety of applications.
3. To prepare students for project management.

Course Outcomes: After successful completion of the course, Student will be able to:

CO 1	Select suitable software development process model for the given scenario(BL-3)
CO 2	Classify the requirements and prepare software requirements specification for projects and perform modeling (BL-2)
CO 3	Understand the various design techniques and implement (BL-2)

CO-PO Mapping

CO	PO												PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	1									2	2
CO2			2	2									2	2
CO3	1	1	1	1							1		2	2
CO4	1	1	1	1									2	2

1: Low, 2-Medium, 3- High

CO 4	Apply testing principles for validating software project.(BL-3)

COURSE CONTENT	CO
Task 1 - Role of Software (6H)	
Objective: To identify the role of software in today's world across various domains. Software is also a predominant are for trade and export especially for the countries like India. Domains like health care, Airlines , financial Services, Insurance , retails, Education, and many more have exploited software and still there a lot of the scope for software to create impact and add values in multiple dimensions. Problem Description: In the context of this background, identify the areas (or application or systems) how software has been leveraged extensively in the following domains Health Care 2. Airlines 3. Banking Insurance 4. Retail 5. Education Summary	CO 1

dentify the role of software across multiple domains related to day to day life.	
Task -2 SOFTWARE DEVELOPMENT LIFE CYCLE MODELS (6H)	
Objective: To identify the suitable process model. Justify the best suitable SDLC for the following: a. College automation system b. online shopping	CO 1
Task -3 SOFTWARE REQUIREMENTS SPECIFICATION (6H)	
Describe the individual phases/modules of the project, Identify deliverables. a) Prepare SRS for Online Railway reservation system. b) Prepare SRS for Hotel Management system.	CO 2
TASK-4 DATA MODELLING (6H)	
Draw use case diagram for Online Movie ticket reservation. Prepare use case diagram for Online airline reservation system	CO 2
TASK-5 CLASS MODELLING (6H)	
Draw class diagram for Health care center. Draw class diagram for inventory system.	CO 2
TASK-6 DATA MODELLING (6H)	
Draw the class and use case diagram for Hospital management system?	CO 2
TASK-7 SOFTWARE TESTING (3H)	
Write the test cases for Banking application	CO 4
TASK-8 SOFTWARE TESTING (3H)	
Create a test plan documentation for Library management system.	CO 4
TASK-9 SOFTWARE TESTING	
UML Diagrams for develop the AUTOMATED TELLER MACHINE (ATM) application	CO 4
TASK -10 SOFTWARE TESTING	
UML Diagrams for develop the LIBRARY INFORMATION SYSTEM application.	CO 4

Additional Experiments:	
TASK-13 SOFTWARE METRICS	CO 4
ke ATM system study its system specification and report various bugs	
TASK -14 SOFTWARE DESIGN	CO 3
A program written in c language for Matrix multiplication fails. Introspect the causes for failure and write down the possible reasons for failure	

Virtual Labs:

http://vlabs.iitkgp.ernet.in/se/

To draw activity flow diagram for Library information system.

Draw a sequence diagram for Library information system.

Draw a state chart diagram for Library information system.

Write the test suites for user login functionality for library management system.

Determine the Cyclomatic complexity for the "ReissueBook" method as shown below:

```
public ID ReissueBook(ID userID, ID bookID) {
Member user = Member.GetMember(userID);
ID transactionID = null;
if ( user.canIssueNow() &&Book.IsAvailable(bookID) ) {
Integer count = user.getReissueCountFor(bookID);    // # of times this books has been reissued after it's recent issue by the user
if ( count < REISSUE_LIMIT ) {
user.incrementReissueCount(bookID);
BookTransaction transaction = new BookTransaction(userID, bookID);
transaction.save();
transactionID = transaction.getID();
}
}
return transactionID;
```

Text Book(s):

1. Roger S. Pressman, "Software engineering A practitioner's Approach", Seventh Edition, McGraw Hill International Education, 2016.
2. Ian Sommerville, "Software Engineering", Sixth Edition, Pearson Education, (2001).

Reference Book(s):

1. Jim Arlow, Ila Neustadt, "UML 2 and the Unified Process: Practical Object-Oriented Analysis and Design", 2nd Edition, Pearson, (2005).
2. John W. Satzinger, Robert B. Jackson, Stephen D. Burd, Object-oriented analysis and design with the Unified process, Cengage Learning
3. James Rumbaugh, Ivar Jacobson, Grady Booch, The Unified modeling language Reference manual, Addison-Wesley

NARAYANA ENGINEERING COLLEGE :: NELLORE							
Career Competency Development II							
B.Tech (CSE,ECE,EEE)	**Hours/Week**			**Total Hours**	**Maximum Marks**		
	L	**T**	**P**		**CIE**	**SEE**	**Total**
Semester IV	0	0	2	36	40	60	100
Objective(s)	To enhance employability skills and to develop career competency						

MODULE 1: Aptitude-2 (7h)

Ages, Alligations & Mixtures, Averages, Partnership, Calendars, Time & Work, Chain Rule, Pipesand Cisterns,

MODULE 2: Reasoning-2 (6h)

Odd Man Out/ Objective Reasoning, Missing Number, Logical word Sequence, Directions,Seating Arrangement, Logical Statement Assumption, Data Arrangements

MODULE 3: Verbal-2 (7h)

Articles, Tenses. Voice (Active & Passive), speech (direct and indirect), one word substitution, Idioms and phrases. Tag questions, subject verb arrangement, Paragraph writing (passage completion, Para completion, fill in the blanks)

MODULE 4: Technical Skills-3 (8h)

Linked Lists: single and Double Linked List Problems.
Solve the given Tasks in **CodeTantra** Platform using C/Python/Java.

Single and Double Linked List -

Task1: Find sum of even positions in a given Linked List (Hint: Construct linked list and find theeven positions in the list and calculate the sum value).

Task2: Check whether 2 Lists are same. (Hint: Lists must be equal number of elements).
Task3: Reverse the values in a List and display. (Hint: Read from last element to first element) **Task4:** Double Linked List Insertion and Deletion of element. (Hint: Construct Double linked listand insert and delete the element in a given position).
Students may solve at least any other 5 problems under "Easy/Medium" category in **HackerRank** other than the given Tasks.

MODULE 5: Technical Skills-4 (8h)

Searching & Sorting: Searching & Sorting Algorithms and related Applications.
Solve the given Tasks in **CodeTantra** Platform using C/Python/Java.

Searching and Sorting

Task1: Searching an Element in a linked list using liner search technique. (Hint: Construct aLinked List and find the element in given location).

Task2: Search an Element in a linked list in using Binary Search Technique (Construct a linked list and sort the elements and find the given element).

Task3: Quick Sort Application (Hint: Solve the problem using Divide and Conquer technique)

Task4: Merge sort Application (Hint: Solve using Recursive technique).

Students may solve at least any other 5 problems under "**Easy/Medium**" category in **Hacker Rank** other than the given Tasks.

EVALUATION:

Continuous Internal Evaluation (CIE)		
Sl.No	**Test/Evaluation**	**Marks**
1	Assignment test in class from Module 1(Evaluation for 10 marks)	8 marks
2	Assignment test in class from Module 2(Evaluation for 10 marks)	8 marks
3	Assignment test in class from Module 3(Evaluation for 10 marks)	8 marks
4	Assignment test in Lab from Module 4(Evaluation for 10 marks)	8 marks
5	Assignment test in Lab from Module 5(Evaluation for 10 marks)	8 marks
	Total	40 marks

Semester End Examination (SEE)		
Sl.No	**Test/Evaluation**	**Marks**
1	Written test - from the syllabus of Module 1, 2 and 3	36 marks
2	Evaluation from Module 4 and Module 5	24 marks
	Total	60 marks

Text / Reference Books:

1. Aptitude & Reasoning by RS Agarwal
2. Aptitude & Reasoning by Tyra
3. Aptitude & Reasoning by Arun Sharma
4. Aptitude & Reasoning by S Chand
5. Contemporary English Grammar by JayanthiDakshinamurthy
6. Verbal Ability by Pearsons
7. Reema Thareja, Data Structures using 'C'
8. Narasimha Karumanchi, Data Structures and Algorithms Made Easy, Career Monk

SEMESTER - V

NARAYANA ENGINEERING COLLEGE::GUDUR								
Course Code	ARTIFICIAL INTELLIGENCE							R20
20CS2008	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
SEMESTER V	3	0	0	50	3	40	60	100

Course Outcomes: After successful completion of the course, student will be able to:	
CO 1	Familiar with basic principles of AI.
CO 2	Explore the uninformed searching and solve the real world problems.
CO 3	Understanding the various informed searching strategies.
CO 4	Aware of knowledge, reasoning and its implementation.
CO 5	Understand the basics in learning and apply the learning strategies to practical applications.

CO-PO Mapping														
CO	**PO**												**PSO**	
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	1											2	
CO2	3	3	3	2	2	2							3	
CO3	2	3	3	2		2							3	
CO4	2	2	3		1								3	
CO5	2	2	3	2	1									2
1: Low, 2-Medium, 3- High														

COURSE CONTENT		
MODULE – 1		**8H**
Overview on A.I The state of the Art, Intelligent Agents - Agents and Environments, Good behavior, The nature of Environments, the Structure of Agents.		
LEARNING OUTCOMES: At the end of this Module students will be able: 1. Recognize the importance of Artificial Intelligence (L1) 2. Identify how intelligent agent is related to its environment (L2)		
MODULE – 2		**9H**

Problem Solving: Problem solving agents, toy problems, Real-world problems, searching for solutions.

Uninformed Search strategies: BFS, DFS, Depth-limited search.

At the end of this Module students will be able:

1. Examine how an agent can formulate an appropriate view of the problem it faces(L5).
2. Solve the problems by systematically generating new states (L3)
3. Derive new representations about the world using process of inference (L3)

MODULE – 3		**12H**

Informed Search strategies: GBFS, A* search, Local search algorithms: Hill-climbing. Adversarial Search: Games, optimal decision in games, Alpha-Beta pruning, Imperfect, Real-Time Decisions.

At the end of this Module students will be able:

1. Apply searching techniques for solving a problem (L3)
2. Evaluate alpha-beta pruning algorithm(L5)
3. Evaluate real time decisions(L5)

MODULE – 4		**9H**

Knowledge and reasoning: Logical Agents: Knowledge -based Agents, The WUMPUS world, Logic, Propositional Logic, Reasoning Patterns in Propositional logic, Resolution, Forward and Backward chaining. First-order Logic: Syntax and Semantics of First-Order Logic.

At the end of this Module students will be able:

1. Build an Intelligent agent (L3)
2. Understand syntax and semantics of first order logic

MODULE – 5		**12H**

Learning: Learning from Observations- Forms of Learning, Inductive Learning, Learning Decision Trees, and Ensemble Learning**.**

Knowledge in Learning: A Logical formulation of learning, knowledge in learning, Explanation-Based Learning, Learning using Relevance Information

At the end of this Module students will be able:

Understand forms of learning techniques(L2)
Illustrate learning techniques using relevance information(L4)

	Total hours:	**50 hours**

TEXTBOOK:

1. Artificial Intelligence a Modern Approach, Stuart Russell, Peter Norvig (Person Education), 3nd edition.
2. Nils J. Nilsson, "Artificial Intelligence: A new Synthesis", Harcourt Asia Pvt. Ltd., 2000.

REFERENCES:

1. Artificial Intelligence- Rich E & Knight K (TMH), 4thedition.
2. Artificial Intelligence Structures and Strategies complex problem Solving – George F. Lugar Pearson Education.
3. D.W. Patterson, –Introduction to AI and Expert Systems‖, PHI, 1992...
4.R.J.Schalk off,—Artificial Intelligence-an Engineering Approach‖, McGraw Hill Int. Ed., Singapore, 1992.

NARAYANA ENGINEERING COLLEGE:: GUDUR								
20CS2009	DESIGN AND ANALYSIS OF ALGORITHMS							R20
SEMESTER	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
V	3	0	0	48	3	40	60	100

Course Outcomes: After successful completion of the course, student will be able to:	
CO 1	Understand the general principle of Divide and Conquer and identify suitable problems to apply Divide and Conquer paradigm.(BL-2)
CO 2	Understand optimization problems and the general principles of Greedy and Dynamic Programming paradigms to solve them.(BL-2)
CO 3	Apply backtracking to solve optimization problem.(BL-3)
CO 4	Analyze the advantage of bounding functions in Branch and Bound technique to solve the problems. (BL-3)
CO 5	Classify deterministic and Non-deterministic algorithms for P, NP, NP –hard and NP-complete classes of problems.(BL-2)

CO-PO Mapping														
CO	**PO**												**PSO**	
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	**3**	**3**	**1**										**3**	
CO2	**3**	**3**	**3**	**3**										**3**
CO3	**3**	**3**	**2**	**3**									**3**	
CO4	**3**	**3**	**3**										**3**	
CO5	**3**	**3**	**3**	**3**										**3**
1: Low, 2-Medium, 3- High														

COURSE CONTENT		
MODULE – 1		**10H**
Introduction: Algorithm, Algorithm specification, Performance analysis. Divide and Conquer: General method, Binary Search, Finding the maximum and minimum, Mergesort, QuickSort, Selection, Strassen's matrix multiplication.		
LEARNING OUTCOMES: At the end of this Module students will be able 1. Derive the recurrence equation for running time of a given algorithm and solve. 2. Understand the general principle of Divide and Conquer and identify suitable problems to apply Divide and Conquer paradigm		

3. Analyze the time complexities of Binary Search, Finding the maximum and minimum, and Strassen's matrix multiplication algorithms.
4. Compare complexities of Merge sort, Quick sort and Selection sort techniques

MODULE – 2		**9H**

Greedy Method: General method, Knapsack problem, Job Scheduling with Deadlines, Minimum cost Spanning Trees, Optimal storage on tapes, Single-source shortest paths.
Dynamic programming: General Method, Multistage graphs, All-pairs shortest paths, Optimal binary search trees, 0/1 knapsack, the traveling salesperson problem.

LEARNING OUTCOMES:

At the end of this Module students will be able:

1. Understand optimization problems and the general principles of Greedy and Dynamic Programming paradigms to solve them
2. Define Principle of optimality with examples.
3. Differentiate Greedy and Dynamic programming paradigms.
4. Apply dynamic programming strategy for Optimal binary search trees, Multistage graphs, All-pairs shortest paths, 0/1 knapsack, the traveling salesperson problem.

MODULE – 3		**10H**

Basic Traversal and Search Techniques: Techniques for binary trees, Techniques for Graphs, Network Flow, Connected components and Spanning trees, Articulation point and Bi-connected components and DFS
Back tracking: General Method, 8 – queens problem, Sum of subsets problem, Graph coloring and Hamiltonian cycles, Knapsack Problem.

LEARNING OUTCOMES:

At the end of this Module students will be able:

1. Illustrate graph search strategies : BFS, DFS and D-Search .
2. Determine articulation points and bi-connected components in a given graph using Depth First Spanning Trees
3. Demonstrate the recursive and iterative backtracking algorithms.
4. Apply backtracking strategy to solve N – queens problem, Sum of subsets problem and Knapsack problem

MODULE – 4		**10H**

Branch and Bound: The method, Travelling salesperson, 0/1 Knapsack problem, Efficiency considerations.
Lower Bound Theory: Comparison trees, Lower bounds through reductions – Multiplying triangular matrices, inverting a lower triangular matrix, computing the transitive closure.

LEARNING OUTCOMES:

At the end of this Module students will be able:

1. Illustrate the state space search techniques; FIFO, LIFO and LC.
2. Analyze the advantage of bounding functions in Branch and Bound technique to solve the Travelling Salesperson problem.

3. Compare the LC and FIFO branch and bound solutions for 0/1 knapsack problem. 4. Understand lower bound theory concept in solving algebraic problems.		
MODULE – 5		**9H**
NP – Hard and NP – Complete Problems: NP Hardness, NP Completeness, Consequences of being in P, Cook‘s Theorem, Reduction Source Problems, Reductions: Reductions for some known problems		
LEARNING OUTCOMES: At the end of this Module students will be able: 1. Differentiate deterministic and Non-deterministic algorithms. 105 Page 2. Define P, NP, NP –hard and NP-complete classes of problems. 3. Understand the satisfiability problem. 4. State Cook’s Theorem. 5. Understand the reduction techniques.		
	Total hours:	**48 hours**

TEXTBOOK:

1. Ellis Horowitz, Sartaj Sahniand Rajasekaran, “Fundamentals of Computer Algorithms”,2nd Edition,2012,University Press.
2. Jon-Kleinberg-Eva-Tardos, Algorithm Design, Pearson; 1st edition

REFERENCES:

1. Anany Levitin, “Introduction to the Design and Analysis of Algorithms”, Third Edition, Pearson Education,2012.
2. Thomas H.Cormen, Charles E.Leiserson, RonaldL. Rivestand Clifford Stein,“ Introduction to Algorithms”, Third Edition, PHI Learning Private Limited, 2012.
3. Alfred V.Aho, John E.Hopcroft and Jeffrey D. Ullman,“Data Structures and Algorithms”, Pearson Education,Reprint2006.
4. 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.

NARAYANA ENGINEERING COLLEGE:: GUDUR								
20CS2010	THEORY OF COMPUTATION							R20
SEMESTER	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
V	3	0	0	50	3	40	60	100

Course Outcomes: On successful completion of the course, student will be able to:	
CO 1	Demonstrate the concepts of language to perform finite automata.(BL-2)
CO 2	Demonstrate the finite automata to recognize patterns in programs.(BL-2)
CO 3	Construct the Regular Grammar from Regular expression to specify how to form grammatically correct strings in the programming language(BL-3)
CO 4	Analyze the Context free grammar by minimizing redundancy from the grammar of a program. (BL-4)
CO 5	Describe the Push down automata concepts to access a limited amount of information on the stack in a program. (BL-2)

CO-PO Mapping														
CO	**PO**												**PSO**	
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2											1	1
CO2	3	3	3	1									3	1
CO3	3	3	1	1									3	1
CO4	2	3	2	2									3	1
CO5	3	3	3	3									3	1
1: Low, 2-Medium, 3- High														

COURSE CONTENT		
MODULE – 1		**10H**
Introduction : Basics of set theory, Relations on sets, Deductive proofs, Reduction to definitions, Other heorem forms, Proving equivalences about sets, The Contra positive, Proof by contradiction, Counter xamples, Inductive proofs, Alphabets, Strings, Languages, Problems, Grammar formalism, Chomsky Hierarchy.		
LEARNING OUTCOMES: 1. At the end of Module 1, student will be able to: 2. Describe equivalence, partial order and compatible relations (L1). 3. Demonstrate the concepts of language to perform finite automata(L1)		
MODULE – 2		**10H**
Finite Automata: An Informal picture of Finite Automata, Deterministic Finite Automata (DFA),Non Deterministic Finite Automata (NFA), Applying FA for Text search, Finite Automata with Epsilon transitions (ϵ-NFA or NFA- ϵ), Finite Automata with output, Conversion of one machine to another, Minimization of Finite Automata, Myhill-Nerode Theorem.		
LEARNING OUTCOMES: At the end of Module 2, student will be able to: 1. Distinguish DFA and NFA. (L4) 2. Construct DFA for an input string. (L6) 3. Perform minimization of Automata.(L5)		
MODULE – 3		**10H**
Regular Expressions: Regular Expressions, Regular Sets, Identity Rules, Equivalence of two Regular Expressions, Manipulations of Regular Expressions, Finite Automata, and Regular Expressions, Inter Conversion, Equivalence between Finite Automata and Regular Expressions, Pumping Lemma, Closure Properties, Applications of Regular Expressions, Finite Automata and Regular Grammars, Regular Expressions and Regular Grammars.		
LEARNING OUTCOMES: At the end of Module 3, student will be able to: 1. Compare Moore and Mealy Machines.(L2) 2. Construct regular expression for the given Finite Automata.(L6) 3. Construct finite automata for the given regular expression.(L6) 4. Apply closure properties on regular expressions.(L3)		
MODULE – 4		**10H**
Context Free Grammars: Formal Languages, Grammars, Classification of Grammars, Chomsky Hierarchy Theorem, Context Free Grammar, Leftmost and Rightmost Derivations, Parse Trees, Ambiguous Grammars, Simplification of Context Free Grammars-Elimination of Useless Symbols, E Productions and Unit Productions, Normal Forms for Context Free Grammars-Chomsky Normal Form and Greibach Normal Form, Pumping Lemma, Closure Properties, Applications of Context Free Grammars.		
LEARNING OUTCOMES: At the end of Module 4, student will be able to: 1. Define Context Free Grammar. (L1)		

2. Distinguish Chomsky Normal Form and Greibach Normal form.(L4) 3. Apply Pumping Lemma theorem on Context Free Grammar.(L3)		
MODULE – 5		**10H**
Push Down Automata: Pushdown Automata, Definition, Model, Graphical Notation, Instantaneous Description Language Acceptance of pushdown Automata, Design of Pushdown Automata, Deterministic and Non – Deterministic Pushdown Automata, Equivalence of Pushdown Automata and Context Free Grammars Conversion, Two Stack Pushdown Automata, Application of Pushdown Automata.		
LEARNING OUTCOMES: At the end of Module 5, student will be able to: 1. List the applications of Pushdown Automata. (L1) 2. Construct Pushdown Automata for context free grammar.(L6)		
	Total hours:	**50 hours**

TEXTBOOK:

1. J.E. Hopcroft, R.Motwani and J.D. Ullman, Introduction to Automata Theory, Languages and Computation, 3rd Edition, Pearson, 2008.
2. Michael Sipser, Introduction to the Theory of Computation, Second Edition, Thomson Course Technology

REFERENCES:

1. Formal Language and Automata Theory, K.V.N. Sunitha and N.Kalyani, Pearson, 2015.
2. Introduction to Automata Theory, Formal Languages and Computation, Shyamalendu Kandar, Pearson, 2013.

NARAYANA ENGINEERING COLLEGE:: GUDUR								
20CS2505	**ARTIFICIAL INTELLIGENCE LABORATORY**							R20
SEMESTER	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
V	0	0	2	36	1	40	60	100

Course Outcomes: After successful completion of the course, student will be able to:	
CO 1	Apply the good programming skills to formulate the solutions for computational problems.[BL-3]
CO 2	Design and develop solutions for informed and uninformed search problems in AI.[BL-3]
CO 3	Apply AI Techniques in Gaming [BL-3]
CO 4	Demonstrate and enrich fundamentals in knowledge and its schemes [BL-2]

CO-PO Mapping														
CO	**PO**												**PSO**	
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	2	3										2	
CO2	2	2	3											2
CO3	2	2	3										3	
CO4	2	1	2										2	
1: Low, 2-Medium, 3- High														

List of Experiments	
TASK – 1	**3H**
Implementation of DFS and BFS	
TASK – 2	**3H**
Implementation of travelling salesman Problem	
TASK – 3	**3H**
Implementation of simple Chabot.	
TASK – 4	**3H**
Implementation of wampus world problem.	

TASK – 5	3H
Implementation of 8 puzzle problem	
TASK – 6	**3H**
Implementation of Towers of Hanoi problem	
TASK – 7	**3H**
Implementation of A* Algorithm	
TASK – 8	**3H**
Implementation of Hill Climbing Algorithm	
TASK – 9	**3H**
Implementation of Simulated Annealing Algorithm.	
TASK – 10	**3H**
Implementation of Knowledge representation schemes.	
TASK – 11	**3H**
Demonstrate knowledge representation for the following using open source tools: a. Ram likes mango. b. Seema is a girl. c. Bill likes Cindy. d. Rose is red. e. John owns gold	
TASK – 12	**3H**
Implementation of any case study using AI techniques	
Total hours:	**36 hours**

TEXTBOOK:

1. Artificial Intelligence, 2nd Edition, E.Rich and K.Knight, TMH.
2. Artificial Intelligence a Modern Approach, Stuart Russell, Peter Norvig (Person Education), 3nd edition.

REFERENCES:

1. Python Essential Reference, David M. Beazley, Pearson Education, Inc.
2. Fluent Python, Luciano Ramalho by O'Reilly Media
3. Python Cookbook, David Beazley and Brian K. Jones, O'Reilly Atlas.3e
4. Artificial Intelligence- Rich E & Knight K (TMH), 4th edition.
5. Artificial Intelligence Structures and Strategies complex problem Solving – George F. Lugar Pearson Education.

NARAYANA ENGINEERING COLLEGE::GUDUR								
20CS2507	**DESIGN AND ANALYSIS OF ALGORITHMS LABORATORY**							R20
SEMESTER	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
V	0	0	2	36	1	40	60	100

Course Outcomes: After successful completion of the course, student will be able to:	
CO 1	Demonstrate searching and sorting technique and calculate the time required to search and sort the elements by using Divide and Conquer method (BL-2)
CO 2	Apply Greedy method to solve knapsack problem and minimum cost spanning tree problem. (BL-3)
CO 3	Apply dynamic programming strategy to solve multistage problem and knapsack problem. (BL-3)
CO 4	Apply backtracking method to calculate 8-queen's problem and sub set problem. (BL-3)

CO-PO Mapping														
CO	**PO**												**PSO**	
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	3	3										
CO2	3	3	3	2										
CO3	3	3	3	2										
CO4	2	2	2	2										
1: Low, 2-Medium, 3- High														

List of Experiments	
TASK – 1	**3H**
1. a) Implementation of Binary search algorithm. b) Implementation of Binary search algorithm using Divide & Conquer method.	
TASK – 2	**3H**
2. a) Implementation of Quick Sort algorithm. b) Implementation of Quick Sort algorithm using Divide & Conquer method.	
TASK – 3	**3H**
3. a) Program to merge two sorted arrays. b) Implementation of Merge Sort algorithm using Divide & Conquer method	
TASK – 4	**3H**
.4. a) Implementation of Matrix multiplication. b) Implementation of Strassen's Matrix multiplication	
TASK – 5	**3H**
5. a) Program to implement knapsack problem using greedy method. b) Program to implement job sequencing with deadlines using greedy method.	
TASK – 6	**3H**
6. a) Find Minimum Cost Spanning Tree of a given undirected graph using Kruskal's algorithm. b) Find Minimum Cost Spanning Tree of a given undirected graph using Prim's algorithm.	
TASK – 7	**3H**
7. a) Print all the nodes reachable from a given starting node in a digraph using BFS method. b) Check whether a given graph is connected or not using DFS method.	
TASK – 8	**3H**
8. a) Implementation of Optimal merge patterns. b) Implement travelling salesman problem.	
TASK – 9	**6H**
9 .a) Program for finding shortest path for multistage graph using dynamic programming. b) Implement 0/1 Knapsack problem using Dynamic Programming.	
TASK – 10	**3H**
10 Program to implement 8-queens problem using backtrack method.	
ADDITIONAL EXPERIMENTS	

1. Implement All-Pairs Shortest Paths Problem using Floyd's algorithm. 2. Find a subset of a given set S = {s1,s2,. ...,sn} of n positive integers whose sum is equal to a given positive integer d. For example, if S= {1, 2, 5, 6, 8} and d = 9 there are two solutions {1,2,6} and {1,8}.A suitable message is to be displayed if the given problem instance doesn't have a solution.

