NARAYANA ENGINEERING COLLEGE::GUDUR

AUTONOMOUS

B.Tech

C.S.E

Course Structure

&

Syllabus

(w.e.f 2021-22 academic year)

(NECR B.Tech 21)

NARAYANA

ENGINEERING COLLEGE

(AUTONOMOUS)

NARAYANA ENGINEERING COLLEGE::GUDUR

AUTONOMOUS

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

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

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.

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.

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.

NARAYANA ENGINEERING COLLEGE::GUDUR

AUTONOMOUS

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

B.Tech – CSE - Course Structure, w.e.f AY: 2021-22

SEMESTER - I

Course Code	Category	Course Title	Contact Periods per week				Credits	Scheme of Examination Max. Marks		
			L	T	P	Total		Int. Marks	Ext. Marks	Total marks
21MA1001	BS	Algebra and Calculus	3	1	0	4	4	40	60	100
21CH1001	BS	Chemistry	3	0	0	3	3	40	60	100
21ES1001	ES	Problem Solving and Programming	3	0	0	3	3	40	60	100
21EN1001	HS	English	2	0	0	2	2	40	60	100
21CH1501	BS	Chemistry Lab	0	0	3	3	1.5	40	60	100
21ES1503	ES	Engineering Graphics	0	1	4	5	3	40	60	100
21ES1501	ES	Problem Solving and Programming lab	0	0	3	3	1.5	40	60	100
21EN1501	HS	English Language Lab	0	0	3	3	1.5	40	60	100
21CS8101	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	Category	Course Title	Contact Periods per week				Credits	Scheme of Examination Max. Marks		
			L	T	P	Total		Int. Marks	Ext. Marks	Total marks
21MA1002	BS	Probability and Statistics	3	1	0	4	4	40	60	100
21PH1004	BS	Semiconductor Physics	3	0	0	3	3	40	60	100
21ES1004	ES	Basic Electrical and Electronics Engineering	3	0	0	3	3	40	60	100
21ES1005	ES	Python Programming and Data Science	3	0	0	3	3	40	60	100
21PH1504	BS	Semiconductor physics lab	0	0	3	3	1.5	40	60	100
21ES1507	ES	Basic Electrical and Electronics Engineering lab	0	0	2	2	1	40	60	100
21ES1505	ES	Engineering and IT Workshop	0	0	3	3	1.5	40	60	100
21ES1508	ES	Python Programming and Data Science Lab	0	0	3	3	1.5	40	60	100
21EN1502	HS	Communication Skills Lab	0	0	2	2	1	40	60	100
21MC8102-13	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	Category	Course Title	Contact Periods per week				Credits	Scheme of Examination Max. Marks		
			L	T	P	Total		Int. Marks	Ext. Marks	Total marks
21EN1002	HS	Universal Human Values	3	0	0	3	3	40	60	100
21ES1009	ES	Data Structures and Algorithms	3	0	0	3	3	40	60	100
21CS2001	PC	Computer Organization and Architecture	3	0	0	3	3	40	60	100
21CS2002	PC	Database Management Systems	3	0	0	3	3	40	60	100
21CS2003	PC	Mathematical Foundation for Computer Science	3	0	0	3	3	40	60	100
21CS2004	PC	Object Oriented Programming through Java	3	0	0	3	3	40	60	100
21ES1513	ES	Data Structures and Algorithms Lab	0	0	3	3	1.5	40	60	100
21CS2501	PC	Database Management Systems Lab	0	0	3	3	1.5	40	60	100
21CS2502	PC	Object Oriented Programming through Java Lab	0	0	3	3	1.5	40	60	100
21CD6001	SC	Career competency development I	0	0	2	2	1	40	60	100
21CC6001	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			
			18	**0**	**14**	**32**	**24.5**	**440**	**660**	**1100**