Total hours:	**36 hours**

TEXTBOOK:

1. Ellis Horowitz, Sartaj Sahniand Rajasekaran, "Fundamentals of Computer Algorithms",2nd Edition,2012,University Press.

2Jon-Kleinberg-Eva-Tardos, Algorithm Design, Pearson; 1st edition

REFERENCES:

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, Reprint2006.

NARAYANA ENGINEERING COLLEGE :: NELLORE							
Career Competency Development III							
B.Tech	Hours/Week			Total Hours	Maximum Marks		
(CSE,ECE,EEE)	L	T	P		CIE	SEE	Total
Semester V	0	0	2	36	40	60	100
Objective(s)	To enhance employability skills and to develop career competency						

MODULE 1: Aptitude-3 (7h)

Percentages, Profit & Loss, Discounts, Simple Interest, Compound Interest, Data Interpretation, Permutations and Combinations, Menstruation-I (Measurement of Areas)

MODULE 2: Reasoning-3 (6h)

Ranking Test, Type Inequalities, Crypto Arithmetic, Critical Reasoning / Data Sufficiency

MODULE 3: Verbal-3 (6h)

Spotting Errors, Error Correction (Underlined Part & Phrase in Bold), Reading Comprehension 1, Sentence completion (Review and practice), Adjectives (Review and practice), Prepositions (Review and practice), Jumbled sentences (Review and practice).

MODULE 4: Structured Query Language & PL/SQL (8h) (through practice)

SQL Constraints, SQL Operations, Nested queries (or) Sub queries and Examples, SQL Types of Joins with Examples, Normal Forms, PL/SQL Programs .

Module 5: Object Oriented Programming Principles through JAVA (9h) (through practice)

JVM Compiler Vs JIT Compiler, Various OOPs Concepts and its Applications, Abstract Classes Vs Interfaces, Method overriding Vs Method Overloading, Access Specifiers, Exceptions and its Types, Exception Handling Mechanisms.

Continuous Internal Evaluation (CIE)		
Sl.No	**Test/Evaluation**	**Marks**
1	Assignment test in class from Module 1(Evaluation for 10 marks)	7 marks
2	Assignment test in class from Module 2(Evaluation for 10 marks)	7 marks
3	Assignment test in class from Module 3(Evaluation for 10 marks)	7 marks
4	Assignment test in Lab from Module 4(Evaluation for 10 marks)	7 marks
5	Assignment test in Lab from Module 5(Evaluation for 10 marks)	7 marks
6	Attendance	5 marks
	Total	40 marks

Semester End Examination (SEE)		
Sl.No	**Test/Evaluation**	**Marks**
1	Written test - from the syllabus of Module 1, 2 and 3	36 marks
2	Evaluation from Module 4 and Module 5	24 marks
	Total	60 marks

Text / Reference Books:

1. Aptitude & Reasoning by RS Agarwal
2. Aptitude & Reasoning by Tyra
3. Aptitude & Reasoning by Arun Sharma
4. Aptitude & Reasoning by S Chand
5. Contemporary English Grammar by JayanthiDakshinamurthy
6. Verbal Ability by Pearsons

SEMESTER - VI

NARAYANA ENGINEERING COLLEGE::GUDUR							
20CS2011	MOBILE APPLICATION DEVELOPMENT						R20
SEMESTER	**Hours / Week**			**Total hrs**	**Credit**	**Max Marks**	
	L	**T**	**P**		**C**	**CIE**	**SEE**	**TOTAL**
VI	2	0	0	50	2	40	60	100

Course Outcomes: After successful completion of the course, Student will be able to:	
CO 1	Illustrate the developmental environment to run Android Applications. (BL 3)
CO 2	Demonstrate the knowledge of Android components for creating basic Android Applications. (BL 3)
CO 3	Illustrate the concepts of layouts, resources and media to design GUI Applications. (BL 3)
CO 4	Demonstrate the concepts of controls, dialogs and fragments for creating Android Applications. (BL 3)
CO 5	Design menus, forms to access database and able to communicate with SMS, email for an Android application (BL 3)

CO-PO Mapping														
CO	**PO**												**PSO**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3				1									
CO2	2	2	2		1								1	1
CO3	2	3	3		1								2	1
CO4	1	3	3		2								2	1
CO5		1	3		2								1	2
1: Low, 2-Medium, 3- High														

COURSE CONTENT		
MODULE – 1	**Introduction to Android**	**8H**
The Android 4.1 jelly Bean SDK, Understanding the Android Software Stack, installing the Android SDK, Creating Android Virtual Devices, Creating the First Android Project, Using the Text view Control, Using the Android Emulator, The Android Debug Bridge(ADB), Launching Android Applications on a Handset.		
At the end of the Module 1, students will be able to: 1. Understand the installation of Android Platform (BL-1) 2. Analyze the working of android applications (BL-2) 3. Apply debugging strategies in basic programming (BL-3)		
MODULE – 2	**Basic Widgets**	**9H**
The Role of Android Application Components, Utility of Android API, Overview of the Android Project Files, Understanding Activities, Role of the Android Manifest File, Creating the User Interface, Commonly Used Layouts and Controls, Event Handling, Displaying Messages Through Toast, Creating and Starting an Activity, Using the Edit Text Control, Choosing Options with Checkbox, Choosing Mutually Exclusive Items Using Radio Buttons.		
At the end of the Module 2, students will be able to: 1. Understand the concepts of Android API Components (BL-1) 2. Interpret the working examples using various android components (BL-2) 3. Solve basic level android applications using activities (BL-3)		
MODULE – 3	**Building Blocks for Android Application Design**	**12H**
Introduction to Layouts, Linear Layout, Relative Layout, Absolute Layout, Using Image View, Frame Layout, Table Layout, Grid Layout, Adapting to Screen orientation. Utilizing Resources and Media Resources, Creating Values Resources, Using Drawable Resources, Switching States with Toggle Buttons, Creating an Images Switcher Application, Scrolling Through Scroll View, playing Audio, Playing Video		
At the end of the Module 3, students will be able to: 1. Understand the various types of layouts (BL-1) 2. Analyze the various screen orientation strategies (BL-2) 3. Illustrate various components to implement audio and video applications (BL-4)		
MODULE – 4	**Selection widgets And Fetching Information Using Dialogs and Fragments**	**9H**

Using List View, Using the Spinner control, Using the GridView Control, Creating an Image Gallery Using the ViewPager Control.

Dialogs, Selecting the Date and Time in One Application, Fragments, Creating Special Fragments**.**

At the end of the Module 4, students will be able to:

1. Understand the special controls like viewpager, GridView like controls (BL-1)
2. Apply various applications using dialogs (BL-3)
3. Remember the concepts of application development using Fragments (BL-1)

MODULE – 5	**Building Menus**	**12H**

Creating Interface Menus and Action Bars, Menus and Their Types, Creating Menus Through XML, Creating Menus Through Coding, Applying a Context Menu to a List View, Using the Action Bar, Replacing a Menu with the Action Bar, Creating a Tabbed Action Bar, Creating a Drop-Down List Action Bar.

At the end of the Module 5, students will be able to:

1. Understand the concepts of Menus (BL-2)
2. Analyze the working of various types of android menus (BL-2)
3. Understanding the special components like Tabbed Action Bar and Drop down list (BL-2)

Total hours:	**50 hours**

TEXTBOOK:

1. Android Programming by B.M Harwani, Pearson Education.
2. Lauren Darcey and Shane Conder, "Android Wireless Application Development", Pearson Education, 2nd edition.
3. Professional Android Application Development, Wiley India Private Limited.

REFERENCES:

1. Dawn Griffiths, David Griffiths, "Head First Android Development: A Brain-Friendly Guide", Second Edition, O'Reilly Media, 2017. ISBN: 978-1491974056.
2. Android application Development for Java Programmers,James C Sheusi, Cengage Learning
3. Android In Action by w.FrankAbleson, Robi Sen, Chris King, C.Enrique Ortiz., Dreamtech.
4. Professional Android 4 applications development, RetoMeier,Wiley India.
5. Beginning Android 4 applications development, Wei- Meng Lee,Wiley India.

NARAYANA ENGINEERING COLLEGE::GUDUR								
20CS2012	**WEB TECHNOLOGIES**							R20
SEMESTER	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
VI	3	0	0	50	3	40	60	100

Course Outcomes: On successful completion of the course, the student will be able to:	
CO 1	Create static web pages using HTML and CSS(BL-3)
CO 2	Implement dynamic web pages and validate them using JavaScript. (BL-3)
CO 3	Create secure, usable database driven web applications (BL-3)
CO 4	Develop web applications using Scripting Languages (BL-3)
CO 5	Construct a well-defined web service. (BL-3)

CO-PO Mapping														
CO	**PO**												**PSO**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	1	2	2		2								1	2
CO2	2	3	3	1	2								1	2
CO3	2	3	3	1	3								1	2
CO4	1	2	3	1	2								1	2
CO5	2	2	3		2								1	1
1: Low, 2-Medium, 3- High														

COURSE CONTENT		
MODULE – 1	**WWW and JAVASCRIPT**	**8H**
WWW: Internet technologies Overview – Internet Standards & Protocols - HTTP. XHTML, CSS. **JAVASCRIPT:** Introduction to Scripting - Data types and Variables - Operators, Expressions and Statements - Functions - Arrays - Objects - Document Object Model - Event Handling – JSON.		
At the end of the Module 1, students will be able to: 1. Understand the concepts of internet standards (BL-2) 2. Understand the basic concepts of Java Script (BL-2) 3. Apply functions, arrays and object principles on basic programming (BL-3)		
MODULE – 2	**SERVLETS**	**9H**
Servlets: Java Servlet Architecture - Servlet Life Cycle - Form GET and POST actions- Session Handling - Understanding Cookies - Database Connectivity - JDBC.		
At the end of the Module 2, students will be able to: 1. Understand the Servlet concept to be used at server side (BL-1) 2. Analyze the life cycle principles of Servlet concept (BL-2) 3. Apply JDBC Concepts in server side scripting using Servlets (BL-3)		
MODULE – 3	**PHP**	**12H**
PHP: Variables – Conditions, Branches, Loops - Arrays & Strings - Regular Expressions - Date and Time Functions - Integer and Float Functions - User-Defined Functions - Program control - Form Processing - Cookies - Database Connectivity.		
At the end of the Module 3, students will be able to: 1. Understand the concepts of PHP basic programming (BL-2) 2. Illustrate various constructs in PHP to write server side scripting (BL-1) 3. Apply database connectivity through Form Processing using PHP (BL-3)		
MODULE – 4	**JQUERY**	**9H**
JQUERY: Introduction to JQuery – Selectors – Elements: Manipulations, Changing and Setting elements – Event Models: Event handlers – Animations & Effects – Functions – Plugins.		
At the end of the Module 4, students will be able to: 1. Remember the concepts of JQUERY (BL-1) 2. Analyze the various event models in JQUERY (BL-2) 3. Apply concepts of JQUERY to develop various applications (BL-3)		
MODULE – 5	**ANGULAR 10 and REACTJS 16**	**12H**
ANGULAR 10: Typescript 3.8 – Node.js 14 - Angular Web Application - Components - Data Binding - Directives - Pipes - Service - Event Binding – Forms. **REACTJS 16:** React Features- ReactJS Vs React native-React JSX-components-state-props-lifecycle-events-forms-router-animation-table.		

At the end of the Module 5, students will be able to: 1. Understand the web applications using NODEJS (BL-1) 2. Implement various services using NODEJS (BL-2) 3. Compare Angular JS with React JS (BL-2)	
Total hours:	**50 hours**

v

TEXTBOOK:

1. Harvey & Paul Deitel& Associates, Harvey Deitel and Abbey Deitel, "Internet and World Wide Web - How To Program", Fifth Edition, Pearson Education, 2011.
2. Nate Murray, Felipe Coury, Ari Lerner, and Carlos, ng-book The Complete Guide to Angular, Fullstack.io, 2020
3. Adam Freeman, Pro React 16, Apress, 2019.
4. NlnLnc, Susan Fitzgerald,"Reactjs: Hands-On full stack web development using React js",2nd Edition, 2020.

REFERENCE:

1. Jeffrey C and Jackson, Web Technologies A Computer Science Perspective, Pearson Education, 2011.
2. Bear Bibeault and Yehuda Katz, jQuery in Action, 2008.
3. Gopalan N.P. and Akilandeswari J., Web Technology, Prentice Hall of India, 2011.
4. UttamK.Roy, Web Technologies, Oxford University Press, 2011.

NARAYANA ENGINEERING COLLEGE::GUDUR							
	MOBILE APPLICATION DEVELOPMENT LABORATORY						R20
Course Code	Hours / Week			Total hrs	Credit	Max Marks	
	L	T	P		C	CIE	SEE	TOTAL
20CS2509	0	0	2	51	1	40	60	100

Course Outcomes: On successful completion of the Laboratory, student will be able to:	
CO 1	Demonstrate data sharing with different applications and sending and intercepting SMS.(BL-2)
CO 2	Develop an application for creating basic GUI components, Layouts and basic widgets.(BL-3)
CO 3	Analyze the capability to implement the application for location tracking, work with databases, and creating some basic widgets.(BL-4)

CO-PO Mapping														
CO	**PO**												**PSO**	
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	3	2	3				2	2		2	3	3
CO2	3	3	2	2	3				2	2		2	3	3
CO3	3	3	3	2	3				2	2		2	3	3
1: Low, 2-Medium, 3- High														

List of Experiments		
TASK – 1	**Android installations**	**3H**
Set up the Development environment to develop Android Applications		
TASK – 2	**Hello World Application.**	**3H**
Create "Hello World" Application.		
TASK – 3	**Using the Activity class**	**1H**
Create an application using the Activity class.		
TASK – 4	**Edit Text control.**	**3H**

Create an application using Edit Text control.		
TASK – 5	**Check Box control.**	**3H**
Creating an application that allows choosing options using Check Box control.		
TASK – 6	**Radio Button control**	**3H**
Creating an application that allows choosing options using Radio Button control		
TASK – 7	**Linear Layout**	**3H**
Create an application using Linear Layout		
	Relative Layout	**3H**
Create an application using Relative Layout		
TASK – 9	**Absolute Layout**	**3H**
Create an application using Absolute Layout		
TASK – 10	**play Audio and Video clips**	**3H**
Create an application to play Audio and Video clips		
TASK – 11	**Using Spinner.**	**3H**
Create an application that allows choosing options using Spinner.		
TASK – 12	**Menus**	**3H**
Create an application using Menus.		
Additional Experiments:		**3H**
TASK-13	**Radio Button control**	**1H**
Creating an application that allows choosing options using two sets of Radio Button controls.		
TASK -14	**Action Bar**	**1H**
1. Create an application using Action Bar. 2 . Create an application to display a Drop-Down List Action Bar.		
	Total hours:	**39 hours**

TEXTBOOK:

1. Android Programming by B.M Harwani, Pearson Education, 2013.
2. Lauren Darcey and Shane Conder, “Android Wireless Application Development”, Pearson Education, 2nd ed. (2011).
3. Professional Android Application Development, Wiley India Private Limited.

REFERENCES:

1. Dawn Griffiths, David Griffiths, “Head First Android Development: A Brain-Friendly Guide”, Second Edition, O'Reilly Media, 2017. ISBN: 978-1491974056.
2. Android application Development for Java Programmers,James C Sheusi, Cengage Learning
3. Android In Action by w.FrankAbleson, Robi Sen, Chris King, C.Enrique Ortiz., Dreamtech.
4. Professional Android 4 applications development, RetoMeier,Wiley India, 2012.
5. Beginning Android 4 applications development, Wei- Meng Lee,Wiley India,2013 [2008], [6th Edition], Java How to Program, Pearson Ed.

NARAYANA ENGINEERING COLLEGE::GUDUR								
	WEB TECHNOLOGIES LABORATORY							R20
Course Code	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
20CS2510	0	0	2	39	1.5	40	60	100

Course Outcomes: On successful completion of the Laboratory, student will be able to:	
CO 1	Develop static user interfaces for web applications with HTML and CSS. (BL-3)
CO 2	Build dynamic user interfaces for client -side scripting using JavaScript. (BL-3)
CO 3	Model a client server architecture using PHP. (BL-3)

CO-PO Mapping														
CO	**PO**												**PSO**	
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	2		3				2	2			3	3
CO2	3	2	3		3				2				3	3
CO3	3	3	3		3				2	2			2	3
1: Low, 2-Medium, 3- High														

List of Experiments	
TASK – 1	**3H**
Create a web page to embed a map along with hot spot, frames & links.	
TASK – 2	**3H**
Create a web page using an embedded, external and inline CSS file.	
TASK – 3	**3H**
Create an online job registration page along with java script validations	
TASK – 4	**3H**
Develop web page for Library Management System using Servlet and JavaScript program that will validate the controls in the forms you have created for the application and access a data from database	
TASK – 5	**3H**

Develop web page for Banking Management System using Servlet and JavaScript program that will validate the controls in the forms you have created for the application and access a data from database.	
TASK – 6	**3H**
Create a program to implement the concepts of AJAX for web page login process.	
TASK – 7	**3H**
Develop a Simple game using JQuery.	
TASK – 8	**3H**
Write a PHP program for Employee Details, which includes Emp ID, Name, Designation, Salary, DOJ, etc., to connect with the database and execute queries to retrieve and update data. Also, prepare the report for single and group of employees based on the end user needs.	
TASK – 9	**3H**
Create an online application in any of the web application like PHP for Tourism management like the available trip details in season based. Type of mode, Concession details for passengers and Booking / Cancelling tickets.	
TASK – 10	**3H**
Design a web page application using Angular 9	
TASK – 11	**3H**
Design a registration page along with event handling using Angular 9	
TASK – 12	**3H**
Design user interface using React JS	
TASK – 13	**3H**
MINI-PROJECT (Suggested Domains):	
Total hours:	**39 hours**

TEXTBOOK:

1. Adam Freeman, Pro React 16, Apress, 2019.
2. NlnLnc, Susan Fitzgerald,"Reactjs: Hands-On full stack web development using React js",2nd Edition, 2020.

REFERENCES:

1. Gopalan N.P. and Akilandeswari J., Web Technology, Prentice Hall of India, 2011.
2. UttamK.Roy, Web Technologies, Oxford University Press, 2011.

SEMESTER -VII

NARAYANA ENGINEERING COLLEGE::GUDUR							
20CS2013	CRYPTOGRAPHY AND NETWORK SECURITY						R20
SEMESTER	Hours / Week			Total hrs	Credit	Max Marks	
	L	T	P			CIE	SEE	TOTAL
VII	3	0	0	50	3	40	60	100

Pre-requisite:

1. Knowledge on Computer Networks and Data Communication.
2. Knowledge on Information Security.

Course Objectives:

1. Introduce the basic categories of threats to computers and networks
2. Illustrate various cryptographic algorithms.
3. Demonstrate public-key cryptosystem.
4. Discuss the fundamental ideas of public-key cryptography.
5. Explore Web security threats and protection mechanisms

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

CO 1	nderstand and apply the cryptographic algorithms to safeguard from intruders(BL-2,3)
CO 2	ompare and contrast symmetric and asymmetric encryption systems and their vulnerability to attack(BL-4)
CO 3	Implement the various key distribution, management and message authentication schemes to send the messages with security(BL-3)
CO 4	Identify information system requirements for Transport level, wireless network, E-Mail and IP(BL-2)
CO 5	Design a network security system by implementing all the concepts of encryption and decryption algorithms(BL-6)

CO-PO Mapping														
CO	PO												PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO 2
CO 1	3	2						1					2	
CO 2	3	3	3										3	
CO 3	3	3	1										1	
CO 4	3	2	3					1					1	
CO 5	3	3	1					2					2	
1: Low, 2-Medium, 3- High														

COURSE CONTENT		
MODULE – 1		**8H**
Attacks on Computers and Computer Security: Introduction, The need for security, Principles of security, Types of Security attacks, Security services, Security Mechanisms, A model for Network Security Cryptography, plain text and cipher text, substitution techniques, transposition techniques, encryption and decryption, symmetric and asymmetric key cryptography, Steganography.		
LEARNING OUTCOMES: At the end of 1 Module students will be able: 1. Identify different types of Attacks (L3) 2. Interpret various cryptography techniques (L5) 3. Distinguish between cryptography and Steganography (L4)		
MODULE – 2		**9H**
Symmetric key Ciphers: Block Cipher principles &Algorithms (DES, AES, Blowfish), Block cipher modes of operation, Stream ciphers, Key distribution. **Asymmetric key Ciphers**: Principles of public key cryptosystems, Algorithms (RSA, Diffie Hellman, ECC), Key Distribution.		
LEARNING OUTCOMES: At the end of this Module students will be able: 1. Differentiate symmetric and asymmetric ciphers (L4) 2. Explain the principles of public key cryptography (L2) 3. Select the appropriate cryptographic algorithm based on the requirements and applications.(L5)		

MODULE – 3		**12H**

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

LEARNING OUTCOMES:

At the end of this Module students will be able:

1. Summarize authentication techniques (L2)
2. Apply Hash algorithm for generating Digital signatures (L3)

MODULE – 4		**9H**

E-Mail Security: Pretty Good Privacy, S/MIME IP Security: IP Security overview, IP Security architecture, Authentication Header, encapsulating security payload, security associations, key-management.

LEARNING OUTCOMES:

At the end of this Module students will be able:

1. Extend security for emails (L2)
2. Examine IP security mechanisms (L4)

MODULE – 5		**10H**

Web Security: Web security considerations, Secure Socket Layer and Transport Layer Security, Secure electronic transaction Intruders, Virus and Firewalls: Intruders, Intrusion detection, password management, Virus and related threats, Firewall design principles, Types of firewalls Case Studies on Cryptography and security: Secure Inter-branch Payment Transactions, Cross site Scripting Vulnerability, Virtual Elections

LEARNING OUTCOMES:

At the end of this Module students will be able:

1. Design secure electronic transactions (L6)
2. Explain different types of Firewalls (L2)

Total hours:	**48 hours**

Text Book(s):

1. William Stallings, “Cryptography and Network Security”, 5th Edition, Pearson Education, 2011.
2. Bernard Menezes “Network Security and Cryptography”, 1stEdition, CENGAGE Learning, 2010.

Reference Book(s):

1. C K Shyamala, N Harini, Dr T R Padmanabhan, Wiley India, “Cryptography and Network Security”,1st Edition, Wiley India Pvt Ltd, 2011.
2. Forouzan Mukhopadhyay “Cryptography and Network Security”, 2nd Edition , Mc Graw Hill, 2010.
3. Mark Stamp, Wiley India, “Information Security, Principles and Practice”, 2nd Edition, Wiley, 2011

NARAYANA ENGINEERING COLLEGE::NELLORE								
	DATA SCIENCE							R20
Course Code	Hours / Week			Total hrs	Credits	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
20CS2511	3	0	0	50	3	40	60	100

Pre-requisite: Database Management System and Data Warehousing and Mining

Course Objectives:

1. To learn the fundamentals of data science
2. Provide insights about the basic roles of a Data Scientist.
3. Develop a greaterUnderstanding of the Data Science process techniques.
4. Develop problem-solving skills on machine learning.

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

CO1	Illustrate the concepts of Data Science and Big data. (BL-2)
CO2	Demonstrate the Data Science Process for Data Analysis. (BL-2)
CO3	Illustrate the large data on single computer and frameworks for big data. (BL-2)
CO4	Demonstrate databases for NoSQL and graph based data types. (BL-2)
CO5	Apply machine learning algorithms for Data Science. (BL-3)

CO-PO Mapping

CO	PO												PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1		2								2	2
CO2	2			2	2								3	3
CO3	2	2	2	1	2								3	3
CO4	2	2	3		2								3	3
CO5	2	2	2	2	2								3	3

1: Low, 2-Medium, 3- High

COURSE CONTENT		
MODULE – 1	**Introduction of Data Science and Big Data**	**8H**
Introduction: Introduction to Data Science, Examples, Data Sources, Challenges, Applications, Comparative Study of data science with databases, facets of data, big data ecosystem and data science,		
LEARNING OUTCOMES: At the end of this Module students will be able: 1. Understand basic concepts of data science(L2) 2. Understand big data ecosystem and various data sources(L2)		
MODULE – 2	**Data Science Process**	**9H**
Data Science Process: Overview of the Data Science Process, defining research goals and creating a project charter, Retrieving data, Cleansing, integrating and transforming data, exploratory data analysis, build the models, presenting findings and building applications on top of them.		
LEARNING OUTCOMES: At the end of this Module students will be able: 1. Understand the data science process(L2) 2. Apply the data science process techniques for analysis(L3)		
MODULE – 3	**Handling Large Data on single Computer and Big Data frameworks**	**11H**
Handling Large data on a Single Computer: The problem you face when handling large data, General techniques for handling large volumes of data, General Programming tips for dealing with large data sets. **First Steps in Big Data:** Distributing data storage and processing with frameworks.		
LEARNING OUTCOMES: At the end of this Module students will be able: 1. Understand how to handle large data on single computer (L2). 2. Illustrate the distributed data storage and processing data with frameworks (L2).		
MODULE – 4	**NoSQL databases and Graph databases**	**9H**
Join the NoSQL Statement: Introduction to NoSQL,ACID,CAP, Principles of NoSQL databases, NoSQL database types. **The rise of graph database:** Introducing connected data and graph database, introducing Neo4j, connected data example.		
LEARNING OUTCOMES: At the end of this Module students will be able: 1. Understand NoSQL databases and data types (L2) 2. Illustrate the concept of connected data and graph databases using Neo4j (L2)		

MODULE – 5	Importance of Machine learning in Data Science	11H
Machine Learning: Introduction to machine learning, applications for machine learning in data science, python tools used in machine learning, the modeling process, types of machine leaning.		
LEARNING OUTCOMES: At the end of this Module students will be able: 1. Demonstrate the way to use machine learning algorithms. (L2). 2. Understand basic concepts of machine learning techniques using python tools (L2)		
	Total hours:	**48 hours**

Text Book(s):

1. Davy Cielen, Arno D. B. Meysman, and Mohamed Ali, "**Introducing Data Scienec- Machine Learning-Pythoin**",
2. Jure Leskovec, Anand Rajaraman, and Jeffery David Ullman, "**Mining of Massive Datasets**"CambridgeUniversity Press, 2 edition (13 November 2014), ISBN-10: 1107077230, ISBN-13:978-1107077232.
3. Tom Mitchell, "**Machine Learning**", McGraw-Hill, 1st Ed May 2013, ISBN-10: 1259096955|ISBN-13: 978-1259096952.

Reference Book(s):

1.Daniel Jurafsky and James H. Martin, "Speech and Language Processing",
Pearson Education, First edition (2011), ISBN-10: 8131716724 , ISBN-13: 978-8131716724.

2.Wes McKinney, "Python for Data Analysis", O'Reilly Media, October 2012, Print ISBN:978-1-4493-1979-3| ISBN 10:1-4493-1979-3.

3.Garrett Grolemund," Hands- on Programming with R", O'Reilly Media (Kindle)

NARAYANA ENGINEERING COLLEGE::GUDUR								
	MACHINE LEARNING							R20
Course Code	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
20CS2015	2	0	0	50	2	40	60	100

Pre-requisite: Familiarity with basic concepts of computer science (algorithms, data structures, and complexity), mathematical maturity commensurate in statistics, probability, algebra , matrix math), probability and statistics, and the ability to program algorithms in a language of your choice

Course Objectives :

1. Gain knowledge about basic concepts of Machine Learning
2. Study about different learning algorithms
3. Learn about Artificial Neural Network learning strategies
4. Familiar with Regression concepts
5. Study about instance based learning and reinforcement learning

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

CO 1	Understand the concepts of computational intelligence like machine learning
CO 2	Understand and apply the various Machine learning strategies
CO 3	Familiar with basic concepts in artificial neural network and its learning methods
CO 4	Explore regression methods in Machine learning
CO 5	Design and analyze the instance based and reinforcement learning

CO-PO Mapping

CO	PO												PSO	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	2	1	1										
CO2	1	3			1	2								
CO3	1	1	3	2	2									
CO4	1	3												
CO5	1	3	2	2										
1: Low, 2-Medium, 3- High														

CONTENTS		
MODULE – 1		**8H**
Introduction: Learning – Types of Machine Learning – Supervised Learning, Relationship between ML and human learning, Example applications of ML-Designing a Learning system, Perspective and Issues in Machine Learning. Concept Learning Task – Concept Learning as Search – Finding a Maximally Specific Hypothesis – Version Spaces and the Candidate Elimination Algorithm.		
LEARNING OUTCOMES: At the end of this Module students will be able: 1. Understand basic concepts of machine learning(L1) 2. Compare machine learning and human learning(L2) 3. Analyze machine learning techniques(L4)		
MODULE – 2		**9H**
Classification: Supervised Learning-The problem of classification-Training and testing classifier models-Decision Tree-Naive Bayes classification-Bayesian networks--Ensemble Learning-Support Vector Machines-Cross-validation-Model evaluation (precision, recall, F1-mesure, accuracy)-Applications of classifications.		
LEARNING OUTCOMES: At the end of this Module students will be able: 1. Differentiate supervised and unsupervised learning methods (L4). 2. Solve classification problem using k-nearest neighbour classifier (L3). 3. Apply Naïve Bayes classifier to solve decision making problem (L3).		
MODULE – 3		**11H**
Artificial Neural Networks: Introduction, Neural Network representation, Appropriate problems, Perceptrons, Multilayer networks and Back propagation algorithm. **Unsupervised Learning** – K means Algorithm-Hierarchical and density based Clustering- Applications of Clustering.		
LEARNING OUTCOMES: At the end of this Module students will be able: 1. Determine Clusters in data using k-means and Hierarchical Clustering methods (L5). 2. Remember applications of clustering techniques		
MODULE – 4		**9H**
Regression: Linear Regression-Multi-variable regression-Model evaluation-Least squares regression-Logistic regression -Gradient Descent Algorithm-Applications of regression.		
LEARNING OUTCOMES: At the end of this Module students will be able: 1. Describe gradient descent approach, maximum likelihood estimation and method of least squares (L1). 2. Apply SVM to determine a hyper plane with maximum margin (L3). 3. Determine decision tree for given data (L5).		

MODULE – 5		11H

Instance Based Learning: Introduction, k-nearest neighbour learning, locally weighted regression, radial basis function, cased-based reasoning.
Reinforcement Learning: Introduction, Learning Task, Q Learning, Non deterministic rewards and actions, Temporal difference learning, Generalizing from examples, relationship to dynamic programming.

LEARNING OUTCOMES:

At the end of this Module students will be able:

Understand instant based learning techniques(L2)

Understand reinforcement learning techniques(L2)

Total hours:	**48 hours**

Content beyond syllabus:

- Bayesian Learning:
- Computational learning theory

Text Book(s):

1. Tom M. Mitchell, Machine Learning, India Edition 2013, McGraw Hill Education
2. Ethem Alpaydın, Introduction to machine learning, second edition, MIT press.

Reference Book(s):

1. Trevor Hastie, Robert Tibshirani, Jerome Friedman, h The Elements of Statistical Learning, 2nd edition, springer series in statistics.
2. Christopher M. Bishop, Pattern Recognition and Machine Learning, Springer-Verlag New York Inc.

NARAYANA ENGINEERING COLLEGE::NELLORE								
	DATA SCIENCE LABORATORY							R20
Course Code	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
20CS2511	0	0	3	36	1.5	40	60	100

Pre-requisite: Any Programming Language

Course Objectives:

1. Use Python for statistical programming, computation, graphics, and modeling.
2. Fit some basic types of statistical models.
3. Be able to write machine learning algorithms.

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

CO 1	Explain Python Programming by installing numpy and pandas.
CO 2	Demonstrate the commands on visualization.
CO 3	Develop programming logic for machine learning algorithms.
CO 4	Analyze data sets using Python Programming capabilities

CO-PO Mapping

CO	PO												PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1		1	1	1	2								3	3
CO2		1		2	2								3	3
CO3		1	3	3	2								3	3
CO4	2	3	2		2								2	3

1: Low, 2-Medium, 3- High

List of Tasks

TASK – 1	3H

(a)Python installation for WINDOWS (b)Installation of Jupyter Notebook

TASK – 2	3H

(a) Write a Numpy program to add a border filled with 0's around the existing array.

(b) Write a Numpy program to get the unique elements of an array.

(c)Write a Numpy program to get the values and indices of the elements that are bigger than10 in a given array.

TASK – 3	3H

(a) Write a pandas program to create and display a data Frame from a specified dictionary data which has the index labels.

(b) Write a pandas program to select the rows where the score is missing, i.e. is NaN.

TASK – 4	3H
(a)Write a Python program to draw a scatter plot with empty circles taking a random distribution in X and Y and plotted against each other. (b) Write a Python program to create a pie chart with a title of the popularity of programming languages.	
TASK – 5	**3H**
(a) Install Plotly (b) Create Line Chart, Bar Chart, Pie Charts using Plotly. (c) Create Box Plots, Violin Plots, Heatmaps using Plotly	
TASK - 6	**3H**
Develop the model Simple Linear regression with Python.	
TASK – 7	**3H**
Develop the model Multiple Linear regression with Python.	
TASK – 8	**3H**
Write a program to implement Logistic Regression.	
TASK – 9	**3H**
Write a program to implement the Decision Tree Regression model	
TASK – 10	**3H**
Write a program to implement the Random Forest Classification model.	
TASK – 11	**3H**
Write a program to implement the K-Nearest Neighbor algorithm to classify the given dataset.	
TASK – 12	**3H**
Write a program to implement the Support Vector Machine algorithm.	
Additional Tasks	
1. Write a program to implement the Naïve Bayesian classifier for a simple training data set stored as a .CSV file. 2. Write a program to implement the k-Means clustering algorithm to cluster the set of data stored in .CSV file.	
Total hours:	**36 hours**

Text Book(s):

1. Python Programming – An Introduction to computer science, John Zelle,JimLeisy

Programming and Problem Solving with Python by Ashok NamdevKamthane and Amit Ashok Kamthane, McGraw Hill Education; First edition (1 November 2017)

Reference Book(s):

1. Programming Python, Mark Lutz, O'Reilly, 3rd Edition, 2006
2. Core Python Programming, Wesley J Chun, PH, 2nd Edition
3. Python Programming: A Compatible Guide for Beginners to Master and Become an Expert in python programming Language, Brain Draper, CreateSpace Independent Publishing Platform, 2016

NARAYANA ENGINEERING COLLEGE::GUDUR								
	MACHINE LEARNING LABORATORY							R20
Course Code	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
20CS2512	0	0	2	36	1	40	60	100

Pre-requisite: Basic knowledge in DBMS and preliminary fundamentals of data mining algorithms	
Course Objectives: 1. To study various machine learning models for building applications.	
Course Outcomes: After successful completion of the course, the student will be able to:	
CO 1	Introduction to Python and Python Libraries- NumPy, Pandas, Matplotlib, Scikit.
CO 2	Perform Data exploration and pre-processing in Python and Feature Engineering and Feature Selection Methods.
CO 3	Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file
CO 4	For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples

CO-PO Mapping														
CO	**PO**												**PSO**	
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	1											2	
CO2	3	3	3	2	2	2							3	
CO3	2	3	3	2		2							3	
CO4	2	2	3		1								3	
1: Low, 2-Medium, 3- High														

List of Experiments		
TASK – 1		**3H**
Introduction to Python and Python Libraries- NumPy, Pandas, Matplotlib, Scikit.		
TASK – 2		**3H**
Perform Data exploration and pre-processing in Python.		
TASK – 3		**3H**
Perform Feature Engineering and Feature Selection Methods.		
TASK – 4		**3H**
Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.		
TASK – 5		**3H**
Implementation of Linear and Logistic Regression		
TASK – 6	**TASK-6 DATA MODELLING**	**3H**
Implementation of K means algorithm.		
TASK – 7		**3H**
For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.		
TASK – 8		**3H**
Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample		
TASK – 9		**3H**
Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.		
TASK – 10		**3H**
Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.		
TASK – 11		**3H**
Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.		
TASK – 12		**3H**
Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.		

Total hours:	**36 hours**

TEXTBOOK:

1. Tom M. Mitchell, Machine Learning**,** India Edition 2013, McGraw Hill Education.

REFERENCES:

2. Ethem Alpaydın, Introduction to machine learning, second edition, MIT press.

OPEN ELECTIVES(OE)

NARAYANA ENGINEERING COLLEGE:GUDUR								
20CS3001	**INTRODUCTION TO DATA STRUCTURES**							R20
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
	3	0	0	48	3	40	60	100

Pre-requisite: Knowledge of Mathematics, Computer Programming, Analytical & Logical Skills

Course Objectives:

1. To explain efficient storage mechanisms of data for an easy access.
2. To design and implementation of various basic and advanced data structures.
3. To introduce various techniques for representation of the data in the real world.
4. To develop applications using data structures.
5. To pertain knowledge on improving the efficiency of algorithm by using suitable data structure.

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

CO 1	Understand basic concepts of data structures and algorithm analysis. (BL - 2)
CO 2	Develop the applications using stacks and queues. (BL - 3)
CO 3	Demonstrate the use of linked lists. (BL - 2)
CO 4	Apply tree, graph data structures for various applications. (BL - 3)
CO 5	Implement algorithms for sorting, searching, and hashing methods. (BL - 3)

CO-PO Mapping

CO	PO												PSO	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO 1	1	1	2										1	
CO 2	2	3	2	2									2	1
CO 3	2	2	3	2	2								3	2
CO 4	2	2	2	1	1							2	3	2
CO 5	2	1	2	1								1	2	2

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1	**Introduction to Data Structures**	**10H**

Introduction: Overview of Data Structures, Implementation of Data Structures, Algorithm Specifications, Analysis of an Algorithm, Asymptotic Notations, Time-Space trade off.

Arrays: One-Dimensional, Multi-Dimensional, Pointer Arrays.		
At the end of the Module 1, students will be able to: 5. Understand the linear and non-linear data structures. (BL - 2) 6. Understand the time and space complexities of an algorithm. (BL - 2) 7. Illustrate representation of data using Arrays. (BL - 2)		
MODULE -2	**Stacks and Queues**	**9H**
Stacks: Introduction, Representation of a Stack, Stack Operations, Applications of Stacks. **Queues:** Introduction, Representation of a Queue, Queue Operations, Circular Queue, Applications of Queues.		
At the end of the Module 2, students will be able to: 7. Explain stack ADT and its operations. (BL - 2) 8. Understand the expression evaluation using stacks. (BL - 2) 9. Implement various queue structures. (BL - 3)		
MODULE-3	**Linked Lists**	**9H**
Introduction, Singly linked lists, Doubly Linked Lists, Circular Linked Lists, Linked Stacks and Queues, Applications of Linked Lists.		
At the end of the Module 3, students will be able to: 4. Understand basics concepts of linked lists. (BL - 2) 5. Illustrate various structures of linked lists. (BL - 2) 6. Understand the concept of dynamic memory management. (BL - 2)		
MODULE-4	**Trees & Graphs**	**10H**
Trees-Introduction, Basic Terminologies, Definition and concepts, Representation of Binary Tree, operations on a Binary Tree, Binary Search Tree, Height Balanced Binary Tree.Graph Terminologies, Representation of Graphs, Graph Operations, Shortest Paths – Warshall's, Floyd's and Dijkstra's algorithms, Topological Sorting.		
At the end of the Module 4, students will be able to: 4. Understand the concept of trees. (BL - 2) 5. Compare different tree structures. (BL - 2) 6. Explain the importance of Graphs for solving problems. (BL - 2) 7. Understand graph traversal methods. (BL - 2) 8. Implement algorithms to identify shortest path. (BL - 3)		
MODULE-5	**Sorting, Searching and Hash Tables**	**10H**
Sorting: Introduction, Bubble Sort, Selection Sort, Quick Sort.Searching: Introduction, Basic Terminology, Linear Search and Binary Search Techniques. Hash Table:Hashing Techniques, Collision Resolution Techniques, Closed Hashing, Open Hashing.		
At the end of the Module 6, students will be able to: 1. Implement the sorting algorithms (BL - 3)		

2. Select the appropriate sorting algorithm for a given application (BL - 3)
3. Understand the concept of Hash Table (BL - 2)
4. Explain searching techniques. (BL - 2)

Total hours:	**48 hours**

Content beyond syllabus:

8. Heap Sort, Insertion Sort, Merge Sort
9. Optimum Sorting Algorithms

Text Book(s):

3. D. Samanta, "Classic Data Structures", 2nd Edition, Prentice-Hall of India, Pvt. Ltd., India, 2012.
4. Ellis Horowitz and Sartaj Sahni, "Fundamentals of Data Structures in C", 2nd Edition, Universities Press , 2008.

Reference Books:

8. NarasimhaKarumanchi, Data Structures and Algorithms Made Easy, Careermonk Publications, 2016
9. Peter Bras, "Advanced Data Structures", Cambridge University Press, 2014.
10. RS Salaria, Data Structures, 3rd Edition, Khanna Publishing House, 2017.
11. YashwantKanetkar, Data Structures through C,3rd Edition, BPB Publications, 2019.
12. RB Patel, Expert Data Structures with C, Khanna Publications, 2019.
13. Richard F. Gilberg, Behrouz A. Forouzan, Data Structures A Pseudo code Approach with C, Second Edition, Cengage Learning.
14. Ananda Rao Akepogu, Radhika Raju Palagiri,Data Structures and Alg. Using C++ ,

NARAYANA ENGINEERING COLLEGE:GUDUR								
20CS3002	**Introduction to Python**							R20
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
II	3	0	0	48	2	40	60	100

Pre-requisite: Knowledge of Mathematics and Basic Programming Language

Course Objectives:

1. To learn the fundamentals of python.
2. To implement python programs for conditional loops and functions.
3. To handle the compound data using python lists, tuples, sets, dictionaries.
4. To learn the files, modules, packages concepts.
5. To introduce the concepts of class and exception handling using python.

Course Outcomes: After successful completion of the course, Student will be able to:

CO 1	ummarize the fundamental concepts of python programming. (BL - 2)
CO 2	pply the basic elements and constructs the python to solve logical problems.(BL-3)
CO 3	rganize data using different data structures of python. (BL - 3)
CO 4	mplement the files modules and packages in programming. (BL - 3)
CO 5	pply object-oriented concepts to build simple applications. (BL - 3)

CO-PO Mapping

CO	PO												PSO	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	2	1	1								1		
CO2	1	3	2	2	1	2			1	1				
CO3	1	1	3	2	2									
CO4	1	3	2	2										
CO5	1	3	2	2										
1: Low, 2-Medium, 3- High														

COURSE CONTENT

MODULE – 1	**Introduction to Python**	**10 H**

History of Python, Features of Python Programming, Applications of Python Programming, Running Python Scripts, Comments, Typed Language, Identifiers, Variables, Keywords, Input/output, Indentation, Data types, Type Checking, range( ), format( ), Math module.

At the end of the Module 1, students will be able to:

4. Learn the basics of python. (BL - 1)

5. Write the python programs. (BL - 1) 6. Understand concept of type checking. (BL - 2)		
MODULE -2	**Operators Expressions and Functions**	**10 H**
Arithmetic, Assignment, Relational, Logical, Boolean, Bitwise, Membership, Identity, Expressions and Order of Evaluations, Control Statements.Defining Functions, Calling Functions, Anonymous Function, Fruitful Functions and Void Functions, Parameters and Arguments, Passing Arguments, Types of Arguments, Scope of variables, Recursive Functions.		
At the end of the Module 2, students will be able to: 4. Solve the problems using operators, conditional and looping. (BL - 3) 5. Solve the problems using the functions. (BL -3) 6. Apply the principle of recursion to solve the problems. (BL-3)		
MODULE-3	**Strings, Lists, Tuples, and Dictionaries**	**9 H**
Strings- Operations, Slicing, Methods, List- Operations, slicing, Methods, Tuple- Operations, Methods, Dictionaries- Operations, Methods, Mutable Vs Immutable, Arrays Vs Lists, Map, Reduce, Filter, Comprehensions.		
At the end of the Module 3, students will be able to: 4. Write programs for manipulating the strings. (BL - 1) 5. Understand the knowledge of data structures like Tuples, Lists, and Dictionaries.(BL - 2) 6. Select appropriate data structure of Python for solving a problem.(BL -3)		
MODULE-4	**Files, Modules and Packages**	**10 H**
Files- Persistent, Text Files, Reading and Writing Files, Format Operator, Filename and Paths, Command Line Arguments, File methods, Modules- Creating Modules, Import Statement, Form. Import Statement, name spacing, Packages- Introduction to PIP, Installing Packages via PIP(Numpy).		
At the end of the Module 4, students will be able to: 4. Understand the concepts of files. (BL - 2) 5. Implement the modules and packages. (BL - 3) 6. Organize data in the form of files. (BL - 3)		
MODULE-5	**Object Oriented Programming, Errors and Exceptions**	**9 H**
Object Oriented Features, Classes, self variable, Methods, Constructors, Destructors, Inheritance, Overriding Methods, Data hiding, Polymorphism. Difference between an error and Exception, Handling Exception, try except block, Raising Exceptions.		
At the end of the Module 5, students will be able to: 4. Apply object orientation concepts.(BL -3) 5. Apply the exception handling concepts. (BL -3) 6. Implement OOPs using Python for solving real-world problems. (BL -3)		
	Total hours:	**48 Hours**

Content Beyond Syllabus: Turtle Module, GUI Programming, Matplotlib, Databases.

Text Book(s):

1. Vamsi Kurama, Python Programming: A Modern Approach, Pearson, 2017.
2. Allen Downey, Think Python, 2ndEdition,Green Tea Press

Reference Books :

1. R. Nageswara Rao, "Core Python Programming", 2nd edition, Dreamtech Press, 2019.
2. Allen B. Downey, "Think Python", 2ndEdition, SPD/O'Reilly, 2016.
3. Martin C.Brown, "The Complete Reference: Python", McGraw-Hill, 2018.
4. Mark Lutz, Learning Python, 5th Edition, Orielly, 2013.
5. Wesley J Chun, Core Python Programming, 2nd Edition, Pearson, 2007
6. Kenneth A. Lambert, Fundamentals of Python, 1st Edition, Cengage Learning, 2015

NARAYANA ENGINEERING COLLEGE::GUDUR								
20CS3003	JAVA PROGRAMMING							R20
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
	3	0	0	48	3	40	60	100

Pre-requisite: Basic knowledge of programming.

Course Objectives:

6. To acquire knowledge on preliminaries of Java.
7. To provide sufficient knowledge on developing real world projects.
8. To demonstrate the principles of packages, inheritance, and interfaces.
9. To understand exception handling, Event handling and Multithreading.
10. To design and build Graphical User Interface applications.

Course Outcomes: After successful completion of the course, Student will be able to:

CO1	Understand Object Oriented Programming concepts. (BL-2)
CO2	Demonstrate the concepts of Arrays and Strings. (BL-2)
CO3	Construct programs on classes, inheritance, and polymorphism. (BL-3)
CO4	Develop packages and interfaces. (BL-3)
CO5	Apply multi-threading and graphical user interface concepts for real time applications. (BL-3)

CO-PO Mapping

CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	2									1	3	2
CO2	2	3	2		1							1	1	2
CO3	2	2	3	2	1				1			2	1	2
CO4	2	2	2	3	2	1			1			2	1	1
CO5	2	2	2	3	2	1			1			2	2	3

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1	Basic concepts of java	9h

The History and Evolution of java: OOP Concepts, History of java, The java Buzz words, The Evolution of java, Lexical issues. Data types, variables: Data types, Variables, The Scope and Life time of variables, Operators, Expressions, Control statements, Type

conversion and casting, Command Line Arguments.

At the end of the Module 1, students will be able to:

4. Describe the Purpose of Object oriented Programming Concepts.(BL-2)
5. Understand the importance of java. (BL-2)
6. Identify various basic components of java. (BL-2)
7. Implement programs on fundamental concepts of java. (BL-2)

MODULE -2	**Arrays and String Handling**	**9h**

Arrays: Declaration, Initialization and accessing values, One-Dimensional Arrays, Multi-dimensional arrays, Alternative Array Declaration Syntax, var-arg methods. Strings: Explore String class, StringBuffer and StringBuilder classes.

At the end of the Module 2, students will be able to:

4. Understand Arrays and accessing array values. (BL-2)
5. Demonstrate1-D and Multi-dimensional arrays. (BL-2)
6. Illustrate the String and StringBuffer Classes. (BL-2)

MODULE-3	**Classes, Inheritance and polymorphism**	**10h**

Class fundamentals. Declaration objects, Assigning object reference variables, Introducing Methods, Constructors, "this" keyword, Garbage collection. Inheritance basics, Using Super keyword, Types of inheritance, Benefits, Member access rules, Constructor and calling sequence, Using abstract Classes, Using final keyword. Method overriding and overloading.

At the end of the Module 3, students will be able to:

5. Understand the basic syntax for class fundamentals. (BL-2)
6. Demonstrate Access modifiers in Inheritance. (BL-2)
7. Compare "Method overloading and Method overriding". (BL-3)

MODULE-4	**Packages and Exception Handling**	**9h**

Defining an interface, Implementing interface, Accessing interface properties. Defining Package, finding packages and class path, accessing Protection**.** Exception handling Fundamentals, exception types, Built-in Exceptions, Using try-catch-finally throw- throws keywords, creating your own Exception subclasses.

At the end of the Module 4, students will be able to:

8. Demonstrate interface and its implementation. (BL-2)
9. Develop user defined packages. (BL-3)
10. Implement Exception Handling. (BL-3)

MODULE-5	**Multi-Threaded Programming and I/O**	**11h**

The java thread model, Thread Life Cycle, The main thread, creating a Thread, Creating Multiple Threads, Using isalive() and join().MVC architecture, creating a window, components and containers, Basics of components, points and rectangles, visual characteristics of components, Defining color, creating cursors, selecting Font, swing components , Layout Managers.

At the end of the Module 4, students will be able to:

1. Demonstrate Multi-Threaded Programming. (BL-2)
2. Understand MVC architecture. (BL-2)
3. Illustrate components of GUI in java. (BL-2)

Total hours:	**48 h**

Content beyond syllabus:

1. Client /Server Communication applications (Servlets, jsp).
2. Database connectivity (JDBC).

Self-Study:

Contents to promote self-Learning:

Text Book(s):

1. Herbert Schildt, "Java The complete reference", 9th edition, McGraw Hill Education (India) Pvt. Ltd.
2. Ivor Horton, Beginning Java 2, JDK 5th Edition, Wiley dreamtech.

Reference Book(s):

1. An introduction to java programming and object oriented application development, R AJohson-Thomson.
2. Introduction to java programming 6thEdition, Y Daniel liang, Pearson Education.
3. Java programming: A practical approach, C.Xavier, TMH, First edition,2011.
4. Thinking in Java ,Bruce Eckel, 2nd Edition, Pearson Education
5. Java How to Program, H.M Dietel and P.J Dietel,6th Edition, Pearson Ed.
6. Introduction to Java programming-comprehensive, Y. Daniel Liang, Tenth Edition,Pearson ltd 2015.
7. E Balagurusamy, Programming With Java : A Primer 5th Edition Tata McGraw Hill.

NARAYANA ENGINEERING COLLEGE:GUDUR								
20CS3004	**ADVANCED JAVA PROGRAMMING**							R2020
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
VI	3	0	0	48	3	40	60	100

Pre-requisite: Knowledge of core concepts of java programming.

Course Objectives:

1. To provide knowledge on console, GUI and Web based applications.
2. To understand the java technologies for multi-tier enterprise application development.
3. To practice applications development on Integrated Development Environment.
4. To perform operations on database using java database connectivity.
5. To examine the working principles of real time enterprise applications.

Course Outcomes: After successful completion of the course, Student will be able to:

CO1	Implement simple Web Applications and networking API.(BL 2)
CO2	Develop database applications using JDBC.(BL 3)
CO3	Understand the dynamic request and response model using Servlets .(BL 2)
CO4	Design enterprise application using Java Server Pages(JSP).(BL 3)
CO5	Implement Web applications using struts and Spring(BL 3)

CO-PO Mapping

CO	PO												PSO	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	2	2	2									2	2
CO2	2	2	2	1	2								2	1
CO3	1	2	2	2	1	1						2	2	1
CO4	2	1	2	1								2	1	1
CO5	2	2	1	2	2							2	2	2

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1	**Introduction to J2EE and Networking**	**10h**

Java Enterprise Edition: Java Platform, J2EE Architecture Types, Explore Java EE Containers, Types of Servers in J2EE Application, HTTP Protocols and API, Request Processing in Web Application, Web Application Structure, Web Containers and Web Architecture Models.

Java Networking: Network Basics and Socket overview, TCP/IP client sockets, URL,TCP/IP server sockets, Datagrams, java.net package Socket, ServerSocket, InetAddress, URL, URLConnection**.**

At the end of the Module 1, students will be able to:

8. Understand J2EE Architecture Types, containers and servers. (BL 2)
9. Gain knowledge on HTTP Protocols and APIs. (BL 2)
10. Discuss web applications and models. (BL 2)
11. Explain TCP/IP client server sockets programming. (BL 2)

MODULE -2	**JDBC Programming**	**9h**

The JDBC Connectivity Model, Database Programming :Connecting to the Database, Creating a SQL Query, Getting the Results, Updating Database Data, Error Checking and the SQL Exception Class, The SQL Warning Class, The Statement Interface, PreparedStatement, CallableStatement The ResultSet Interface, Updatable Result Sets, JDBC Types, Executing SQL Queries, Result Set Meta Data, Executing SQL Updates, Transaction Management.

At the end of the Module 2, students will be able to:

1. Prepare The JDBC Connectivity Model. (BL 3)
2. Practice on PreparedStatement, Callable Statement and ResultSet Interface. (BL 3)
3. Explain JDBC Types. (BL 2)
4. Implement SQL Queries &Transaction Management. (BL 2)

MODULE-3	**Servlet API and Overview**	**10h**

Overview of Servlet, Servlet Life Cycle, HTTP Methods Structure and Deployment descriptor Servlet Context and Servlet Config interface, Attributes in Servelt Request Dispache rinterface, The Filter API: Filter, Filter Chain. Using the Generic Servlet Class**.** Understanding state and session, Understanding Session Timeout and Session Tracking, URL Rewriting.

At the end of the Module 3, students will be able to:

1. Understand Servlet Life Cycle. (BL 2)
2. Differentiate ServletContext and ServletConfig interface. (BL 2)
3. Understand Config Cookies and Session Management. (BL 2)
4. Differentiate the GenericServlet and HTTP Servlet Class. (BL 2)

MODULE-4	**Java Server Pages**	**9h**

The Problem with Servlets, Life Cycle of JSP Page, JSP Processing, JSP Application Design with MVC, Setting Up the JSP Environment JSP Directives, JSP Action, JSP Implicit Objects JSP Form Processing, JSP Session and Cookies Handling.JSP Session Tracking JSP Database Access, JSP Standard Tag Libraries, JSP Custom Tag, JSP Expression Language, JSP Exception Handling, JSP XML Processing.

At the end of the Module 4, students will be able to:

1. Understand Life Cycle of JSP Page. (BL 2)
2. Explain MVC architecture and JSP Environment. (BL 2)
3. Construct JSP with DATABASES and exception handling. (BL 3)

4. Understand the role of XML in JSP. (BL 2)		
MODULE-5	**Struts and Spring Frame Work**	**10h**
Basics & Architecture – Request Handling Life Cycle - Building a simple struts– Configuration, Actions, Interceptors, Results, Struts2 Tag Libraries, Struts2 XML Based Validations - Database Access. Overview of Spring, Spring Architecture, bean life cycle, XML Configuration on Spring, Aspect – oriented Spring, Managing Database, Managing Transaction.		
At the end of the Module 5, students will be able to: 13. Explain struts frame work. (BL 2) 14. Implement the Struts Framework. (BL 3) 15. Understand Spring Architecture(BL-2) 16. Implementation of spring to build web applications(BL-3).		

Content beyond syllabus: java mobile application development.

Text Book(s):

1. Black Book " Java server programming" J2EE, 1st ed., Dream Tech Publishers, 2008.
2. James Keogh, Complete Reference J2EE,mcgraw publication

Reference Book(s):

1. Matthew Scarpino, Hanumant Deshmukh, JigneshMalavie SCWCD, , Manning publication
2. Cay Horstmann and Gary Cornell, Core Java, Volume II: Advanced Features, Pearson Publication
3. Christian Bauer, Gavin King, Java Persistence with Hibernate,
4. Craig walls, Spring in Action, 3rdedition , Manning Publication
5. Jeff Linwood and Dave Minter Hibernate 2nd edition, Beginning Après publication
6. Kito D. Mann, Java Server Faces in Action, Manning Publication
7. Maydene Fisher, Jon Ellis, Jonathan Bruce, JDBC™ API Tutorial and Reference, Third Edition, Addison Wesley.
8. Giulio Zambon, Beginning JSP, JSF and Tomcat, Apress.
9. Anghel Leonard, JSF2.0 CookBook, PACKT publication

NARAYANA ENGINEERING COLLEGE::GUDUR								
20CS3005	**PRINCIPLES OF DATABASES**							R2020
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
	3	0	0	48	3	40	60	100

Pre-requisite: Knowledge of computer programming.

Course Objectives:

6. To teach the role of database management system in an organization.
7. To design databases using data modeling and Logical database design techniques.
8. To construct database queries using relational algebra and calculus and SQL.
9. To explore implementation issues in database transaction.
10. To familiarize database indexing.

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

CO 1	Describe database technologies and database design.	(BL-2)
CO 2	Understand Relational Database Management Systems.	(BL-2)
CO 3	Construct queries for database creation in RDBMS model.	(BL-3)
CO 4	Apply normalization on database design.	(BL-3)
CO 5	Demonstrate transaction management, database recovery and indexing.	(BL-2)

CO-PO Mapping

CO	PO												PSO	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	1	2	3	1									2	1
CO2	3	3											1	
CO3	2	3	3	3									3	1
CO4	2	3	3	3									3	1
CO5	2	2											1	

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE - 1	**Introduction to Database concepts and Modeling**	**10 H**

Introduction to Data bases, Purpose of Database Systems, View of Data, Data Models, Database Languages, Database Users, Database Systems architecture. Overview of Database Design, Beyond ER Design, Entities, Attributes and Entity sets, Relationships and Relationship sets, Conceptual Design with the ER Model.

At the end of the Module 1, students will be able to:

12. Understand the Purpose of Database Systems, Data Models, View of Data. (BL-2)

13. Summarize the concept of Database Languages, Users, Architecture. (BL-2)
14. Design ER diagrams for given database. (BL-2)
15. Explain conceptual design for enterprise systems (BL-2)

MODULE - 2	Relational Model, Relational Algebra	9 H

Introduction to the Relational Model – Integrity Constraints over Relations, Enforcing Integrity constraints, querying relational data, Logical data base Design, Views. Introduction to Relational algebra, selection and projection, set operations, renaming, joins, division.

At the end of the Module 2, students will be able to:

10. Understand Basics of Relational Model. (BL-2)
11. Describe phases of Logical Database Design.(BL-2)
12. Explain the relational algebra operations on relations. (BL-2)

MODULE - 3	SQL	10 H

SQL: Basic form of SQL Query, DDL, DML, Views in SQL, Joins, Nested & Correlated queries, Operators, Aggregate Functions, integrity Constraints.

At the end of the Module 3, students will be able to:

8. Construct SQL queries in RDBMS. (BL-3)
9. Understand integrity and security Constraints in SQL (BL-2)
10. Construct PL/SQL programs in RDBMS. (BL-3)

MODULE - 4	Normalization	10 H

Relational database design: Pitfalls of RDBD, Lossless join decomposition, Functional dependencies, Normalization for relational databases 1st, 2nd and 3rd normal forms.

At the end of the Module 4, students will be able to:

4. Analyze functional dependencies. (BL-3)
5. Apply normal forms on functional dependencies. (BL-3)
6. Understand Multi Valued Dependencies and Join Dependencies (BL-2)

MODULE - 5	Transaction Management	9 H

Transaction processing, Transaction Concept, Transaction State, Implementation of Atomicity and Durability, Concurrent Executions, Failure Classification, Recovery and Atomicity.Introduction to Index data structures, Hash-Based, Tree Based Indexing

At the end of the Module 5, students will be able to:

4. Understand Atomicity and Durability, Concurrent Executions. (BL-2)
5. Discuss the concept of Transaction, Transaction State. (BL-2)
6. Discuss the Concurrency Control and various Protocols. (BL-2)
7. Explain indexing in database.

Total hours:	**48 Hours**

Content beyond syllabus:

Embedded SQL

Client/Server Database environment

Web Database environment

Text Book(s):

3. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, Database System Concepts, 6th Edition, Tata McGraw-Hill Publishing Company,2017.
4. Raghu Ramakrishnan, Database Management System, 3rd Edition, Tata McGraw-Hill Publishing Company, 2014.

Reference Book(s):

7. Peter Rob, A.Ananda Rao, Corlos Coronel, Database Management Systems (for JNTU), Cengage Learning, 2011.
8. Hector Garcia Molina, Jeffrey D. Ullman, Jennifer Widom, Database System Implementation, 1st Edition, Pearson Education, United States, 2000.
9. E. Ramez and Navathe, Fundamental of Database Systems, 7th Edition, Pearson Education
10. R.P. Mahapatra & Govind Verma, Database Management Systems, Khanna Publishing House, 2016.
11. 5Carlos Coronel and Steven Morris, Database Systems: Design, Implementation, and Management, 12th edition, Cengage Learning,2016.
12. John V. ,Absolute beginner's guide to databases, Petersen, QUE

NARAYANA ENGINEERING COLLEGE:GUDUR								
20CS3006	**OPERATING SYSTEMS CONCEPTS**							R2020
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
IV	3	0	0	48	3	40	60	100

Pre-requisite: Fundamentals of computers

Course Objectives:

6. To understand the fundamental principles of the operating system, its services and Functionalities.
7. To illustrate the concepts of inter-process communication, synchronization and scheduling.
8. To understand different types of memory management viz. virtual memory, paging and segmentation.
9. To identify the reasons for deadlock and understand the techniques for deadlock detection, prevention and recovery.
10. To understand the need of Mass storage and protection mechanisms in computer systems.

Course Outcomes: After successful completion of the course, Student will be able to:

CO 1	Describe the concept operating system and operating system design. (BL-2)
CO 2	Analyze Process and CPU Scheduling, Process Coordination with concurrencies. (BL-3)
CO 3	Identify and evaluate Memory Management and Virtual Memory. (BL-3)
CO 4	Organize File System Interface. (BL-3)
CO 5	Understand Mass Storage Structure and Protection Mechanism. (BL-2)

CO-PO Mapping

CO	PO												PSO	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	1	2	2	2									2	
CO2		2	2	1										
CO3	3	1	2	1	1								1	
CO4	1	2	1		1									
CO5	3	2	1		2								2	

1: Low, 2-Medium, 3- High

COURSE CONTENT		
MODULE – 1	**Introduction**	**9H**
Computer system architecture, operating systems structure, operating systems operations; Evolution of operating systems: Simple Batch, multi programmed, time shared, parallel distributed systems, real time systems, special purpose systems, operating system services, user operating systems interface. Types of systems calls, system programs, protection and security, operating system design and implementation, operating systems structure**.**		
At the end of the Module 1, students will be able to: 4. Illustrate the structure of operating system and basic architectural components involved in operating system design. (BL-2) 5. Demonstrate how the computing resources are managed by the operating system. (BL-2) 6. Explain the objectives and functions of operating systems. (BL-2)		
MODULE -2	**Process and CPU scheduling, process coordination**	**10H**
The process, process state, process control block, threads; Process scheduling: Scheduling queues, context switch, preemptive scheduling, dispatcher, scheduling criteria, scheduling algorithms. Process synchronization, the critical section problem, synchronization hardware, semaphores and classic problems of synchronization, monitor. Deadlock characterization, methods of handling deadlocks, deadlock prevention, dead lock avoidance, dead lock detection and recovery from deadlock**.**		
At the end of the Module 2, students will be able to: 5. Contrast the process and a thread. (BL-2) 6. Develop applications to run in parallel either using process or thread models of different operating system. (BL-3) 7. Illustrate the various resource management techniques for timesharing and distributed systems. (BL-2) 8. Describe deadlock and deadlock mechanisms.(BL-2)		
MODULE-3	**Memory management and virtual memory**	**10H**
Swapping, contiguous memory allocation, paging, structure of page table. Segmentation with paging, virtual memory, demand paging; Performance of demand paging: Page replacement, page replacement algorithms, allocation of frames, thrashing**.**		
At the end of the Module 3, students will be able to: 5. Demonstrate the virtual memory, entities and attributes. (BL-3) 6. Illustrate the mapping from virtual memory address to physical address and vice-versa. (BL-3) 7. Identify how a shared memory area can be implemented using virtual memory addresses in different processes. (BL-3) 8. Contrast between Paging and Segmentation. (BL-2)		
MODULE-4	**File system interface**	**9H**

The concept of a file, access methods, directory structure, file system mounting, file sharing, protection, file system structure. File system structure, File system implementation, directory implementation, allocation methods, free space management**.**		
At the end of the Module 4, students will be able to: 1. List the mechanisms adopted for file distribution in applications. (BL-1) 2. Explain the need of memory management in operating systems and understand the limits of fixed memory allocation schemes. (BL-2) 3. Organize file management when designing or developing a new operating system. (BL-3)		
MODULE-5	**Mass-storage structure**	**10H**
Overview of mass storage structure, Disk structure, Disk attachment, Disk scheduling, Disk management, Swap space management, RAID structure, Stable storage implementation**.** goals of protection, principles of protection, domain of protection, access matrix, implementation of access matrix		
At the end of the Module 5, students will be able to: 6. Illustrate the fragmentation in dynamic memory allocation, and identify dynamic allocation approaches.(BL-2) 7. Illustrate how program memory addresses relate to physical memory addresses, memory management in base-limit machines, and swapping.(BL-2) 8. Compare RAID levels of memory.(BL-2) 9. Illustrate various disk scheduling algorithms.(BL-2) 10. Understand the access control and protection mechanisms. (BL-2)		
	Total hours:	**48 hours**

Content beyond syllabus:

Linux operating systems, Multiprocessor management systems, Unix features, real time operating systems, modern operating systems.

Text Book(s):

5. Abraham Silberschatz, Peter B. Galvin, Greg Gagne, "Operating System Principles",10th Edition, Wiley Student Edition, 2018.
6. William Stallings, "Operating System- Internals and Design Principles", 6th Edition, Pearson Education, 2002.

Reference Book(s):

3. D. M. Dhamdhere, "Operating Systems a Concept based Approach", 2nd Edition, Tata McGraw-Hill, 2006.
4. P.C.P. Bhatt, "An Introduction to Operating Systems", PHI Publishers.
7. G. Nutt, N. Chaki and S. Neogy, "Operating Systems", Third Edition, Pearson Education.
8. Andrew S Tanenbaum, "Modern Operating Systems", 3rd Edition, PHI, 2007.

NARAYANA ENGINEERING COLLEGE::GUDUR								
20CS3007	**COMPUTER COMMUNICATION NETWORKS**							R2020
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
IV	3	0	0	48	3	40	60	100

Pre-requisite: Knowledge of Information Technology, Computer Organization & Architecture

Course Objectives:

6. To impart the core principles of Information Communication Technology.
7. To deliver background information on the key transmission technologies used in computer networks.
8. To convey dimensions of Network layer through Internet Protocol.
9. To provide an insight into the most widely used Transport Layer protocols
10. To teach the principles of Application Layer and its protocols.

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

CO 2	Choose suitable transmission media depending on requirements. (BL-2)
CO 3	etermine the errors in data transfer between source and destination. (BL-3)
CO 4	Obtain the skills of subnetting and routing mechanisms. (BL-2)
CO 5	Illustrate reliable, unreliable communication on public networks. (BL-3)
CO 6	Demonstrate elements of socket programming, principles of protocols.(BL-3)

CO-PO Mapping

CO	PO												PSO	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	2	2											1	
CO2	2	2	3	3									3	3
CO3	2	3	2										1	2
CO4	2	1											1	
CO5	2	1	1										1	1

1: Low, 2-Medium, 3- High

COURSE CONTENT		
MODULE – 1	**Physical Layer**	**(10H)**
Introduction: Data Communications, Networks, Network Types, Internet History, Standards and Administration, Protocol Layering, TCP/IP Protocol Suite, The OSI Model**,** Data and Signals, Digital Signals, Transmission Impairment, Data Rate Limits, Performance. Transmission Media: Introduction, Guided Media, Unguided Media.		
At the end of the Module 1, students will be able to: 1. Understand the basics of computer networks. (BL-2) 2. Summarize the concept of Internet and its standards. (BL-2) 3. Describe the picture of data communication with layered architecture. (BL-2) 4. Classify the elements of physical media used for data transmission. (BL-2)		
MODULE – 2	**Data-Link Layer & MAC**	**(9H)**
Introduction, Link-Layer Addressing, Error Detection and Correction: Checksum, CRC, Data Link Control (DLC)**:**DLC Services, Data-Link Layer Protocols, HDLC, PPP. Media Access Control (MAC): Random Access.		
At the end of the Module 2, students will be able to: 5. Explain link layer services. (BL-2) 6. Discuss Error Detection and Correction mechanisms. (BL-2) 7. Describe Data Link Control services and protocols. (BL-2) 8. Illustrate Media Access Control Protocols. (BL-3)		
MODULE – 3	**Network Layer**	**(10H)**
Network Layer: Network Layer Design Issues, Routing Algorithms: The Optimality Principle, Shortest Path Algorithm, Flooding, Distance Vector, Link State, Hierarchical, Broadcast, Multicast, Anycast, Congestion Control Algorithms, Quality of Service.		
At the end of the Module 3, students will be able to: 1. Understand design issues of network layer. (BL-2) 2. Explain efficient routing protocols in computer networks. (BL-2) 3. Describe elements of network layer required for data transfer over Internet. (BL-2)		
MODULE – 4	**Transport Layer**	**(10H)**
Internetworking, The network layer in the Internet: IPV4 Addresses, IPV6, Internet Control protocol, BGP. The Transport Layer: The Transport layer services, Elements of Transport Protocols, The Internet transport protocols: UDP, TCP., Sliding Window Protocols,		
At the end of the Module 4, students will be able to: 5. Understand the services provided by transport layer. (BL-2) 6. Describe elements of transport layer required for data transfer over Internet. (BL-2) 7. Demonstrate end to end communication. (BL-3) 8. Discuss performance issues in transport layer. (BL-2)		
MODULE – 5	**Application Layer**	**(9H)**

Application Layer: Introduction, World Wide Web and HTTP, Domain Name System, FTP, e-mail, TELNET, Secure Shell.	
At the end of the Module 5, students will be able to: 5. Explain the working of world wide web with HTTP, DNS. (BL-2) 6. Describe the protocols for mail, remote system login. (BL-2) 7. Discuss file transfer, network management protocols. (BL-2)	
Total hours:	**48 hours**

Content beyond syllabus:

4. Connecting Devices and VPN
5. Peer-to-Peer paradigm

Text Book(s):

3. Behrouz A. Forouzan, Data communications and networking, 5th edition, Mc Graw Hill Education, 2012.
4. Andrew S. Tanenbaum, Wetherall, Computer Networks, 5th edition, Pearson, 2013.

Reference Book(s):

8. Douglas E. Comer, Internetworking with TCP/IP – Principles, protocolsand architecture-Volume 15th edition, PHI.
9. Kurose James, Ross Keith, Computer Networking: A Top-Down Approach, 6th Edition, Pearson Education.
10. Behrouz A. Forouzan, TCP/IP Protocol Suite, 4th edition, Tata McGraw Hill

NARAYANA ENGINEERING COLLEGE:GUDUR								
20CS3008	MOBILE APPLICATION DEVELOPMENT							R2021
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
	3	0	0	48	3	40	60	100

Pre-requisite: Java programming and Object-oriented programming, Basics of any Scripting Language.

Course Objectives:

1. To understand fundamentals of android operating systems.
2. To understand the platform, tools, technology and process for developing mobile applications.
3. To demonstrate the operation of the application, configuration files, intents and activities.
4. To develop and deploy Android applications.
5. To illustrate the various components, layouts and views in creating android applications.

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

CO 1	Identify a significant programming component, involving the sensors and hardware features of mobile device. (BL-2)
CO 2	Demonstrate the use of Android software development controls. (BL-2)
CO 3	Construct mobile applications on the Android Platform using different layouts for playing video and audio. (BL-3)
CO 4	Acquire the Information Using Dialogs and Fragments by the mobile applications for the Android operating system. (BL-3)
CO 5	Prepare mobile applications involving Menus and Action Bars. (BL-3)

CO-PO Mapping

CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	1	1										1	1
CO2	2	1	2	1									2	2
CO3	2	2	2	2	2								2	1
CO4	1	1	2	2								1	1	2
CO5	2	3	3	1								1	2	1

1: Low, 2-Medium, 3- High

COURSE CONTENT		
MODULE – 1	**Introduction to Android**	**12H**
The Android 4.1 jelly Bean SDK, Understanding the Android Software Stack, installing the Android SDK, Creating Android Virtual Devices, Creating the First Android Project, Using the Text view Control, Using the Android Emulator, The Android Debug Bridge(ADB), Launching Android Applications on a Handset.		
At the end of the Module 1, students will be able to: 1. Observe the features of android software. (BL-2) 2. Understand the order of Android software stack. (BL-2) 3. Discover and Launch an android application on a handset. (BL-2)		
MODULE -2	**Basic Widgets**	**10H**
The Role of Android Application Components, Utility of Android API, Overview of the Android Project Files, Understanding Activities, Role of the Android Manifest File, Creating the User Interface, Commonly Used Layouts and Controls, Event Handling, Displaying Messages Through Toast, Creating and Starting an Activity, Using the Edit Text Control, Choosing Options with Checkbox, Choosing Mutually Exclusive Items Using Radio Buttons.		
At the end of the Module 2, students will be able to: 1. Differentiate the hierarchy of files and sub files. (BL-2) 2. Understand the importance of Manifest file. (BL-2) 3. Select the widgets and group different controls for event handling. (BL-2)		
MODULE-3	**Building Blocks for Android Application Design**	**9H**
Introduction to Layouts, Linear Layout, Relative Layout, Absolute Layout, Using Image View, Frame Layout, Table Layout, Grid Layout, Adapting to Screen orientation. Utilizing Resources and Media Resources, Creating Values Resources, Using Drawable Resources, Switching States with Toggle Buttons, Creating an Images Switcher Application, Scrolling Through Scroll View, playing Audio, Playing Video		
At the end of the Module 3, students will be able to: 1. Construct an android application using layouts. (BL-3) 2. Operate audio and video on hand set. (BL-3) 3. Apply displaying progress with Scrolling Through Scroll View. (BL-3)		
MODULE-4	**Selection widgets And Fetching Information Using Dialogs and Fragments**	**9H**

Using List View, Using the Spinner control, Using the GridView Control, Creating an Image Gallery Using the ViewPager Control. Dialogs, Selecting the Date and Time in One Application, Fragments, Creating Special Fragments**.**		
At the end of the Module 4, students will be able to: 1. Choose and select which one is the best view of list. (BL-3) 2. Develop customized dialogs. (BL-3) 3. Selecting the Date and Time in an Application.(BL-3)		
MODULE-5	**Building Menus**	**8H**
Creating Interface Menus and Action Bars, Menus and Their Types, Creating Menus Through XML, Creating Menus Through Coding, Applying a Context Menu to a List View, Using the Action Bar, Replacing a Menu with the Action Bar, Creating a Tabbed Action Bar, Creating a Drop-Down List Action Bar.		
At the end of the Module 5, students will be able to: 1. Prepare and produce information through menus. (BL-3) 2. Visualize the Action Bar. (BL-3) 3. Manipulate a Menu with the Action Bar. (BL-3)		
	Total hours:	**48 hours**

Content beyond syllabus: Advanced Android Programming: Gaming engines like Unity, Unreal Engine Etc..

Text Book(s):

4. B.M Harwani, Android Programming, Pearson Education.
5. Lauren Darcey and Shane Conder, "Android Wireless Application Development", 2nd edition, Pearson Education.

Reference Book(s):

6. Professional Android Application Development, Wiley India Private Limited.
7. Dawn Griffiths, David Griffiths, "Head First Android Development: A Brain-Friendly Guide", Second Edition, O'Reilly Media, 2017.
8. James C Sheusi, Android application Development for Java Programmers, Cengage Learning.
9. w.FrankAbleson, Robi Sen, Chris King, C.Enrique Ortiz., Android In Action,Dreamtech.
10. RetoMeier,Professional Android 4 applications development, Wiley India.
11. Wei- Meng Lee, Beginning Android 4 applications development, Wiley India.

NARAYANA ENGINEERING COLLEGE::GUDUR								
20CS3009	**WEB TECHNOLOGIES**							R20
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
	3	0	0	48	3	40	60	100

Pre-requisite: Knowledge of Information Technology

Course Objectives:

1. To impart basic web application development skills.
2. To translate user requirements into the overall architecture and implementation of new systems and manage project and coordinate with the client.
3. To develop scripting code in PHP language and Writing optimized front end code HTML and JavaScript.
4. To create and debug database related queries and Create test code to validate the applications against client requirement.
5. To monitor the performance of web applications, infrastructure and Troubleshooting web applications with a fast and accurate resolution.

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

CO 1	Construct static web pages using HTML and CSS. **(BL-3)**
CO 2	Implement various concepts related to dynamic web pages and validate them using JavaScript**.** **(BL-3)**
CO 3	Create secure, usable database driven web applications**.** **(BL-3)**
CO 4	Develop web Applications using Scripting Languages. **(BL-3)**
CO 5	Explain the concepts of Extensible Mark-up Language **(BL-2)**

CO-PO Mapping

CO	PO												PSO	
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	1	2	2										1	2
CO2	2	3	3	1									1	2
CO3	2	3	3	1									1	2
CO4	1	2	3	1									1	2
CO5	2	2	3										1	1

1: Low, 2-Medium, 3- High

COURSE CONTENT		
MODULE - 1	**HTML, CSS &Web Servers**	**(10H)**
HTML: Basic Syntax, Standard HTML Document Structure, Basic Text Mark-up, HTML styles, Elements, Attributes, Heading, Layouts, HTML media, Iframes Images, Hypertext Links, Lists, Tables, Forms, GET and POST method, HTML 5, Dynamic HTML. Cascading style sheets, Levels of Style Sheets, Style Specification Formats, Selector Forms, The Box Model, Conflict Resolution, CSS3, Web Servers- Apache, IIS, Bundle Servers.		
At the end of the Module 1, students will be able to: 1. Understand the basics of web programming. (BL-2) 2. Explain tags in HTML, CSS. (BL-2) 3. Construct static web pages using HTML tags. (BL-3) 4. Install and configure web servers, bundle servers. (BL-3)		
MODULE - 2	**Java Script**	**(10 H)**
Java script: Introduction to Java script, Objects, Primitives Operations and Expressions, Control Statements, Arrays, Functions, Constructors, Pattern Matching using Regular Expressions, Exception Handling, Validation, Built-in objects, Event Handling, DHTML with JavaScript., DOM Model		
At the end of the Module 2, students will be able to: 1. Explain basic programming constructs of java script. (BL-2) 2. Develop dynamic and interactive web pages. (BL-3) 3. Perform validations for the web pages. (BL-2)		
MODULE - 3	**PHP**	**(9 H)**
PHP Data types and Concepts: The anatomy of a PHP Page, Variables and data types, Operators, Expressions and Statements, Strings, Arrays and Functions.		
At the end of the Module 3, students will be able to: 1. Compare java and php programming features. (BL-2) 2. Understand the anatomy of php page. (BL-2) 3. Explain various PHP programming constructs. (BL-2) 4. Implement simple PHP programs in the server. (BL-3)		
MODULE - 4	**PHP Advanced Concepts**	**(9 H)**
PHP Advanced Concepts: UsingCookies, Using HTTP Headers, Using Sessions, authenticating users, Using Environment and Configuration variables, Working with Date and Time.		
At the end of the Module 4, students will be able to: 1. Understand cookies, http headers, sessions. (BL-2) 2. Explain user authentication in PHP. (BL-2) 3. Analyze PHP document structure. (BL-3)		
MODULE - 5	**Extensible Markup Language**	**(10 H)**

Working with XML: Document type Definition (DTD), XML schemas, XSLT, Document object model, Parsers - DOM and SAX. News Feed (RSS and ATOM). Java Web Services: Web services Basics – Creating, Publishing, Testing and Describing a Web services (WSDL)-Consuming a web service, SOAP.
At the end of the Module 5, students will be able to: 1. Understand the structure of Document type Definition (DTD), XML schemas. (BL-2) 2. Analyze parsing of XML document with DOM, SAX. (BL-3) 3. Demonstrate web service with SOAP, WSDL in Java web application development. (BL-2)

Total hours:	**48 Hours**

Text Book(s):

1. Robet W Sebesta, Programming the World Wide Web, 7th Edition, Pearson, 2013
2. Uttam K Roy, Web Technologies, 1stEdition ,7th impression, Oxford, 2012
3. Lee Babin, Nathan A Good, Frank M. Kromann and Jon Stephens, PHP 5 Recipes A problem Solution Approach.

Reference Book(s):

1. Deitel and Deitel and Nieto, Internet and World Wide Web - How to Program, , 5th Edition, Prentice Hall, 2011.
2. ELad Elrom, Pro Mean Stack Development, 1st Edition, Apress O'Reilly, 2016
3. David sawyer mcfarland, Java Script & jQuery the missing manual, 2nd Edition, O'Reilly, 2011
4. Peter Pollock, Web Hosting for Dummies, 1st Edition, John Wiley & Sons, 2013
5. Tom Christiansen, Jonathan Orwant, Programming Perl, 4th Edition, O'Reilly, 2012
6. Kogent L S, Web Technologies: HTML, JavaScript, PHP, Java, JSP, XML and AJAX, Black book, 1st Edition, Dream Tech, 2009
7. Paul S Wang, Sanda S Katila, An Introduction to Web Design, Programming, 1st Edition, Cengage Learning, 2003

Virtual Lab:

List editors which can be used to create HTML documents.

Understand: Describe the Structure of HTML document.

Apply: Identity different Tags are given in HTML.

Analyze: Compare the various HTML Tags.

1. Introduction to HTML
2. Applying Attributes in HTML Tags
3. Inserting images through img tags
4. Using Anchor Tags for Hyperlinks
5. How marquee Tags work in HTML
6. Creating Tables in HTML
7. Types of Lists in HTML
8. Working of div Tag in HTML
9. Embedding through iframe Tag
10. Creating Webpage Layout in HTML

NARAYANA ENGINEERING COLLEGE::GUDUR								
20CS3010	APPLIED ARTIFICIAL INTELLIGENCE							R2020
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
	3	0	0	48	3	40	60	100

Pre-requisite:

Mathematical Foundations of Computer Science, Computer Programming, Data Structures and Algorithms.

Course Objectives:

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

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

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

CO-PO Mapping

CO	PO												PSO	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	1	1											1	
CO2	2	3											1	
CO3	2	3											1	
CO4	3	3											1	
CO5	3	2											1	

1: Low, 2-Medium, 3- High

COURSE CONTENT		
MODULE – 1	**Introduction to Artificial Intelligence**	**10H**
Introduction: AI Definition, Foundations of Artificial Intelligence, History of Artificial Intelligence. Intelligent Agents: Agents and Environments, Good Behavior Concept of Rationality, Nature of Environments, The Structure of Agents. Problem-Solving Agents, Searching for Solutions; Uninformed Search Strategies: Breadth-first search, Uniform-cost search, DFS: Informed (Heuristic) Search strategies: Greedy BFS, A^* search.		
At the end of the Module 1, students will be able to: 1. Understand the basics and applications of Artificial intelligence.(BL-2) 2. Illustrate how rationality can be applied to a wide variety of agents.(BL-2) 3. Demonstrate the various search strategies and heuristics. (BL-2)		
MODULE – 2	**Problem Solving beyond classical search and Learning**	**10H**
Local search algorithms and optimization problems**:** Hill-climbing, simulated annealing; Local Search in Continuous Spaces, Searching with Non-Deterministic Actions, Searching with partial observations, Online Search Agents and Unknown Environment. Forms of Learning, Supervised Learning, Learning Decision Trees, Logical Formulation of Learning, Explanation-Based Learning, Learning Using Relevance Information, Inductive Logic Programming.		
At the end of the Module 2, students will be able to: 1. Understand advanced classical searching techniques.(BL-2) 2. Demonstrate Online Search Agents, Non-Deterministic Actions & Partial Observations.(BL-2) 3. Gain knowledge on basic forms of learning, learning decision trees and Explanation-based learning (BL-2)		
MODULE – 3	**Reinforcement Learning and Natural LanguageProcessing**	**10H**
Introduction, Passive Reinforcement Learning, Active reinforcement Learning, Generalization in Reinforcement Learning, Policy Search, applications of Reinforcement Learning**,** Language Models, Text Classification, Information Retrieval, Information Extraction.		
At the end of the Module 3, students will be able to: 1. Understand the Reinforcement learning methods and policy search. (BL-2) 2. Demonstrate language models and text classification. (BL-3) 3. Gain knowledge on Information retrieval and extraction. (BL-2)		
MODULE – 4	**Natural Language for communication and Perception**	**9H**
Phrase structure grammars, Syntactic analysis, Augmented grammars and semantic Interpretation, Machine translation, Speech Recognition. Image formation, Early Image Processing Operations, Object recognition by appearance, Reconstructing the 3D World,		

Object recognition from structural information, Using Vision**.**		
At the end of the Module 4, students will be able to: 1. Understand Syntactic analysis and semantic interpretation.(BL-3) 2. Demonstrate machine translation and speech recognition.(BL-3) 3. Gain knowledge on Object recognition and how to use Vision(BL-2)		
MODULE – 5	**Robotics and Philosophical foundations**	**9H**
Introduction, Robotic Hardware, Robotic Perception, Planning to move, Planning uncertain movements, Moving, Robotic software architectures, application domains. Week AI, Strong AI, Ethics and Risks of AI, Agent Components and Agent architectures, Are we going in the right direction, What if AI does succeed.		
At the end of the Module 5, students will be able to: 1. Understand the basics of robotics. (BL-2) 2. Demonstrate robotic hardware, software and applications. (BL-2) 3. Understand the philosophical foundations and agent architectures.(BL-2)		
	Total hours:	**48 hours**

Content beyond syllabus:

1. Constraint Satisfaction Problems.
2. Planning
3. Uncertain Knowledge and reasoning

Text Book(s):

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

Reference Book(s):

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

NARAYANA ENGINEERING COLLEGE::NELLORE							
	INFORMATION AND CYBER SECURITY						R20
Course Code	Hours / Week			Total hrs	Credit	Max Marks	
	L	T	P		C	CIE	SEE	TOTAL
20CS3011	3	1	0	50	3	40	60	100

Course Outcomes: On successful completion of the course, student will be able to:	
CO1	Apply computer security concepts and encryption techniques to enhance the security in a communication model. [BL-3]
CO2	Choose number theory concepts to implement public key cryptosystems. [BL -3]
CO3	Apply hash functions and authentication codes to preserve integration and confidentiality of a message [BL-3]
CO4	Apply user authentication principals and key management issue to applications. [BL-3]
CO5	Design secure applications at Transport/Network Layer and risk free computer system. [BL-3]

CO-PO Mapping														
CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	2	2		2						2	3	2
CO2	3	3	2	2		2						2	3	2
CO3	3	3	2	2		2						2	3	2
CO4	3	3	2	2		2						2	3	2
CO5	3	2	2	2		2						2	3	2
1: Low, 2-Medium, 3- High														

COURSE CONTENT		
MODULE – 1		**10H**
Cyber crime: Mobile and Wireless devices-Trend mobility-authentication service security Attacks on mobile phones-mobile phone security Implications for organizations-Organizational measurement for Handling mobile-Security policies and measures in mobile computing era. Cases.		
At the end of the Module 1, students will be able to: 1. Analyze and evaluate the cyber security needs of an organization. 2. Conduct a cyber security risk assessment.		
MODULE – 2		**10H**
Tools and methods used in cyber crime-Proxy servers and Anonymizers-Phishing Password cracking-Key loggers and Spy wares-Virus and worms-Trojan Horse and Backdoors Steganography-SQL Injection-Buffer overflow-Attacks on wireless network. Cases		
At the end of the Module 2, students will be able to: 1. Measure the performance and troubleshoot cyber security systems. 2. Implement cyber security solutions.		
MODULE – 3		**10H**
Understanding computer forensic-Historical background of cyber forensic Forensic analysis of e-mail-Digital forensic life cycle-Network forensic-Setting up a computer forensic Laboratory-Relevance of the OSI 7 Layer model to computer Forensic-Computer forensic from compliance perspectives. Cases.		
At the end of the Module 3, students will be able to: 1. Be able to use cyber security, information assurance, and cyber/computer forensics software/tools. 2. Design and develop a security architecture for an organization.		
MODULE – 4		**10H**
Forensic of Hand –Held Devices-Understanding cell phone working characteristics-Hand-Held devices and digital forensic- Toolkits for Hand-Held device-Forensic of i-podand digital music devices-Techno legal Challenges with evidence from hand-heldDevices. Cases.		
At the end of the Module 4, students will be able to: 1. Design operational and strategic cyber security strategies and policies.		
MODULE – 5		**10H**
Cyber Security –Organizational implications-cost of cybercrimes and IPR issues Web threats for organizations: the evils and Perils-Social media marketing Security and privacy Implications-Protecting people privacy in the organizations Forensic best practices for organizations. Cases		
At the end of the Module 5, students will be able to: 1. Measure the performance and troubleshoot cyber security systems. 2. Identify the key cyber security vendors in the marketplace.		
	Total hours:	**50 hours**

TEXTBOOK:

1. Nina Godbole &SunitBelapure ―Cyber Security‖, Wiley India, 2012.
2. Harish Chander, ―cyber laws & IT protection‖, PHI learning pvt.ltd, 2012.

REFERENCES:

1. Dhiren R Patel, ―Information security theory &practice‖,PHI learning pvt Ltd,2010.
2. MS.M.K.Geetha&Ms.SwapneRaman‖Cyber Crimes and Fraud
3. Management, ‖MACMILLAN,2012. Pankaj Agarwal : Information Security&
4. Cyber Laws (Acme Learning), Excel, 2013.
5. Vivek Sood, Cyber Law Simplified, TMH, 2012.

NARAYANA ENGINEERING COLLEGE::GUDUR								
	CLOUD COMPUTING							R20
Course Code	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
20CS3012	3	0	0	50	3	40	60	100

Course Outcomes: After successful completion of the course, student will be able to:	
CO 1	Summarize the basic concepts of, Cloud technologies for development of Cloud applications (BL-2)
CO 2	Develop cloud Applications through Cloud Technologies(BL-3)
CO 3	Interpret Cloud service architectures in Cloud environment(BL-3)
CO 4	Analyse the core issues of cloud computing. (BL-3)
CO 5	Choose appropriate technologies, algorithms and approaches to used in cloud Computing(BL-3)

CO-PO Mapping														
CO	**PO**												**PSO**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO 2**
CO1	1	1											1	
CO2	3	1											1	
CO3	1	2											2	1
CO4	2	1	2										1	1
CO5	1	1	1										1	
1: Low, 2-Medium, 3- High														

COURSE CONTENT		
MODULE – 1		**9H**
Cloud Computing Insights- Distributed Computing, High Performance Computing, Utility and Enterprise Grid Computing, Cluster Computing**,** Cloud Computing fundamentals, Essential Characteristics, On Demand Self Service, Location independent resource pooling, Elastic Computing, Measured Service, Comparing cloud providers with traditional IT service providers, Vendor Lock-in, security level of third party- Security issues: Government policies.		

At the end of the Module 1, students will be able to: 1. Outline the Cloud characteristics and models.(BL-2) 2. understand security issues in cloud computing(BL-2)		
MODULE – 2		**10H**
Cloud computing architecture, Layers of Cloud computing- IaaS, PaaS and SaaS, Cloud deployment models- Private, Public, Hybrid and Community Clouds, Advantages of Cloud Computing.		
At the end of the Module 2, students will be able to: 1. Design and build cloud applications.(BL-6) 2. Describe the multimedia cloud. (BL-2)		
MODULE – 3		**10H**
Introduction, Characteristics of Virtualized Environments, Virtualization and Cloud Computing, Pros and Cons of Virtualization, Virtual machines and Virtualization of Clusters and Data Centres, Case studies – Xen Virtual Machine monitors – Xen API, VMware- VMware products-VMware features, Microsoft Virtual Server- Features of Microsoft Virtual Server, Open stack.		
At the end of the Module 3, students will be able to: 1. Classify different models, different technologies in cloud.(BL-2) 2. Understand Microsoft virtual server concepts(BL-2)		
MODULE – 4		**10H**
Cloudsim Open source framework, Simulate VMs, memory, network, disks; Aneka – Cloud computing Framework for Enterprise Cloud applications development, Aneka Architecture, Programming models: Thread, Task and Map Reduce		
At the end of the Module 4, students will be able to: 1. Illustrate applications of cloud computing 2. Apply cloud computing concepts using programming models		
MODULE – 5		**10H**
Case studies – Salesforce.com for SaaS application development, GAE- Google App Engine, Microsoft Windows Azure – public resources for VMs and Services, AWS- Amazon Web Services – public cloud registration, Services, OpenStack – Open Source Development Platform for Clouds and tools.		
At the end of the Module 5, students will be able to: 1. Understand Cloud computing and Virtualization.(BL-1) 2. Deploying SaaS application on Google App engine or Azure cloud.(BL-3)		
	Total hours:	**49 hours**

NARAYANA ENGINEERING COLLEGE::GUDUR								
	INTRODUCTION TO MACHINE LEARNING							R20
Course Code	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
20CS3013	3	0	0	50	3	40	60	100

COURSE CONTENT		
MODULE – 1	**REGRESSION ANALYSIS**	**9H**
Introduction: Learning methods, Statistical Decision Theory - Regression, Classification, Bias Variance, Linear Regression, Multivariate Regression, Statistical Techniques-Subset Selection, Shrinkage Methods, Partial Least squares, Linear Classification, Linear Discriminant Analysis, Numerical Problems.		
MODULE – 2	**NEURAL NETWORKS**	**10H**
Perceptron, Support Vector Machines, Neural Networks - Introduction, Early Models, Perceptron Learning, Backpropagation, Training & Validation, Parameter Estimation, Bayesian Estimation, Decision Trees, Regression Trees, Categorical Attributes, Multiway Splits, Missing Values, Decision Trees - Instability Evaluation Measures, Naive Bayes, k-Nearest Neighnours, Numerical Problems.		
MODULE – 3	**METHODS OF EVALUATION**	**10H**
ANN Architectures, Training/Tuning methods, Bootstrapping & Cross Validation, Class Evaluation Measures, ROC curve, MDL, Ensemble Methods - Bagging, Committee Machines and Stacking, Boosting, Random Forests, Multi-class Classification, Bayesian Networks, Numerical Problems.		
MODULE – 4	**PROPAGATION AND ALGORITHMS**	**10H**
Necessity of various skills of Machine Learning, Undirected Graphical Models, HMM, Variable Elimination, Belief Propagation, Hierarchical Clustering, Birch Algorithm, CURE Algorithm, Numerical Problems.		
MODULE – 5	**IMPLEMENTING MACHINE LEARNING**	**10H**
Language choice, Gaussian Mixture Models, Expectation Maximization, Learning Theory, Introduction to Reinforcement Learning, Numerical Problems.		
	Total hours:	**49 hours**

TEXTBOOK:

1. The Elements of Statistical Learning, by Trevor Hastie, Robert Tibshirani, Jerome H. Friedman (freely available online)
2. Pattern Recognition and Machine Learning, by Christopher Bishop (optional)

REFERENCES:

1. Introduction to Statistical Learning by Gareth James, Daniela Witten, Trevor Hastie and Robert Tibshirani. Springer, 2013. Corrected 8th printing, 2017.
2. Deep Learning by Ian Goodfellow, Yoshua Bengio, and Aaron Courville. MIT Press, 2016.
3. Evaluating Machine Learning Models by Alice Zheng. O'Reilly, 2015.

THE PROFESSIONAL ELECTIVES

The Professional Elective Courses (PE) are shown in different tracks/groups: The students will have options of selecting the electives from the different tracks/groups depending on the specialization one wishes to acquire.

Electives Track/ Groups	**Professional Elective-1**	**Professional Elective-2**	**Professional Elective -3**	**Professional Elective-4**	**Professional Elective-5**
Computer Networks andSecurities	Network Protocols and Programming	Software Defined Networks	Information andCyber Security	Web Application and Security	Block chain Technologies
Software Engineering	Software Project Management	Software Architecture	Software Testing	Object Oriented Analysis and Design	Agile Software Development
Data Science and Engineering	Data warehousing and data mining	Business Intelligence andAnalytics	Information Storage and Retrieval Systems	Deep Learning	Programming for Data Science
Cloud Computing	Distributed Systems	Green Computing	Cloud Computing	High Performance Computing	Cloud Security
Virtualization and Others	Compiler Design	Robotic Process Automation	Digital Marketing	Augmented and Virtual Reality	Virtualization Technologies

PROFESSIONAL ELECTIVE-1

NARAYANA ENGINEERING COLLEGE::GUDUR								
	NETWORK PROTOCOLS AND PROGRAMMING							R20
Course Code	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
20CS4001	4	0	0	48	4	40	60	100

Course Outcomes: On successful completion of the course, student will be able to:	
CO 1	Demonstrate mastery of main protocols comprising the Internet
CO 2	Develop skills in network programming techniques
CO 3	Implement network services that communicate through the Internet.
CO 4	Apply the client-server model in networking applications.
CO 5	Practice networking commands available through the operating systems.

CO-PO Mapping														
	PO												**PSO**	
	PO	**PO**	**PO**	**PO**	**PO**	**PO**	**PO**	**PO**	**PO**	**PO**	**PO**	**PO**	**PSO**	**PSO**
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**1**	**11**	**12**	**1**	**2**
CO1	3	1	2	2									2	1
CO2	3	2	2	1								1	2	1
CO3	3	2	2	2								1	2	1
CO4	3	2	1	2								1	1	1
CO5	3	3	1	1								1	2	1
1: Low, 2-Medium, 3- High														

COURSE CONTENT		
MODULE – 1		**9H**
Introduction: Day Time Client/Server, Concurrent Client/Server, Error Handling, Protocol Independence, Port Numbers. **Sockets:** Address structures, value – result arguments, Byte ordering and manipulation function and related functions, Elementary TCP sockets – Socket, connect, bind, listen, accept, fork and exec function, concurrent servers, Close and related function.		
MODULE – 2		**10H**
TCP Client Server: Introduction, TCP Echo server functions, Normal startup, terminate and signal handling server process termination, Crashing and Rebooting of server host shutdown of server host.		

MODULE – 3		10H
I/O Multiplexing and socket options: I/O Models, Select function, Batch input, shutdown function, Poll function, TCP Echo server, getsockopt and setsockopt functions. Socket states, Generic socket option, IPV6 socket option, ICMPV6 socket option, IPV6 socket option and TCP socket options.		
MODULE – 4		**10H**
Elementary UDP sockets: Introduction UDP Echo server function, lost datagram, summary of UDP example, Lack of flow control with UDP, determining outgoing interface with UDP. **Elementary name and Address conversions:** Domain Name System, gethostbynamefunction, RES_USE_INET6 Resolver option, gethostbyname2 function and IPv6 support, gethostbyaddr function, name function, gethostname function, getservbyname andgetservbyport functions.		
MODULE – 5		**9H**
IPv4 and IPv6 interoperability: IPv4 client,IPv6 server, IPv6 client, IPv4 server. **Network Management and Debugging:** Troubleshooting a Network, ping, trace route, netstat, Packet Sniffers, Network Management Protocols, SNMP.		
	Total hours:	**48 hours**

TEXTBOOK:

1. R. W. Stevens, B. Fenner, A. M. Rudoff, Unix Network Programming: The Sockets Networking API, 3rd edition, vol.1, PHI, 2010.
2. E. Nemeth, G. Snyder, T. R. Hein, B. Whaley, UNIX and Linux System Administration Handbook 4th Edition, Pearson Education 2011.

REFERENCES:

1.A.S. Tanenbaum; Computer Networks, 5th edition, Pearson, 2012 (Reference Book).
2. B.A. Forouzan, Data Communications and Networking, 4th edition, Tata McGraw Hill, 2006 (Reference Book).

NARAYANA ENGINEERING COLLEGE::GUDUR								
	SOFTWARE PROJECT MANAGEMENT							R20
Course Code	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
20CS4002	3	0	0	48	3	40	60	100

Course Outcomes: After successful completion of the course, the student will be able to:	
CO 1	Identify the concepts of conventional software project management and Software Economics for developing a software project.
CO 2	Apply Conventional and modern principles of software project management to develop the software products.
CO 3	Explain the software architecture, life cycle phases and process for a building a software product.
CO 4	Interpret the techniques to evaluate progress of software project workflows in terms of milestones and check points, project organization responsibilities and process automation
CO 5	Choose the software metrics to implement a software product through process instrumentation ethical principles to be followed in management of software economics

CO-PO Mapping														
CO	**PO**												**PSO**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	3									1		2	3
CO2	2	2	2								3	2		
CO3	2	2	2								1		3	2
CO4	2	3	2								3	1	2	3
CO5	2	2	3								3		2	2
1: Low, 2-Medium, 3- High														

<table>
<tr><th colspan="3">COURSE CONTENT</th></tr>
<tr><td>MODULE – 1</td><td>Conventional Software Management</td><td>9H</td></tr>
<tr><td colspan="3">The waterfall model, conventional software Management performance. Evolution of Software Economics: Software Economics, pragmatic software cost estimation</td></tr>
<tr><td>MODULE – 2</td><td>Improving Software Economics</td><td>9H</td></tr>
<tr><td colspan="3">Reducing Software product size, improving software processes, improving team effectiveness, improving automation, Achieving required quality, peer inspections
The old way and the new: The principles of conventional software engineering, principles of modern software management, transitioning to an iterative process</td></tr>
<tr><td>MODULE – 3</td><td>Life cycle phases</td><td>10H</td></tr>
<tr><td colspan="3">Engineering and production stages, inception, Elaboration, construction, transition phases. Artifacts of the process: The artifact sets, Management artifacts, Engineering artifacts, programmatic artifacts. Model based software architectures: A Management perspective and technical perspective</td></tr>
<tr><td>MODULE – 4</td><td>Work Flows of the process</td><td>10H</td></tr>
<tr><td colspan="3">Software process workflows, Inter Trans workflows. Checkpoints of the Process: Major Mile Stones, Minor Milestones, Periodic status assessments. Iterative Process Planning: Work breakdown structures, planning guidelines, cost and schedule estimating, Interaction planning process, Pragmatic planning.
Project Organizations and Responsibilities: Line-of-Business Organizations, Project Organizations, evolution of Organizations. Process Automation: Automation Building Blocks, The Project Environment</td></tr>
<tr><td>MODULE – 5</td><td>Project Control and Process instrumentation</td><td>10H</td></tr>
<tr><td colspan="3">The server care Metrics, Management indicators, quality indicators, life cycle expectations pragmatic Software Metrics, Metrics automation. Tailoring the Process: Process discriminates, Example.
Future Software Project Management: Modern Project Profiles Next generation Software economics, modern Process transitions</td></tr>
<tr><td colspan="2">Total hours:</td><td>48 ours</td></tr>
</table>

TEXTBOOK:

1. Bob Hughes, Mike Cotterell and Rajib Mall: Software Project Management – Fifth Edition, Tata McGraw Hill, New Delhi, 2012.

REFERENCES:

2. Robert K. Wysocki "Effective Software Project Management" – Wiley Publication,2011.

3. Walker Royce: "Software Project Management"- Addison-Wesley, 1998.Gopalaswamy Ramesh, "Managing Global Software Projects" – McGraw HillEducation (India), Fourteenth Reprint 2013.

NARAYANA ENGINEERING COLLEGE::GUDUR							
	DATA WAREHOUSING AND DATA MINING						R20
Course Code	Hours / Week			Total hrs	Credit	Max Marks	
	L	T	P		C	CIE	SEE	TOTAL
20CS4003	3	0	0	48	3	40	60	100

Course Outcomes: After successful completion of the course, the student will be able to:	
CO 1	Design a Data warehouse system and perform business analysis with OLAP tools
CO 2	Apply suitable pre-processing and visualization techniques for data analysis
CO 3	Apply frequent pattern and association rule mining techniques for data analysis
CO 4	Design appropriate classification and clustering techniques for data analysis
CO 5	Understand knowledge from raw data

CO-PO Mapping

CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3									1		2	3
CO2	2	2	2								3	2		
CO3	2	2	2								1		3	2
CO4	2	3	2								3	1	2	3
CO5	2	2	3								3		2	2

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1		**10H**

Basic Concepts – Data Warehousing Components – Building a Data Warehouse – Database Architectures for Parallel Processing – Parallel DBMS Vendors – Multidimensional Data Model

Data Warehouse Schemas for Decision Support, Concept Hierarchies Characteristics of OLAP Systems – Typical OLAP Operations, OLAP and OLTP.

MODULE – 2		**9H**

Introduction to Data Mining Systems – Knowledge Discovery Process – Data Mining Techniques – Issues – applications- Data Objects and attribute types, Statistical description of data, Data Preprocessing – Cleaning, Integration, Reduction, Transformation and discretization, Data Visualization, Data similarity and dissimilarity measures.

MODULE – 3		**9H**

Mining Frequent Patterns, Associations and Correlations – Mining Methods- Pattern Evaluation Method – Pattern Mining in Multilevel, Multi Dimensional Space – Constraint Based Frequent Pattern Mining, Classification using Frequent Patterns.

MODULE – 4		**10H**

Decision Tree Induction – Bayesian Classification – Rule Based Classification – Classification by Back Propagation – Support Vector Machines — Lazy Learners – Model Evaluation and Selection-Techniques to improve Classification Accuracy. Clustering Techniques – Cluster analysis-Partitioning Methods – Hierarchical Methods – Density Based Methods – Grid Based Methods – Evaluation of clustering – Clustering high dimensional data- Clustering with constraints, Outlier analysis-outlier detection methods.

MODULE – 5		**10H**
Datasets – Introduction, Iris plants database, Breast cancer database, Auto imports database – Introduction to WEKA, The Explorer – Getting started, Exploring the explorer, Learning algorithms, Clustering algorithms, Association–rule learners.		
	Total hours:	**48hours**

TEXTBOOK:

1. Jiawei Han and Micheline Kamber, ―Data Mining Concepts and Techniques, Third Edition,Elsevier, 2012.

REFERENCES:

1. Alex Berson and Stephen J.Smith, ―Data Warehousing, Data Mining & OLAP‖, TataMcGraw – Hill Edition, 35th Reprint 2016.
2. K.P. Soman, Shyam Diwakar and V. Ajay, ―Insight into Data Mining Theory and Practice,Eastern Economy Edition, Prentice Hall of India, 2006.
3. Ian H.Witten and Eibe Frank, ―Data Mining: Practical Machine Learning Tools andTechniques, Elsevier, Second Edition.

NARAYANA ENGINEERING COLLEGE::GUDUR								
	DISTRIBUTED SYSTEMS							R20
Course Code	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
20CS4004	3	0	0	50	3	40	60	100

Course Outcomes:

At the end of the course the students will be able to

	Course Outcome	BTL
CO 1	Understand the design principles in distributed systems and the architecture for distributed systems.(BTL-3)	3
CO 2	Apply various distributed algorithms related to clock synchronization, con-currency control, deadlock detection, load balancing, voting etc.(BTL-4)	4
CO 3	Analyze fault tolerance and recovery in distributed systems and algorithmsfor the same.(BTL-4)	4
CO 4	Analyze the design and functioning of existing distributed systems and file systems.(BTL-4)	4
CO 5	Implement different distributed algorithms over current distributed plat-forms (BTL-5)	5

CO-PO Mapping

CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2		2	2									2	3
CO2	2		2	2									2	3
CO3	2		2	2									2	3
CO4	3	3	3	3									2	3
CO5	3		3	2	3								2	3
1: Low, 2-Medium, 3- High														

COURSE CONTENT		
MODULE – 1	**INTRODUCTION**	**9H**
Characterization of Distributed Systems: Introduction, Examples of Distributed Systems, Resource Sharing and the Web, Challenges. **System Models:** Introduction, Architectural Models, Fundamental Models		
MODULE – 2	**Time and Global States & Coordination and Agreement**	**10H**
Time and Global States: Introduction, Clocks Events and Process States, Synchronizing Physical Clocks, Logical Time and Logical Clocks, Global States, Distributed Debugging. **Coordination and Agreement:** Introduction, Distributed Mutual Exclusion, Elections, Multicast Communication, Consensus and Related Problems...		
MODULE – 3	**Inter Process Communication**	**10H**
Inter Process Communication: Introduction, The API for the Internet Protocols, External Data Representation and Marshalling, Client-Server Communication, Group Communication, Case Study: IPC in UNIX. **Distributed Objects and Remote Invocation:** Introduction, Communication between Distributed Objects, Remote Procedure Call, Events and Notifications, Case Study: JAVA RMI.		
MODULE – 4	**Distributed File Systems**	**11H**
Distributed File Systems: Introduction, File Service Architecture, Case Study 1: Sun Network File System, Case Study 2: The Andrew File System. **Name Services:** Introduction, Name Services and the Domain Name System, Directory Services, Case Study of the Global Name Services. **Distributed Shared Memory:** Introduction, Design and Implementation Issues, Sequential Consistency and IVY case study, Release Consistency, Munin Case Study, Other Consistency Models.		
MODULE – 5	**Transactions and Concurrency Control**	**10H**
Transactions and Concurrency Control: Introduction, Transactions, Nested Transactions, Locks, Optimistic Concurrency Control, Timestamp Ordering, Comparison of Methods for Concurrency Control. **Distributed Transactions:** Introduction, Flat and Nested Distributed Transactions, Atomic Commit Protocols, Concurrency Control in Distributed Transactions, Distributed Deadlocks, Transaction Recovery		
	Total hours:	**50 hours**

TEXTBOOK:

1. Distributed Systems, Concepts and Design, George Coulouris, J Dollimore and Tim Kindberg, Pearson Education, 4th Edition, 2009.
2. Distributed Systems, Principles and Paradigms, Andrew S. Tanenbaum, Maarten Van Steen, 2nd Edition, PHI.

REFERENCES:

1. Distributed Systems, An Algorithm Approach, Sukumar Ghosh, Chapman & Hall/CRC, Taylor &Fransis Group, 2007..

NARAYANA ENGINEERING COLLEGE::GUDUR								
	COMPILER DESIGN							R20
Course Code	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
20CS2005	3	0	0	49	3	40	60	100

Course Outcomes: On successful completion of the course, student will be able to:	
CO1	Describe the Lexical Analysis with LEX tool for generating tokens of a program.(BL-2)
CO2	Construct the parse tables by applying top-down and bottom-up parsing methods to examine the syntax of program constructs.(BL-3)
CO3	Demonstrate the intermediate code generation concept to translate the source code into the machine code.(BL-2)
CO4	Construct the storage allocation strategies and symbol table organization methods to store the information from analysis and synthesis phases of a program.(BL-3)
CO5	Analyze the optimization of code technique to generation of a target code of various programs.(BL-4)

CO-PO Mapping														
CO	**PO**												**PSO**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	1	2										2	2
CO2	1	3	2										2	2
CO3	2	3	2										2	2
CO4	1	3	2										2	3
CO5	2	3	3										2	3
1: Low, 2-Medium, 3- High														

COURSE CONTENT		
MODULE – 1		**9H**
Introduction: The structure of a compiler, the science of building a compiler, programming language Basics **Lexical Analysis:** The Role of the Lexical Analyzer, Input Buffering, Recognition of Tokens, The Lexical-Analyzer Generator Lex, Finite Automata, From Regular Expressions to Automata, Design of Lexical-Analyzer Generator, Optimization of DFA-Based Pattern Matchers		
MODULE – 2		**10H**
Syntax Analysis: Introduction, Context-Free Grammars, Writing a Grammar, Top-Down Parsing Bottom-Up Parsing, Introduction to LR Parsing: Simple LR, More Powerful LR Parsers, Using Ambiguous Grammars and Parser Generators..		
MODULE – 3		**10H**
Syntax-Directed Translation: Syntax-Directed Definitions, Evaluation Orders for SDD's, Applications of Syntax-Directed Translation, Syntax-Directed Translation Schemes, and Implementing L-Attributed SDD's. **Intermediate-Code Generation:** Variants of Syntax Trees, Three-Address Code, Types and Declarations, Type Checking, Control Flow, Switch-Statements, Intermediate Code for Procedures.		
MODULE – 4		**10H**
Run-Time Environments: Stack Allocation of Space, Access to Nonlocal Data on the Stack, Heap Management, Introduction to Garbage Collection, Introduction to Trace-Based Collection. **Code Generation:** Issues in the Design of a Code Generator, The Target Language, Addresses in the Target Code, Basic Blocks and Flow Graphs, Optimization of Basic Blocks, A Simple Code Generator, Peephole Optimization, Register Allocation and Assignment, Dynamic Programming Code-Generation.		
MODULE – 5		**10H**
Machine-Independent Optimization: The Principal Sources of Optimization, Introduction to Data-Flow Analysis, Foundations of Data-Flow Analysis, Constant Propagation, Partial-Redundancy Elimination, Loops in Flow Graphs..		
	Total hours:	**49 hours**

TEXTBOOK:

1. Compilers: Principles, Techniques and Tools, Second Edition, Alfred V. Aho, Monica S. Lam,Ravi Sethi, Jeffry D. Ullman.
2. Lex &Yacc – John R. Levine, Tony Mason, Doug Brown, O'reilly

REFERENCES:

1. Compiler Construction, Louden, Thomson.

PROFESSIONAL ELECTIVE-II

NARAYANA ENGINEERING COLLEGE::GUDUR							
	SOFTWARE DEFINED NETWORKS						R20
Course Code	Hours / Week			Total hrs	Credit	Max Marks	
	L	T	P		C	CIE	SEE	TOTAL
PE	3	0	0	48	3	40	60	100

Course Outcomes: On successful completion of the course, student will be able to:	
CO 1	Describes History of Software Defined Networking
CO 2	Identifies various Drawbacks of Open SDN, SDN via APIs, SDN ,Various Partitioning Techniques.
CO 3	Defines SDN Solutions for the Data Center Network – VLANs – EVPN – VxLAN – NVGRE
CO 4	Describes various SDN PROGRAMMING
CO 5	Explains Data Centre Orchestration

CO-PO Mapping														
	PO												PSO	
	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO
CO	1	2	3	4	5	6	7	8	9	1	11	12	1	2
CO1	3	1	2	2									2	1
CO2	3	2	2	1								1	2	1
CO3	3	2	2	2								1	2	1
CO4	3	2	1	2								1	1	1
CO5	3	3	1	1								1	2	1
1: Low, 2-Medium, 3- High														

COURSE CONTENT		
MODULE – 1	**INTRODUCTION**	**9H**
History of Software Defined Networking (SDN) – Modern Data Center – Traditional Switch Architecture – Why SDN – Evolution of SDN – How SDN Works – Centralized and Distributed Control and Date Planes		
MODULE – 2	**OPEN FLOW & SDN CONTROLLERS**	**9H**
Open Flow Specification – Drawbacks of Open SDN, SDN via APIs, SDN via Hypervisor-Based Overlays – SDN via Opening up the Device – SDN Controllers – General Concepts		
MODULE – 3	**DATA CENTERS**	**10H**
Multitenant and Virtualized Multitenant Data Center – SDN Solutions for the Data Center Network – VLANs – EVPN – VxLAN – NVGRE		
MODULE – 4	**SDN PROGRAMMING**	**10H**
Programming SDNs: Northbound Application Programming Interface, Current Languages and Tools, Composition of SDNs – Network Functions Virtualization (NFV) and Software Defined Networks: Concepts, Implementation and Applications		
MODULE – 5	**SDNFrameworks**	**10H**
Juniper SDN Framework – IETF SDN Framework – Open Daylight Controller – Floodlight Controller – Bandwidth Calendaring – Data Center Orchestration		
	Total hours:	**48 hours**

TEXTBOOK:

1. Paul Goransson and Chuck Black, ―Software Defined Networks: A Comprehensive Approach, First Edition, Morgan Kaufmann, 2014.
2. Thomas D. Nadeau, Ken Gray, ―SDN: Software Defined Networks, O'Reilly Media, 2013.

REFERENCES:

1. Siamak Azodol molky, ―Software Defined Networking with Open Flow , Packet Publishing, 2013.
2. Vivek Tiwari, ― SDN and Open Flow for Beginners‖, Amazon Digital Services, Inc., 2013.
3. Fei Hu, Editor, ―Network Innovation through Open Flow and SDN: Principles and Design, CRC Press, 2014.

NARAYANA ENGINEERING COLLEGE::GUDUR								
	SOFTWARE ARCHITECTURE							R20
Course Code	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
20CS2007	3	0	0	49	3	40	60	100

Course Outcomes: After successful completion of the course, the student will be able to:	
CO 1	Demonstrate Software Architecture reference models and architecture business cycle for making a good Software Architecture
CO 2	Choose different Software Architectural life cycles for designing a good architecture
CO 3	Identify Quality Attributes, Functional attributes, and different types of tactics for creating architecture.
CO 4	Develop the document of software architecture and views for creating architecture.
CO 5	Develop real time projects by combining ATAM and CBAM frameworks with quality attributes.

CO-PO Mapping														
CO	**PO**												**PSO**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	2	1										2	2
CO2		3	2										2	3
CO3	3	1	2										2	1
CO4	3	2	1										2	1
CO5	2	3	2										2	2
1: Low, 2-Medium, 3- High														

COURSE CONTENT		
MODULE – 1	**SOFTWARE ARCHITECTURE**	**10H**
What is software Architecture-What is Software Architecture, Other Points of View, Architectural Patterns, Reference Models, and Reference Architectures, Importance of Software Architecture, Architectural Structures and views. **ENVISIONING ARCHITECTURE**: Architecture Business Cycle- Architectures influences, Software Processes and the Architecture Business Cycle, Making of ―Good‖ Architecture.		
MODULE – 2	**DESIGNING THE ARCHITECTURE WITH STYLES**	**10H**
Designing the Architecture: Architecture in the Life Cycle, Designing the Architecture, Formatting the Team Structure, Creating a Skeletal System. Architecture Styles: Architectural Styles, Pipes and Filters, Data Abstraction and Object Oriented Organization, Event-Based, Implicit Invocation, Layered Systems, Repositories, Interpreters.2013-2014		
MODULE – 3	**CREATING AN ARCHITECTURE-I**	**10H**
Creating an Architecture: Understanding Quality Attributes – Functionality and Architecture, Architecture and Quality Attributes, System Quality Attributes, Quality Attribute. Scenarios in Practice, Other System Quality Attributes, Business Qualities, Architecture Qualities. Achieving Qualities: Introducing Tactics, Availability Tactics, Modifiability Tactics, Performance Tactics, Security Tactics, Testability Tactics, Usability Tactics.		
MODULE – 4	**CREATING AN ARCHITECTURE-II**	**10H**
Documenting Software Architectures: Use of Architectural Documentation, Views, Choosing the Relevant Views, Documenting a view, Documentation across Views. Reconstructing Software Architecture: Introduction, Information Extraction, Database Construction, View Fusion, and Reconstruction.		
MODULE – 5	**ANALYZING ARCHITECTURES**	**9H**
The ATAM: Participants in the ATAM, Outputs of The ATAM, Phases Of the ATAM. The CBAM: Decision-Making Context, The Basis for the CBAM, Implementing the CBAM. The World Wide Web: A Case study in Interoperability- Relationship to the Architecture Business Cycle, Requirements and Qualities, Architecture Solution, Achieving Quality Goals.		
	Total hours:	**49 hours**

TEXTBOOK:

Software Architectures in Practice , Len Bass, Paul Clements, Rick Kazman, 2nd Edition, Pearson Publication.

Software Architecture, Mary Shaw and David Garlan, First Edition, PHI Publication, 1996.

REFERENCES:

Software Design: From Programming to Architecture, Eric Braude, Wiley, 2004.

N. Domains of Concern in Software Architectures and Architecture Description Languages. Medvidovic and D. S. Rosenblum. USENIX.

NARAYANA ENGINEERING COLLEGE::GUDUR								
	BUSINESS INTELLIGENCE AND ANALYTICS							R20
Course Code	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
20CS2008	3	0	0	48	3	40	60	100

Course Outcomes: After successful completion of the course, the student will be able to:	
CO 1	Understanding the scope of Business Intelligence solutions
CO 2	Understanding components of Business Intelligence solutions
CO 3	Apply BI concepts to build BI project
CO 4	Building reports with relational and Multidimensional data models
CO 5	Understand differences between Centralized and Decentralized Architecture.

CO-PO Mapping														
CO	**PO**												**PSO**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	2	2	2										
CO2	3													
CO3	3													
CO4	3		3		2									
CO5		3		3										
1: Low, 2-Medium, 3- High														

COURSE CONTENT		
MODULE – 1	**Introduction to Business Intelligence**	**10H**
Understanding the scope of today's BI solutions and how they fit into existing infrastructure Assessing new options such as SaaS and cloud-based technology. Describe BI, its components & architecture, previewing the future of BI Crafting a better experience for all business users, End User Assumptions, Setting up Data for BI, The Functional Area of BI Tools, Query Tools and Reporting, OLAP and Advanced Analytics, Supporting the requirements of senior executives, including performance management.		
MODULE – 2	**Elements of Business Intelligence Solutions**	**10H**
Reports & ad hoc queries; Analyze OLAP data; Dashboards & Scorecards development, Metadata Models; Automated tasks & events; Mobile & disconnected BI; Collaboration capabilities; Real time monitoring capabilities; Software development kit; Consume BI through portals, web applications, Desktop applications.		
MODULE – 3	**Building the BI Project**	**9H**
Planning the BI project, Project Resources; Project Tasks, Risk Management and Mitigation, Cost-justifying BI solutions and measuring success, Collecting User Requirements, Requirements-Gathering Techniques; Prioritizing & Validating BI Requirements, Changing Requirements; BI Design and Development, Best Practices for BI Design; Post-Implementation Evaluations, Maintaining Your BI Environment.		
MODULE – 4	**Reporting authoring**	**10H**
Building reports with relational vs. Multidimensional data models ; Types of Reports – List, crosstabs, Statistics, Chart, map, financial etc; Data Grouping & Sorting, Filtering Reports, Adding Calculations to Reports, Conditional formatting, Adding Summary Lines to Reports. Drill up, drill- down, drill-through capabilities. Run or schedule report, different output forms – PDF, excel, csv, xml etc.		
MODULE – 5	**BI Deployment, Administration & Security**	**9H**
Centralized Versus Decentralized Architecture, BI Architecture Alternatives, phased & incremental BI roadmap, System Sizing, Measurements and Dependencies, System Sizing, Measurements, and Dependencies. Setting Early Expectations and Measuring the Results. End-User Provisos. OLAP Implementations. Expanding BI Authentication Authorization, Access Permissions, Groups and Roles, Single-sign on Server Administration, Manage Status & Monitoring, Audit, Mail server & Portal integration, Back Up and Restore.		
Total hours:		**48 hours**

TEXTBOOK:

1. Business Intelligence - IBM ICE Publication, 2012

REFERENCES:

1. http://en.wikipedia.org/wiki/Business_intelligence.
2. http://www.webopedia.com/TERM/B/Business_Intelligence.html.
3. Http://www.cio.com/article/40296/Business_Intelligence_Definition_and_Solutions.

NARAYANA ENGINEERING COLLEGE::GUDUR							
	GREEN COMPUTING						R20
Course Code	Hours / Week			Total hrs	Credit	Max Marks	
	L	T	P		C	CIE	SEE	TOTAL
	3	1	0	49	3	40	60	100

Course Outcomes: After successful completion of the course, Student will be able to:	
CO 1	Learn the fundamentals of Green Computing
CO 2	Analyze the Green computing Grid Framework
CO 3	Understand the issues related with Green compliance
CO 4	Study and develop various case studies
CO 5	Identify Environmentally Responsible Business Strategies

CO-PO Mapping														
CO	**PO**												**PSO**	
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	1	1											1	
CO2	3	1											1	
CO3	1	2											2	1
CO4	2	1	2										1	1
CO5	1	1	1										1	
1: Low, 2-Medium, 3- High														

COURSE CONTENT		
MODULE – 1		**9H**
Green IT Fundamentals: Business, IT, and the Environment – Green computing: carbon foot print, scoop on power – Green IT Strategies: Drivers, Dimensions, and Goals – Environmentally Responsible Business: Policies, Practices, and Metrics.		
MODULE – 2		**9H**
Green Assets: Buildings, Data Centers, Networks, and Devices – Green Business Process **Management:** Modelling, Optimization, and Collaboration – Green Enterprise Architecture – Environmental Intelligence – Green Supply Chains – Green Information Systems: Design and Development Models.		
MODULE – 3		**10H**
Virtualization of IT systems – Role of electric utilities, Telecommuting, teleconferencing and teleporting – Materials recycling – Best ways for Green PC – Green Data center – Green Grid framework.		
MODULE – 4		**11H**
Socio-cultural aspects of Green IT – Green Enterprise Transformation Roadmap – Green Compliance: Protocols, Standards, and Audits – Emergent Carbon Issues: Technologies and Future		
MODULE – 5		**10H**
The Environmentally Responsible Business Strategies (ERBS) – Case Study Scenarios for Trial Runs – Case Studies – Applying Green IT Strategies and Applications to a Home, Hospital, Packaging Industry and Telecom		
	Total hours:	**49 hours**

TEXTBOOK:

1. Bhuvan Unhelkar, ―Green IT Strategies and Applications-Using Environmental Intelligence‖, CRC Press, June 2014.
2. Woody Leonhard, Katherine Murray, ―Green Home computing for dummies‖, August 2012

REFERENCES:

1. Alin Gales, Michael Schaefer, Mike Ebbers, ―Green Data Center: steps for the Journey‖, Shroff / IBM rebook, 2011.
2. John Lamb, ―The Greening of IT‖, Pearson Education, 2009.
3. Jason Harris, ―Green Computing and Green IT- Best Practices on regulations& industry‖, Lulu.com, 2008
4. Carl speshocky, ―Empowering Green Initiatives with IT‖, John Wiley & Sons, 2010. Wu Chun Feng (editor), ―Green computing: Large Scale energy efficiency‖, CRC.

NARAYANA ENGINEERING COLLEGE::GUDUR								
	ROBOTICS PROCESS AUTOMATION							R20
Course Code	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
20CS4010	3	0	0	49	3	40	60	100

Course Outcomes: On successful completion of the course, student will be able to:	
CO-1	Describe RPA, where it can be applied and how it's implemented
CO-2	Describe the different types of variables, Control Flow and data manipulation techniques
CO-3	Identify and understand Image, Text and Data Tables Automation
CO-4	Describe how to handle the User Events and various types of Exceptions and strategies.
CO-5	Understand the Deployment of the Robot and to maintain the connection

CO-PO Mapping

CO	PO												PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2		2						2	3	2
CO2	3	3	2	2		2						2	3	2
CO3	3	3	2	2		2						2	3	2
CO4	3	3	2	2		2						2	3	2
CO5	3	2	2	2		2						2	3	2

1: Low, 2-Medium, 3- High

COURSE CONTENT		
MODULE – 1		**9H**
RPA Foundations & RPA Skills What Is RPA? Flavours of RPA History of RPA, The Benefits of RPA, The Downsides of RPA, RPA Compared to BPO, BPM, and BPA, Consumer Willingness for Automation, The Workforce of the Future. RPA Skills: On-Premise Vs. the Cloud, Web Technology, Programming Languages and Low Code.OCR (Optical Character Recognition), Databases, APIs (Application Programming Interfaces), AI (Artificial Intelligence), Cognitive Automation, Agile, Scrum, Kanban, and Waterfall, DevOps, Flowcharts		
MODULE – 2		**9H**
Process Methodologies & Planning: Lean, Six Sigma, How to Implement Six Sigma, Six Sigma Roles and Levels, Lean Six Sigma, Finding the Right Balance, Applying Lean and Six Sigma to RPA. Planning: The Preliminaries , Use a Consulting Firm? PA Consulting: Some Case Studies, What to Automate? ROI for RPA, RPA Use Cases, Plan.		
MODULE – 3		**10H**
RPA Vendor Evaluation & Center of Excellence(CoE): Be Realistic, Check Out Third Parties, Minimum Capabilities, Who Is the User?, Funding, Ecosystem, Costs, Training and Education, Support, Best-of-Breed vs. End-to-End, Thought Leadership and Vision, Industry Expertise, Security, Monitoring, and Deployment, What Type of RPA?, The Design, Next-Generation Technologies Center of Excellence (CoE): What Is the CoE? Why Have a CoE? Forming the Team, Business Analyst, Developer, RPA Solution Architect, RPA Supervisor, What Should a CoE Do? Communication, Change Management, CoE Case Study: Intuit.		
MODULE – 4		**11H**
Bot Development, Deployment and Monitoring & Data Preparation: Preliminaries, Installation of UiPath, Getting Started, Activities, Flowcharts and Sequences, Log Message, Variables, Loops and Conditionals, For Each Loop, Do While Loop and While Loop,IF/THEN/ELSE Conditionals, Switch, Debug, Common UiPath Functions, The UiPath Orchestrator, Best Practices for Bot Development Deployment and Monitoring: Testing, Going into Production, Monitoring, Security, Scaling Data Preparation: Types of Data, Big Data, The Issues with Big Data, The Data Process, Types of Algorithms, The Perils of the Moonshot, Bias		
MODULE – 5		**10H**
Open Source RPA, Process Mining & Future of RPA: What Is Open Source Software? The Business Model of Open Source? The Pros and Cons of Open Source Software, Open RPA, UI. Vision, Robot Framework, Robocorp, Orchestra, TagUI Process Mining: Old Way Vs. Process Mining, Backgrounder on Process Mining, How ProcessMining Works, Celonis, ProM, Signavio, Fluxicon, ABBYY, The Future of Process Mining Future of RPA: Consolidation and IPOs, Microsoft, Attended Automation, Vertical-Specific Companies, Hype Factor, Software-as-a-Service (SaaS) and Open Source, Chatbots, Artificial Intelligence, Privacy and Ethics		
	Total hours:	**49 hours**

TEXTBOOK:

1. Tom Taulli, “The Robotic Process Automation Handbook”, Apress, 2020
2. Alok Mani Tripathi, “Learning Robotic Process Automation”, March 2018

REFERENCES:

1. .Robotic process and Cognitive Automation by, Mary C Lacity& Leslie P Willcocks, 2018.

PROFESSIONAL ELECTIVE-3

NARAYANA ENGINEERING COLLEGE::GUDUR								
	INFORMATION AND CYBER SECURITY							R20
Course Code	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
	3	1	0	50	3	40	60	100

Course Outcomes: On successful completion of the course, student will be able to:	
CO1	Apply computer security concepts and encryption techniques to enhance the security in a communication model. [BL-3]
CO2	Choose number theory concepts to implement public key cryptosystems. [BL -3]
CO3	Apply hash functions and authentication codes to preserve integration and confidentiality of a message [BL-3]
CO4	Apply user authentication principals and key management issue to applications. [BL-3]
CO5	Design secure applications at Transport/Network Layer and risk free computer system. [BL-3]

CO-PO Mapping

CO	PO												PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2		2						2	3	2
CO2	3	3	2	2		2						2	3	2
CO3	3	3	2	2		2						2	3	2
CO4	3	3	2	2		2						2	3	2
CO5	3	2	2	2		2						2	3	2

1: Low, 2-Medium, 3- High

COURSE CONTENT		
MODULE – 1		**10H**
Cyber crime: Mobile and Wireless devices-Trend mobility-authentication service security Attacks on mobile phones-mobile phone security Implications for organizations-Organizational measurement for Handling mobile-Security policies and measures in mobile computing era. Cases.		
MODULE – 2		**10H**
Tools and methods used in cyber crime-Proxy servers and Anonymizers-Phishing Password cracking-Key loggers and Spy wares-Virus and worms-Trojan Horse and Backdoors Steganography-SQL Injection-Buffer overflow-Attacks on wireless network. Cases		
MODULE – 3		**10H**
Understanding computer forensic-Historical background of cyber forensic Forensic analysis of e-mail-Digital forensic life cycle-Network forensic-Setting up a computer forensic Laboratory-Relevance of the OSI 7 Layer model to computer Forensic-Computer forensic from compliance perspectives. Cases.		
MODULE – 4		**10H**
Forensic of Hand –Held Devices-Understanding cell phone working characteristics-Hand-Held devices and digital forensic- Toolkits for Hand-Held device-Forensic of i-podand digital music devices-Techno legal Challenges with evidence from hand-held Devices. Cases.		
MODULE – 5		**10H**
Cyber Security –Organizational implications-cost of cybercrimes and IPR issues Web threats for organizations: the evils and Perils-Social media marketing Security and privacy Implications-Protecting people privacy in the organizations Forensic best practices for organizations. Cases		
	Total hours:	**50 hours**

TEXTBOOK:

3. Nina Godbole & SunitBelapure ―Cyber Security‖, Wiley India, 2012.
4. Harish Chander, ―cyber laws & IT protection‖, PHI learning pvt.ltd, 2012.

REFERENCES:

6. Dhiren R Patel, ―Information security theory &practice‖, PHI learning pvt Ltd, 2010.
7. MS.M.K.Geetha&Ms.SwapneRaman‖Cyber Crimes and Fraud
8. Management, ‖MACMILLAN, 2012. Pankaj Agarwal : Information Security&
9. Cyber Laws (Acme Learning), Excel, 2013.
10. Vivek Sood, Cyber Law Simplified, TMH, 2012.

NARAYANA ENGINEERING COLLEGE::GUDUR								
	SOFTWARE TESTING							R20
Course Code	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
20CS4007	2	1	0	48	3	40	60	100

Course Outcomes: After successful completion of the course, the student will be able to:	
CO 1	Illustrate the purpose of testing and adequacy assessment using control flow and path testing techniques
CO 2	Demonstrate the strategies in data flow testing to find the test paths of a program
CO 3	Identify the boundary point using domain testing to access appropriate output of system
CO 4	Simplify the path from flow graph using reduction procedure of a program
CO 5	Demonstrate the states and state graph strategies of a program

CO-PO Mapping														
CO	**PO**												**PSO**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	2	2	2	1								3	3
CO2	3	3	2	2	2								3	3
CO3	2	3	2	2	2								3	3
CO4	3	3	2	2	2								3	3
CO5	2	3	2	2	1								3	3
1: Low, 2-Medium, 3- High														

COURSE CONTENT		
MODULE – 1		**9H**
Introduction: Purpose of Testing, Dichotomies, Model for Testing, Consequences of Bugs, Taxonomy of Bugs. **Flow graphs and Path testing:** Basics Concepts of Path Testing, Predicates, Path Predicates and Achievable Paths, Path Sensitizing, Path Instrumentation, Application of Path Testing.		
MODULE – 2		**10H**
Transaction Flow Testing: Transaction Flows, Transaction Flow Testing Techniques. Dataflow testing: Basics of Dataflow Testing, Strategies in Dataflow Testing, Application of Dataflow Testing.		
MODULE – 3		**9H**
Domain Testing: Domains and Paths, Nice & Ugly Domains, Domain testing, Domains and Interfaces Testing, Domain and Interface Testing, Domains and Testability.		
MODULE – 4		**9H**
Paths, Path products and Regular expressions: Path Products & Path Expression, Reduction Procedure, Applications, Regular Expressions & Flow Anomaly Detection. Logic Based Testing: Overview, Decision Tables, Path Expressions, KV Charts, Specifications.		
MODULE – 5		**9H**
State, State Graphs and Transition Testing: State Graphs, Good & Bad State Graphs, State Testing, Testability Tips. **Graph Matrices and Application:** Motivational Overview, Matrix of Graph, Relations, Power of a Matrix, Node Reduction Algorithm, Building Tools.		
	Total hours:	**48hours**

TEXTBOOK:

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

REFERENCES:

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

NARAYANA ENGINEERING COLLEGE::GUDUR								
	INFORMATION STORAGE AND RETRIEVAL SYSTEMS							R20
Course Code	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
20CS4013	3	0	0	50	3	40	60	100

Course Outcomes: After successful completion of the course, the student will be able to:	
CO 1	Understand the different information retrieval models
CO 2	Know about evaluation methods of the information retrieval model
CO 3	Know about text categorization and its implementation
CO 4	Demonstrate the challenges associated with each topic on new domain of retrieval and classification
CO 5	Understand in detail about text search algorithms

CO-PO Mapping														
CO	**PO**												**PSO**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	2	3		3	2									
CO2	2		3	2										
CO3	3	1		2										
CO4	2		2		3		2							
CO5	2		2	2		2								
1: Low, 2-Medium, 3- High														

COURSE CONTENT		
MODULE – 1		**9H**
Introduction to Information Retrieval Systems: Definition of Information Retrieval System, Objectives of Information Retrieval Systems, Functional Overview, Relationship to Database Management Systems, Digital Libraries and Data Warehouses Information Retrieval System Capabilities: Search Capabilities, Browse Capabilities, Miscellaneous Capabilities		
MODULE – 2		**10H**
Cataloging and Indexing: History and Objectives of Indexing, Indexing Process, Automatic Indexing, Information Extraction Data Structure: Introduction to Data Structure, Stemming Algorithms, Inverted File Structure, N-Gram Data Structures, PAT Data Structure, Signature File Structure, Hypertext and XML Data Structures, Hidden Markov Models		
MODULE – 3		**10H**
Automatic Indexing: Classes of Automatic Indexing, Statistical Indexing, Natural Language, Concept Indexing, Hypertext Linkages Document and Term Clustering: Introduction to Clustering, Thesaurus Generation, Item Clustering, Hierarchy of Clusters		
MODULE – 4		**10H**
User Search Techniques: Search Statements and Binding, Similarity Measures and Ranking, Relevance Feedback, Selective Dissemination of Information Search, Weighted Searches of Boolean Systems, Searching the INTERNET and Hypertext Information Visualization: Introduction to Information Visualization, Cognition and Perception, Information Visualization Technologies		
MODULE – 5		**10H**
Text Search Algorithms: Introduction to Text Search Techniques, Software Text Search Algorithms, Hardware Text Search Systems Multimedia Information Retrieval: Spoken Language Audio Retrieval, Non-Speech Audio Retrieval, Graph Retrieval, Imagery Retrieval, Video Retrieval		
	Total hours:	**48 hours**

TEXTBOOK:

1. Information Storage and Retrieval Systems – Theory and Implementation, Second Edition,Gerald J. Kowalski, Mark T. Maybury, Springer

REFERENCES:

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

NARAYANA ENGINEERING COLLEGE::GUDUR							
	CLOUD COMPUTING						R20
Course Code	Hours / Week			Total hrs	Credit	Max Marks	
	L	T	P		C	CIE	SEE	TOTAL
20CS4014	3	0	0	50	3	40	60	100

Course Outcomes: After successful completion of the course, student will be able to:	
CO 1	Summarize the basic concepts of Cloud technologies for development of Cloud applications (BL-2)
CO 2	Develop cloud Applications through Cloud Technologies(BL-3)
CO 3	Interpret Cloud service architectures in Cloud environment(BL-3)
CO 4	Analyse the core issues of cloud computing. (BL-3)
CO 5	Choose appropriate technologies, algorithms and approaches to used in cloud Computing(BL-3)

CO-PO Mapping														
CO	**PO**												**PSO**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	1	1											1	
CO2	3	1											1	
CO3	1	2											2	1
CO4	2	1	2										1	1
CO5	1	1	1										1	
1: Low, 2-Medium, 3- High														

COURSE CONTENT		
MODULE – 1		**9H**
Cloud Computing Insights- Distributed Computing, High Performance Computing, Utility and Enterprise Grid Computing, Cluster Computing**,** Cloud Computing fundamentals, Essential Characteristics, On Demand Self Service, Location independent resource pooling, Elastic Computing, Measured Service, Comparing cloud providers with traditional IT service providers, Vendor Lock-in, security level of third party- Security issues: Government policies.		
MODULE – 2		**10H**
Cloud computing architecture, Layers of Cloud computing- IaaS, PaaS and SaaS, Cloud deployment models- Private, Public, Hybrid and Community Clouds, Advantages of Cloud		

Computing.		
MODULE – 3		**10H**
Introduction, Characteristics of Virtualized Environments, Virtualization and Cloud Computing, Pros and Cons of Virtualization, Virtual machines and Virtualization of Clusters and Data Centres, Case studies – Xen Virtual Machine monitors – Xen API, VMware- VMware products-VMware features, Microsoft Virtual Server- Features of Microsoft Virtual Server, Open stack.		
MODULE – 4		**10H**
CloudsimOpen source framework, Simulate VMs, memory, network, disks; Aneka – Cloud computing Framework for Enterprise Cloud applications development, Aneka Architecture, Programming models: Thread, Task and MapReduce		
MODULE – 5		**10H**
Case studies – Salesforce.com for SaaS application development, GAE- Google App Engine, Microsoft Windows Azure – public resources for VMs and Services, AWS- Amazon Web Services – public cloud registration, Services, OpenStack – Open Source Development Platform for Clouds and tools.		
	Total hours:	**49 hours**

TEXTBOOK:

1. RajkumarBuyya, Christian Vecchiola, S. ThammaraiSelvi, "Mastering Cloud Computing – Foundations and applications", McGraw Hill Publications,
2. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing – A Practical Approach", Mc Graw Hill, Inc, New York, NY, USA.

REFERENCES:

1. Kai Hwang, Geoffrey C Fox, Jack J. Dongarra, "Distributed and Cloud Computing, Morgan Kaufmann.
2. Cloud Computing Principles and Paradigms, John Wiley & Sons publications

NARAYANA ENGINEERING COLLEGE::GUDUR							
	DIGITAL MARKETING						R20
Course Code	Hours / Week			Total hrs	Credit	Max Marks	
	L	T	P		C	CIE	SEE	TOTAL
	3	0	0	49	3	40	60	100

Course Outcomes: On successful completion of the course, student will be able to:	
CO 1	Demonstrate the difference between Traditional Vs. Digital Marketing
CO 2	Describes Search Engine Optimization
CO 3	Describes Website Analysis And Backlinks Building
CO 4	Apply the client-server model in networking applications.
CO 5	Describes various methods of Social media marketing

CO-PO Mapping														
	PO												**PSO**	
	PO	**PO**	**PO**	**PO**	**PO**	**PO**	**PO**	**PO**	**PO**	**PO**	**PO**	**PO**	**PSO**	**PSO**
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**1**	**11**	**12**	**1**	**2**
CO1	3	1	2	2									2	1
CO2	3	2	2	1								1	2	1
CO3	3	2	2	2								1	2	1
CO4	3	2	1	2								1	1	1
CO5	3	3	1	1								1	2	1
1: Low, 2-Medium, 3- High														

COURSE CONTENT		
MODULE – 1	**BASICS of DIGITAL MARKETING**	**9H**
Introduction To Online Digital Marketing, Importance Of Digital Marketing, How did Internet Marketing work?, Traditional Vs. Digital Marketing, Types of Digital Marketing, Increasing Visibility, Visitors' Engagement, Bringing Targeted Traffic, Lead Generation		
MODULE – 2	**SEARCH ENGINE OPTIMIZATION (SEO)**	**10H**
Introduction To Search Engine Optimization, How Did Search Engine work?, SEO Fundamentals & Concepts, Understanding the SERP, Google Processing, Indexing Crawling		
MODULE – 3	**SEO UPDATES AND ANALYSIS**	**10H**
Google Panda, Penguin, Humming Bird Algorithm, Google Penalties, SEO Tools For Website Analysis And Optimization, Competitor Website Analysis And Backlinks Building, Backlinks Tracking, Monitoring, And Reporting		

MODULE – 4	SOCIAL MEDIA OPTIMIZATION (SMO)	10H
Social Media Optimization Introduction To Social Media Networks, Types Of Social Media Websites, Social Media Optimization Concepts, Face book, Google+, LinkedIn, YouTube, Pinterest, Hash tags, Image Optimization		
MODULE – 5	**SOCIAL MEDIA MARKETING (SMM)**	**10H**
Face book Optimization Fan Page Vs Profile Vs Group, Creating Facebook Page For Business, Increasing Fans And Doing Marketing, Face book Analytics, Facebook Advertising And Its Types In Detail Creating Advertising Campaigns, Payment Modes, Introduction To Twitter, Creating Strong Profiles On Twitter, Followers, ReTweets, Clicks, Conversions, HashTags, LinkedIn Optimization, What Is LinkedIn?, Individual Profile Vs. Company Profile, Branding On LinkedIn, Marketing On LinkedIn Groups		
	Total hours:	**49 hours**

TEXTBOOK:

1. Ryan, D. (2014) Understanding Digital Marketing: Marketing Strategies for Engaging the Digital Generation, Kogan Page Limited.
2. The Beginner's Guide to Digital Marketing (2015). Digital Marketer. Pulizzi,J.(2014) Epic Content Marketing, McGraw Hill Education.

REFERENCES:

1. Ryan Deiss& Russ Henneberry, Digital Marketing for Dummies
3. Simon Kings north, Digital Marketing Strategy: An Integrated Approach to Online Marketing

PROFESSIONAL ELECTIVE-4

NARAYANA ENGINEERING COLLEGE::GUDUR							
	WEB APPLICATION SECURITY						R20
Course Code	Hours / Week			Total hrs	Credit	Max Marks	
	L	T	P		C	CIE	SEE	TOTAL
	4	0	0	52	4	40	60	100

Course Outcomes: After successful completion of the course, student will be able to:	
CO 1	Identify the vulnerabilities in the web applications
CO 2	Identify the various types of threats and mitigation measures of web applications
CO 3	Apply the security principles in developing a reliable web application
CO 4	Use industry standard tools for web application security
CO 5	Apply penetration testing to improve the security of web applications.

CO-PO Mapping

CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	2	2		2						2	3	2
CO2	3	3	2	2		2						2	3	2
CO3	3	3	2	2		2						2	3	2
CO4	3	3	2	2		2						2	3	2
CO5	3	2	2	2		2						2	3	2

1: Low, 2-Medium, 3- High

COURSE CONTENT		
MODULE – 1	**Overview of Web Applications & Security**	**10H**
Introduction history of web applications interfaces and structure benefits and drawbacks of web applications Web application Vs Cloud application. Security Fundamentals: Input Validation - Attack Surface Reduction Rules of Thumb-Classifying and Prioritizing Threads		
MODULE – 2	**Web Application Vulnerabilities**	**11H**
Understanding vulnerabilities in traditional client server application and web applications, client state manipulation, cookie based attacks, SQL injection, cross domain attack (XSS/XSRF/XSSI) http header injection. SSL vulnerabilities and testing - Proper encryption use in web application - Session vulnerabilities and testing - Cross-site request forgery		
MODULE – 3	**Web Application Mitigations**	**11H**
Http request , http response, rendering and events , html image tags, image tag security, issue, java script on error , JavaScript timing , port scanning , remote scripting , running remote code, frame and iframe , browser sandbox, policy goals, same origin policy, library import, domain relaxation		
MODULE – 4	**Secure Website Design**	**10H**
Secure website design : Architecture and Design Issues for Web Applications, Deployment Considerations Input Validation, Authentication, Authorization, Configuration Management ,Sensitive Data, Session Management, Cryptography, Parameter Manipulation, Exception Management, Auditing and Logging, Design Guidelines, Forms and validity, Technical implementation		
MODULE – 5	**Cutting Edge Web Application Security**	**10H**
Click jacking - DNS rebinding - Flash security - Java applet security - Single-sign-on solution and security - IPv6 impact on web security, Recent Trends in Web Application Security		
	Total hours:	**52 hours**

TEXTBOOK:

1. Sullivan, Bryan, and Vincent Liu. Web Application Security, A Beginner's Guide. McGraw Hill Professional, 2011.
2. Stuttard, Dafydd, and Marcus Pinto. The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws. John Wiley Sons, 2011

REFERENCES:

1. Shema, M. & Adam. (2010). Seven deadliest web application attacks. Amsterdam: Syngress Media.
2. Stuttard, D. & Pinto, M. (2011). The web application hacker's handbook: Discovering and exploiting security flaws (2nd ed). Indianapolis, IN: Wiley, John & Sons.
3. Heiderich, M., Nava E.A.V., Heyes, G., & Lindsay, D. (2011). Web application obfuscation. Amsterdam: Syngress Media, U.S. Sullivan, Bryan (2012). Web Application Security, A Beginner's Guide. McGraw- Hill Education.

PROFESSIONAL ELECTIVE-4

NARAYANA ENGINEERING COLLEGE::GUDUR							
	OBJECT ORIENTED ANALYSIS AND DESIGN						R20
Course Code	Hours / Week			Total hrs	Credit	Max Marks	
	L	T	P		C	CIE	SEE	TOTAL
20CS2017	3	1	0	48	3	40	60	100
Course Outcomes: After successful completion of the course, the student will be able to:								
CO 1	Apply the basic concepts of object oriented techniques							
CO 2	Design the users view context and diagrams using UML modeling techniques							
CO 3	Identify the basic issues in reusable design and recognize the basic design pattens							
CO 4	Apply OOAD methodology concepts using UML							
CO 5	Design various test cases for OOAD problems							

CO-PO Mapping														
CO	**PO**												**PSO**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	2												
CO2	2	3	3		3								3	
CO3	2	3	3										2	
CO4	2	3	1		2								2	2
CO5	1	3			1								2	2
1: Low, 2-Medium, 3- High														

COURSE CONTENT		
MODULE – 1		**9H**
Introduction: The Structure of Complex systems, The Inherent Complexity of Software, Attributes of Complex System, Organized and Disorganized Complexity, Bringing Order to Chaos, Designing Complex Systems, Evolution of Object Model, Foundation of Object Model, Elements of Object Model, Applying the Object Model.		
MODULE – 2		**10H**
Classes and Objects: Nature of object, Relationships among objects, Nature of a Class, Relationship among Classes, Interplay of Classes and Objects, Identifying Classes and Objects, Importance of Proper Classification, Identifying Classes and Objects, Key abstractions and Mechanisms.		
MODULE – 3		**10H**
Introduction to UML: Why model, Conceptual model of UML, Architecture, Classes, Relationships, Common Mechanisms, Class diagrams, Object diagrams.		
MODULE – 4		**9H**
Structural Modeling: Package Diagram, Composite Structure Diagram, Component Diagram, Deployment Diagram, Profile Diagram.		
MODULE – 5		**10H**
Behavioral Modeling: Use Case Diagram, Activity Diagrams, State Machine Diagrams, Sequence Diagram, Communication Diagram, Timing Diagram, Interaction Overview Diagram.		
	Total hours:	**48 hours**

TEXTBOOK:

1. Object- Oriented Analysis And Design with Applications", Grady BOOCH, Robert A. Maksimchuk, Michael W. ENGLE, Bobbi J. Young, Jim Conallen,Kellia Houston, PEARSON, 3rd edition, 2013.
2. "The Unified Modeling Language User Guide", Grady Booch, James Rumbaugh,Ivar Jacobson, PEARSON 12th Impression, 2012.

REFERENCES:

1. Mahesh P. Matha, Object-oriented analysis and design using UML", , PHI
2. Head first object-oriented analysis and design", Brett D. McLaughlin, Gary Pollice, Dave West, O'Reilly
3. Satzinger, Robert B. Jackson, Stephen D. Burd,Object-oriented analysis and design with the Unified process", John W.Cengage Learning
4. The Unified modeling language Reference manual", James Rumbaugh, Ivar Jacobson, Grady Booch, Addison-Wesley

NARAYANA ENGINEERING COLLEGE::GUDUR								
	DEEP LEARNING							R20
Course Code	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
20CS4015	3	0	0	49	3	40	60	100

Course Outcomes: After successful completion of the course, the student will be able to:	
CO 1	Understand basic concepts of neural networks and back propagation algorithm
CO 2	Analyze the layers in the architecture of convolution neural networks
CO 3	Acquire knowledge on auto encoders, word2vec architecture
CO 4	Explore deep learning models for sequence analysis
CO 5	Understand recurrent and recursive nets.

CO-PO Mapping

CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1			1	2									1	1
CO2	2		2	2									2	2
CO3	1		1	1									1	1
CO4	3		2	2									2	2
CO5			1	1									1	1
1: Low, 2-Medium, 3- High														

COURSE CONTENT		
MODULE – 1		**9H**
Linear Algebra: Scalars, Vectors, Matrices and Tensors, Matrix operations, types of matrices, Norms, Eigen decomposition, Singular Value Decomposition, Principal Components Analysis. Probability and Information Theory: Random Variables, Probability Distributions, Marginal Probability, Conditional Probability, Expectation, Variance and Covariance, Bayes' Rule, Information Theory. Numerical Computation: Overflow and Underflow, Gradient-Based Optimization, Constrained Optimization, Linear Least Squares.		
MODULE – 2		**10H**
Machine Learning: Basics and Under fitting, Hyper parameters and Validation Sets, Estimators, Bias and Variance, Maximum Likelihood, Bayesian Statistics, Supervised and Unsupervised Learning, Stochastic Gradient Descent, Challenges Motivating Deep Learning. Deep Feed forward Networks: Learning XOR, Gradient-Based Learning, Hidden Units, Architecture Design, Back-Propagation and other Differentiation Algorithms		
MODULE – 3		**10H**
Regularization for Deep Learning: Parameter Norm Penalties, Norm Penalties as Constrained Optimization, Regularization and Under-Constrained Problems, Dataset Augmentation, Noise Robustness, Semi-Supervised Learning, Multi-Task Learning, Early Stopping, Parameter Tying and Parameter Sharing, Sparse Representations, Bagging and Other Ensemble Methods, Dropout, Adversarial Training, Tangent Distance, Tangent Prop and Manifold Tangent Classifier. Optimization for Training Deep Models: Pure Optimization, Challenges in Neural Network Optimization, Basic Algorithms, Parameter Initialization Strategies, Algorithms with Adaptive Learning Rates, Approximate Second-Order Methods, Optimization Strategies and Meta-Algorithms		
MODULE – 4		**10H**
Convolutional Networks: The Convolution Operation, Pooling, Convolution, Basic Convolution Functions, Structured Outputs, Data Types, Efficient Convolution Algorithms, Random or Unsupervised Features, Basis for Convolutional Networks		
MODULE – 5		**10H**
Sequence Modelling: Recurrent and Recursive Nets: Unfolding Computational Graphs, Recurrent Neural Networks, Bidirectional RNNs, Encoder-Decoder Sequence-to-Sequence Architectures, Deep Recurrent Networks, Recursive Neural Networks, Echo State Networks, LSTM, Gated RNNs, Optimization for Long-Term Dependencies, Auto encoders, Deep Generative Models		
	Total hours:	**49 hours**

TEXTBOOK:

1. Ian Goodfellow, YoshuaBengio, Aaron Courville, “Deep Learning”, MIT Press,2016.
2. Josh Patterson and Adam Gibson, “Deep learning: A practitioner's approach”, O'Reilly Media, First Edition,2017

REFERENCES:

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

NARAYANA ENGINEERING COLLEGE::GUDUR								
	HIGH PERFORMANCE COMPUTING							R20
Course Code	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
20CS4019	3	1	0	50	3	40	60	100

Course Outcomes: On successful completion of the course, student will be able to:	
CO 1	Describe various Memory Hierarchies
CO 2	Describes optimization techniques for serial code
CO 3	Analyze Taxonomy of parallel computing paradigms
CO 4	Describes Distributed memory parallel programming
CO 5	Explains Shared memory parallel programming with Open MP

CO-PO Mapping -LEVELS														
	PO												**PSO**	
	PO	**PO**	**PO**	**PO**	**PO**	**PO**	**PO**	**PO**	**PO**	**PO**	**PO**	**PO**	**PSO**	**PSO**
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**1**	**11**	**12**	**1**	**2**
CO1	3	1	2	2									2	2
CO2	3	3	2	1								3	2	2
CO3	3	3	2	2								3	2	2
CO4	3	2	1	2								3	2	2
CO5	3	3	1	1								3	2	2
1: Low, 2-Medium, 3- High														

COURSE CONTENT		
MODULE – 1		**9H**
Modern Processors : Stored Program Computer Architecture-General purpose cache- based microprocessor-Performance based metrics and benchmarks- Moore's Law- Pipelining- Super scalarity-SIMD- Memory Hierarchies Cache- mapping- prefetch Multi-core processors- Multithreaded processors- Vector Processors- Design Principles- Maximum performance estimates- Programming for vector architecture		
MODULE – 2		**9H**
Basic optimization techniques for serial code : scalar profiling function and line based runtime profiling- hardware performance counters- common sense optimizations- simple measures, large impact- elimination of common sub expressions- avoiding branches using SIMD instruction sets- the role of compilers – general optimization options- in lining - aliasing- computational accuracy register optimizations- using compiler logs- C++ optimizations -temporaries- dynamic memory management- loop kernels and iterators data access optimization: balance analysis and light speed estimates- storage order- case study: Jacobi algorithm and dense matrix transpose.		

MODULE – 3		10H
Parallel Computers : Taxonomy of parallel computing paradigms- Shared memory computers- Cache coherence- UMA–NUMA Distributed-memory computers- Hierarchical systems- Networks-Basic performance characteristics- Buses- Switched and fat- tree networks- Mesh networks- Hybrids - Basics of parallelization -Why parallelize - Data Parallelism - Function Parallelism- Parallel Scalability- Factors that limit parallel execution- Scalability metrics- Simple scalability laws- parallel efficiency – serial performance Vs Strong scalability- Refined performance models-Choosing the right scaling baseline- Case Study: Can slow processors compute faster- Load balance.		
MODULE – 4		**11H**
Distributed memory parallel programming with MPI: message passing - introduction to MPI – example - messages and point-to point communication - collective communication – non blocking point-to-point communication- virtual topologies – MPI parallelization of Jacobi solver- MPI implementation – performance properties ion Examples. Efficient MPI programming : MPI performance tools communication parameters- Synchronization, serialization, contention- Reducing communication overhead- optimal domain decomposition- Aggregating messages – Non blocking Asynchronous communication- Collective communication- Understanding intra-node point-to-point communication		
MODULE – 5		**11H**
Shared memory parallel programming with Open MP : introduction to Open MP - parallel execution - data scoping- Open MP work sharing for loops- synchronization - reductions - loop scheduling -tasking - case study: Open MP- parallel Jacobi algorithm- advanced open Mp wave front parallelization- Efficient Open MP programming: Profiling Open MP programs - Performance pitfalls ,Case study: Parallel Sparse matrix-vector multiply.		
	Total hours:	**50 hours**

TEXTBOOK:

1. Georg Hager, Gerhard Wellein, Introduction to High Performance Computing for
2. Scientists and Engineers, Chapman & Hall / CRC Computational Science Series,2011.
3. 2Charles Severance, Kevin Dowd, High Performance Computing, O'Reilly Media, 2nd
4. Edition, 1998.

REFERENCES:

1. Kai Hwang, Faye Alaye Briggs, Computer Architecture and Parallel Processing, McGraw Hill, 1984

NARAYANA ENGINEERING COLLEGE::GUDUR								
	AUGUMENTED AND VIRTUAL REALITY							R20
Course Code	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
20CS4020	3	0	0	49	3	40	60	100

Course Outcomes: After successful completion of the course, student will be able to:	
CO 1	Demonstrate human interaction with computers
CO 2	Animate using Virtual reality and 3D Art optimization
CO 3	Design audio and video interaction paradigms
CO 4	Design Data visualization tools
CO 5	Apply VR/AR in various fields in industry

CO-PO Mapping														
CO	**PO**												**PSO**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	1	1											1	
CO2	3	1											1	
CO3	1	2											2	1
CO4	2	1	2										1	1
CO5	1	1	1										1	
1: Low, 2-Medium, 3- High														

COURSE CONTENT		
MODULE – 1		**10H**
How Humans interact with Computers: Common term definition, introduction, modalities through the ages (pre- 20th century, through world war-II, post-world war-II, the rise of personal computing, computer miniaturization), why did we just go over all of this? Types of common HCI modalities, new modalities, the current state of modalities for spatial computing devices, current controllers for immersive computing systems, a note on hand tracking and hand pose recognition. Designing for our Senses, Not our Devices: Envisioning a future, sensory technology explained, who are we building this future for?, sensory design, five sensory principles, Adobe's AR story		
MODULE – 2		**9H**
Virtual Reality for Art: A more natural way of making 3D art, VR for animation. 3D art optimization: Introduction, draw calls, using VR tools for creating 3D art, acquiring 3D models vs making them from scratch. How the computer vision that makes augmented reality possible works:		

Who are we?, a brief history of AR, how and why to select an AR platform, mapping, platforms, other development considerations, the AR cloud.		
MODULE – 3		**10H**
Virtual reality and augmented reality: cross platform theory: Why cross platform? The role of game engines, understanding 3D graphics, portability lessons from video game design, simplifying the controller input. Virtual reality toolkit: open source framework for the community: What is VRTK and why people use it? The history of VRTK, welcome to the steam VR unity toolkit, VRTK v4, the future of VRTK, success of VRTK. Three virtual reality and augmented reality development practices: Developing for virtual reality and augmented reality, handling locomotion, effective use of audio, common interaction paradigms		
MODULE – 4		**10H**
Data and machine learning visualization design and development in spatial computing: Introduction, understanding data visualization, principles for data and machine learning visualization design and development in spatial computing, why data and machine learning visualization works in spatial computing, 2D data visualization vs 3D data visualization in spatial computing, interactivity in data visualizations and in spatial computing, animation, failures in data visualization, good data visualization design optimize 3D spaces, how to create data visualization: data visualization creation pipeline, webXR, data visualization challenges in XR, data visualization industry use case examples of data visualization		
MODULE – 5		**10H**
Character AI and Behaviors: Introduction, behaviors, current practice: Reactive AI, more intelligence in the system, Deliberative AI, machine learning. The virtual and augmented reality health technology ecosystem: VR/AR health technology application design, standard UX isn't intuitive, tutorial: insight Parkinson's experiment, companies, case studies from leading academic institutions		
	Total hours:	**49 hours**

TEXTBOOK:

1. Erin Pangilinan, Steve lukas, and Vasanth Mohan, "Creating Augmented & Virtual Realities", 1st edition, O'REILLY, 2019.

REFERENCES:

1. Steve Aukstakalnis, "Practical Augmented Reality", Pearson Education, 2017.

PROFESSIONAL ELECTIVE-5

NARAYANA ENGINEERING COLLEGE::GUDUR								
	BLOCKCHAIN TECHNOLOGY							R20
Course Code	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
20CS4021	4	1	0	48	4	40	60	100

Course Outcomes: After successful completion of the course, student will be able to:	
CO 1	Demonstrate the foundation of the Block chain technology and understand the processes in payment and funding.
CO 2	Identify the risks involved in building Block chain applications.
CO 3	Review of legal implications using smart contracts.
CO 4	Choose the present landscape of Block chain implementations and Understand Crypto currency markets.
CO 5	Examine how to profit from trading crypto currencies

CO-PO Mapping														
CO	**PO**												**PSO**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	1	1											1	
CO2	3	1											1	
CO3	1	2											2	1
CO4	2	1	2										1	1
CO5	1	1	1										1	
1: Low, 2-Medium, 3- High														

COURSE CONTENT		
MODULE – 1		**10H**
Blockchain concepts: Blockchain, Blockchain application example: Escrow, Blockchain stack, from web 2.0 to the next generation decentralized web, domain specific Blockchain application, Blockchain benefits and challenges. Blockchain application templates: Blockchain application components, design methodology for Blockchain applications, Blockchain applications templates		
MODULE – 2		**10H**
Setting up Ethereum development tools: Ethereum clients, Ethereum languages, Test RPC, Mist Ethereum walle, meta mask, web3 JavaScript API, truffle .Ethereum Accounts: Ethereum Accounts, key pairs, working with EOA Accounts, working with contract accounts.		
MODULE – 3		**10H**
Smart contracts: Smart contract, structure of a contract, setting up and interacting with a contract using Gethclient, setting up and interacting with a contract using Mist Wallet		
MODULE – 4		**9H**
Smart contracts (continued): Smart contract examples, Smart contract patterns. Decentralized Applications: implementing D pps, case studies,		
MODULE – 5		**9H**
Mining: Consensus on Blockchain network, mining, Block validation, state storage in Ethereum.		
	Total hours:	**48 hours**

TEXTBOOK:

1. Arshadeepbahga, Vijay madisetti, “Blockchain Applications A hands-on approach”, VPT2017.
2. Chandramouli Subramanian, Asha A George, Abhilash K A and MeenaKarthikeyan, Blockchain Technology”, Universty Press, 2021

REFERENCES:

1. Imran Bashir, “Mastering Blockchain” Packt Publishing Ltd, March 2017.
2. Melanie swan, “Blokchain blueprint for a new economy”, O’REILLY

NARAYANA ENGINEERING COLLEGE::GUDUR							
	AGILE SOFTWARE DEVELOPMENT						R20
Course Code	Hours / Week			Total hrs	Credit	Max Marks	
	L	T	P		C	CIE	SEE	TOTAL
20CS4022	4	1	0	49	4	40	60	100

Course Outcomes: After successful completion of the course, the student will be able to:	
CO 1	Understand the different types of data sources.
CO 2	Explain data pre-processing model and demonstrate the working on every data type .
CO 3	Apply different Exploratory Data Analysis techniques.
CO 4	Apply different similarity measures, distance measures to find similarity or distances between data.
CO 5	Demonstrate the handling of very large data using Map Reduce.

CO-PO Mapping														
CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3								2				3	3
CO2		3	2						3		2		3	3
CO3		3	3										3	3
CO4				1							3		3	3
CO5			3	3									3	3
1: Low, 2-Medium, 3- High														

COURSE CONTENT		
MODULE – 1		**10H**
Introduction: Need of Agile software development, agile context– Manifesto, Principles, Methods, Values, Roles, Artifacts, Stakeholders, and challenges. Business benefits of software agility.		
MODULE – 2		**10H**
Project Planning: Recognizing the structure of an agile team– Programmers, Managers, Customers. User stories– Definition, Characteristics and content. Estimation– Planning poker, Prioritizing, and selecting user stories with the customer, projecting team velocity for releases and iterations.		
MODULE – 3		**10H**
Project Design: Fundamentals, Design principles–Single responsibility, Open-closed, Liskov substitution, Dependency-inversion, Interface-segregation.		
MODULE – 4		**9H**
Design Methodologies: Need of scrum, Scrum practices –Working of scrum, Project velocity, Burn down chart, Sprint backlog, Sprint planning and retrospective, Daily scrum, Scrum roles– Product Owner, Scrum Master, Scrum Team. Extreme Programming- Core principles, values and practices. Kanban, Feature-driven development, Lean software development.		
MODULE – 5		**10H**
Testing: The Agile lifecycle and its impact on testing, Test driven development– Acceptance tests and verifying stories, writing a user acceptance test, Developing effective test suites, Continuous integration, Code refactoring. Risk based testing, Regression tests, Test automation.		
	Total hours:	**49 hours**

TEXTBOOK:

1. Ken Schawber, Mike Beedle, “Agile Software Development with Scrum”, International Edition, Pearson.
2. Robert C. Martin, “Agile Software Development, Principles, Patterns and Practices”, First International Edition, Prentice Hall.
3. Pedro M. Santos, Marco Consolaro, and Alessandro Di Gioia, “Agile Technical Practices Distilled: A learning journey in technical practices and principles of software design”, First edition, Packt Publisher.

REFERENCES:

1. Lisa Crispin, Janet Gregory, “Agile Testing: A Practical Guide for Testers and Agile Teams”, International edition, Addison Wesley.
2. Alistair Cockburn, “Agile Software Development: The Cooperative Game”, 2nd Edition, Addison-Wesley

NARAYANA ENGINEERING COLLEGE::GUDUR							
	PROGRAMMING FOR DATA SCIENCE						R20
Course Code	Hours / Week			Total hrs	Credit	Max Marks	
	L	T	P		C	CIE	SEE	TOTAL
PE	3	0	2	48	4	40	60	100

Course Outcomes: After successful completion of the course, the student will be able to:	
CO 1	Understand basic concepts of data science
CO 2	Analyze data pre-processing techniques
CO 3	Understand algorithms of data science
CO 4	Apply R programming in data science
CO 5	Evaluate performance evaluation through R in data science

CO-PO Mapping														
CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2	2											
CO2	3	3	3	3										
CO3	3	2	2											
CO4	2				1									
CO5	3		2											
1: Low, 2-Medium, 3- High														

COURSE CONTENT		
MODULE – 1	**INTRODUCTION**	**9H**
Data Science: Introduction to Data Science – Digital Universe – Sources of Data – Information Commons – Data Science Project Life Cycle: OSEMN Framework		
MODULE – 2	**DATA PREPROCESSING**	**10H**
Introduction to Data Preprocessing – Reading, Selecting, Filtering Data – Filtering Missing Values – Manipulating, Sorting, Grouping, Rearranging, Ranking Data		
MODULE – 3	**CONCEPT LEARNING**	**10H**
Formulation of Hypothesis – Probabilistic Approximately Correct Learning - VC Dimension – Hypothesis elimination – Candidate Elimination Algorithm		
MODULE – 4	**ESSENTIALS OF R**	**9H**
R Basics - data types and objects - control structures – data frame -Feature Engineering - scaling, Label Encoding and One Hot Encoding, Reduction **MODEL FIT USING R** Regression Models- Linear and Logistic Model, Classification Models – Decision Tree, Naïve Bayes, SVM and Random Forest, Clustering Models – K Means and Hierarchical clustering		
MODULE – 5	**VISUALIZATION**	**10H**
VISUALIZATION: Data visualization: Box plot, histogram, scatter plot, heat map – Working with Tableau – Outlier detection – Data Balancing **PERFORMANCE EVALUATION in R:** Loss Function and Error: Mean Squared Error, Root Mean Squared Error – Model Selection and Evaluation criteria: Accuracy, Precision, F1 score, Recall Score – Binary Predictive Classification – Sensitivity – Specificity.		
	Total hours:	**48 hours**

TEXTBOOK:

1. Hadley Wickham, Garrett Grolemund, R for data science : Import, Tidy, Transform, Visualize, And Model Data Paperback, 2017
2. Ethem Alpaydin, Introduction to Machine Learning, Fourth Edition, MIT Press, 2020

REFERENCES:

1. Han, J., Kamber, M., Pei, J. Data mining concepts and techniques. Morgan Kaufmann. 2011
2. Carl Shan, Henry Wang, William Chen, Max Song. The Data Science Handbook: Advice and Insight from 25 Amazing Data Scientists. The Data Science Bookshelf. 2016
3. James, G., Witten, D., T., Tibshirani, R. An Introduction to statistical learning with applications in R. Springer. 2013

NARAYANA ENGINEERING COLLEGE::GUDUR							
	CLOUD SECURITY						R20
Course Code	Hours / Week			Total hrs	Credit	Max Marks	
	L	T	P		C	CIE	SEE	TOTAL
PE	3	0	0	48	3	40	60	100

Course Outcomes: On successful completion of the course, student will be able to:	
CO 1	Identify different cloud delivery models.
CO 2	Evaluate security features offered by public cloud providers.
CO 3	Build cloud infrastructure with security in mind.
CO 4	Protect data stored in cloud environments.
CO 5	Build security controls into cloud technologies such as serverless and containers.

CO-PO Mapping														
	PO												**PSO**	
	PO	**PO**	**PO**	**PO**	**PO**	**PO**	**PO**	**PO**	**PO**	**PO**	**PO**	**PO**	**PSO**	**PSO**
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**1**	**11**	**12**	**1**	**2**
CO1	3	1	2	2									2	1
CO2	3	3	2	1								3	2	1
CO3	3	3	2	2								3	2	1
CO4	3	2	1	2								3	1	1
CO5	3	3	1	1								3	2	1
1: Low, 2-Medium, 3- High														

COURSE CONTENT		
MODULE – 1	**Cloud Computing Architectural Framework**	**9H**
Cloud Computing Architectural Framework: Cloud Benefits, Business scenarios, Cloud Computing Evolution, cloud vocabulary, Essential Characteristics of Cloud Computing, Cloud deployment models, Cloud Service Models, Multi- Tenancy, Approaches to create a barrier between the Tenants, cloud computing vendors, Cloud Computing threats, Cloud Reference Model, The Cloud Cube Model, Security for Cloud Computing, How Security Gets Integrated.		
MODULE – 2	**Cloud software security fundamentals**	**10H**
Cloud software security fundamentals: – Security objective, security service, Cloud security design principles, Secure cloud software requirements, Secure development practice, Approaches of cloud software requirements engineering, Security policy implementation, Secure cloud software testing, penetration testing, Disaster recovery, Cloud for BCP/DCP.		
MODULE – 3	**Security and Recovery**	**9H**

Traditional Security, Business Continuity, Disaster Recovery, Risk of insider abuse, Security baseline, Customers actions, Contract, Documentation, Recovery Time Objectives (RTOs), Customers responsibility, Vendor Security Process (VSP).		
MODULE – 4	**Cloud Risk Issues and Challenges**	**10H**
CIA triad, Privacy and Compliance Risk, PCIDSS, Information privacy and privacy law, Common threats and vulnerabilities, Access control issues, service provider Risk. Security policy Implementation, Computer Security incident response team (CSIRT), Virtualization security Management- virtual threats, VM security recommendations, VM security techniques – hardening, securing VM remote access.		
MODULE – 5	**Cloud Security Architecture**	**10H**
General issues, Trusted cloud, Secure execution environments and communications, Micro architecture, Identity management, Access control, Autonomic security, protection, self-healing. Cloud life cycle issues – cloud standards, DMTF, ISO, ETSI, OASI, SNIA, OGF, OWASP, Incident response, Internet Engineering Task Force Incident- Handling Guidelines, Computer security and response team, Encryption and key management, VM Architecture, Key Protection, Hardware protection, VM life cycle.		
	Total hours:	**48 hours**

TEXTBOOK:

1. Ronald L. Krutz, Russell Dean Vines, “Cloud Security”, Wiley publication 2010 J.R. ("Vic") Winkler, “Securing the Cloud” Syngress, 2011.
2. Tim Mather, Subra Kumaraswamy, Shahed Latif, “Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance” O'Reilly Media; 1 edition, 2009.

REFERENCES:

1. Toby Velte, Anthony Velte, Robert Elsenpeter, Cloud Computing, A Practical Approach, Tata McGraw-Hill Education, 2009.
2. GautamShroff, Enterprise Cloud Computing Technology Architecture Applications, Cambridge University Press, 2010.

NARAYANA ENGINEERING COLLEGE::GUDUR							
	VIRTUALIZATION TECHNOLOGIES						R20
Course Code	Hours / Week			Total hrs	Credit	Max Marks	
	L	T	P		C	CIE	SEE	TOTAL
20CS4025	3	0	0	49	3	40	60	100

Course Outcomes: On successful completion of the course, student will be able to:	
CO 1	Describes the virtualisation process and Taxonomy of Virtual Machines
CO 2	Identifies Various Partitioning Techniques and Types of Server Virtualization
CO 3	Defines various Networks-Virtualizing, WAN Design and Virtualization Routing Protocols.
CO 4	Details the Storage Virtualization
CO 5	Differentiates various Virtualization Technologies

CO-PO Mapping														
	PO												**PSO**	
	PO	**PO**	**PO**	**PO**	**PO**	**PO**	**PO**	**PO**	**PO**	**PO**	**PO**	**PO**	**PSO**	**PSO**
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**1**	**11**	**12**	**1**	**2**
CO1	3	1	2	2									2	1
CO2	3	3	2	1								1	2	1
CO3	3	3	2	2								1	2	1
CO4	3	2	1	2								1	1	1
CO5	3	3	1	1								1	2	1
1: Low, 2-Medium, 3- High														

COURSE CONTENT		
MODULE – 1		**9H**
Introduction To Virtualization System Architectures - Virtual Machine Basics- Process Virtual Machines - System Virtual Machines - Taxonomy of Virtual Machines - Emulation: Basic Interpretation – Threaded Interpretation - Pre-Coded & Direct Interpretation - Binary Translation - Full and Para-Virtualization - Types of Hypervisor- Types of Virtualization.		
MODULE – 2		**10H**
Server Virtualization Server Virtualization - Partitioning Techniques-Hardware Virtualization - Virtual Hardware -Types of Server Virtualization -Business Cases for Sever Virtualization-Uses of Virtual Server Consolidation -Selecting Server Virtualization Platform.		
MODULE – 3		**10H**

Network Virtualization Design of Scalable Enterprise Networks-Virtualizing the Campus - WAN Design-WAN Architecture - WAN virtualization -Virtual Enterprise Transport Virtualization - VLANs and Scalability - Theory Network Device Virtualization Layer 2 -VLANs Layer 3 VRF In stances Layer 2 - VFls Virtual Firewall Contexts Network Device Virtualization -Datapath Virtualization Layer 2: 802.1q-Trunking Generic Routing Encapsulation -IPSec L2TPv3Label Switched Paths-Control-Plane Virtualization -Routing Protocols -VRF- Aware Routing - Multi-Topology Routing.		
MODULE – 4		**10H**
Storage Virtualization Devices - SCSI -SCSI Communication -Using SCSI Buses - Fiber Channel -Fiber Channel Cables -Fiber Channel Hardware Devices – i-SCSI Architecture – Securing i-SCSI SAN Backup & Recovery Techniques - RAID -Classic Storage Model - SNIA Shared Storage Model Host based Architecture - Storage based architecture - Network based Architecture - Fault tolerance to SAN-Performing Backups - Virtual Tape Libraries		
MODULE – 5		**10H**
Applying Virtualization Comparison of Virtualization Technologies: Guest OS, Host OS, Hypervisor, Emulation, Kernel Level -Shared Kernel-Enterprise Solutions: Vm ware Server, ESXi, Citrix Xen Server, Microsoft Virtual PC, Microsoft Hyper-V, Virtual Box - Server Virtualization: Configuring Server with Server Virtualization, Adjusting & Tuning Virtual Servers, VM Backup and Migration -Desktop Virtualization: Terminal Services, Hosted Desktop, Web Based Solutions, Localized Virtualized Desktop-Network and Storage Virtualization: VPN,VLAN, SAN and VSAN, NAS.		
	Total hours:	**49 hours**

TEXTBOOK:

1. Chris Wolf, Erick M. Halter, “Virtualization: From the Desktop to the Enterprise’, APress, 2005.
2. James E. Smith, Ravi Nair, “Virtual Machines: Versatile Platforms for Systems and Processes’, Elsevier/Morgan Kaufmann, 2005.
3. David Marshall, Wade A. Reynolds, “Advanced Server Virtualization: VMware and Microsoft Platform in the Virtual Data Center’, Auerbach Publications, 2006.

REFERENCES:

1. William von Hagen, “Professional Xen Virtualization’, Wrox Publications, January, 2008.
2. Kumar Reddy, Victor Moreno, “Network virtualization”, Cisco Press, July, 2006.
3. Amy Newman, Kenneth Hess, “Practical Virtualization Solutions: Virtualization from the Trenches", Prentice Hall, October 2009.