SEMESTER –IV

Course Code	Category	Course Title	Contact Periods per week				Credits	Scheme of Examination Max. Marks		
			L	T	P	Total		Int. Marks	Ext. Marks	Total marks
21MA1007	BS	Exploratory Data Analysis with R	3	0	0	3	3	40	60	100
21CS2005	PC	Computer Networks	3	0	0	3	3	40	60	100
21CS2006	PC	Operating Systems	3	0	0	3	3	40	60	100
21CS2007	PC	Software Engineering	3	0	0	3	3	40	60	100
	OE	Open Elective I	3	0	0	3	3	40	60	100
21MA1501	BS	Exploratory Data Analysis with R Lab	0	0	3	3	1.5	40	60	100
21CS2503	PC	Operating Systems and Computer Networks Lab	0	0	3	3	1.5	40	60	100
21CS2504	PC	Software Engineering Lab	0	0	3	3	1.5	40	60	100
21CD6002	SC	Career Competency development II	0	0	2	2	1	40	60	100
21IC6001	SC	Industry oriented Course-I	0	0	0	0	1	100	--	100
21MC8102-13	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**	**460**	**540**	**1000**

SEMESTER –V

Course Code	Category	Course Title	Contact Periods per week				Credits	Scheme of Examination Max. Marks		
			L	T	P	Total		Int. Marks	Ext. Marks	Total marks
21CS2008	PC	Artificial Intelligence	3	0	0	3	3	40	60	100
21CS2009	PC	Design and Analysis of Algorithms	3	0	0	3	3	40	60	100
21CS2010	PC	Theory of Computation	3	0	0	3	3	40	60	100
	OE	Open Elective II	3	0	0	3	3	40	60	100
21CS4001-05	PE	Professional Elective I	3	0	0	3	3	40	60	100
21CS2505	PC	Artificial intelligence lab	0	0	2	2	1	40	60	100
21CS2506	PC	Coding Lab	0	0	2	2	1	40	60	100
21CS2507	PC	Design and Analysis of Algorithms Lab	0	0	2	2	1	40	60	100
21CD6003	SC	Career competency development III	0	0	2	2	1	40	60	100
21CC6002	SC	Value added Course/Certificate Course II	0	0	0	0	1	40	60	100
21CS7501	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**	**660**	**1100**

SEMESTER –VI

Course Code	Category	Course Title	Contact Periods per week				Credits	Scheme of Examination Max. Marks		
			L	T	P	Total		Int. Marks	Ext. Marks	Total marks
21HS5001-05	HS	Humanities and Social Science Elective	2	0	0	2	2	40	60	100
21CS2011	PC	Data Analytics	3	0	0	3	3	40	60	100
21CS2012	PC	Web Technologies	3	0	0	3	3	40	60	100
	OE	Open elective III	3	0	0	3	3	40	60	100
21CS4006-10	PE	Professional elective II	3	0	0	3	3	40	60	100
21CS4011-15	PE	Professional Elective III	3	0	0	3	3	40	60	100
21CS2508	PC	Data Analytics Lab	0	0	2	2	1	40	60	100
21CS2509	PC	Web Technologies Lab	0	0	3	3	1.5	40	60	100
21CD6004	SC	Career competency Development IV	0	0	2	2	1	40	60	100
21IC6002	SC	Industry oriented Course-II	0	0	0	0	1	100	--	100
21MC8102-13	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			
			19	**0**	**10**	**29**	**21.5**	**460**	**540**	**1000**

SEMESTER –VII

Course Code	Category	Course Title	Contact Periods per week				Credits	Scheme of Examination Max. Marks		
			L	T	P	Total		Int. Marks	Ext. Marks	Total marks
21CS2013	PC	Cryptography and Network Security	3	0	0	3	3	40	60	100
21CS2014	PC	Mobile Application Development	3	0	0	3	3	40	60	100
21CS2015	PC	Machine Learning	2	0	0	2	2	40	60	100
	OE	Open Elective IV	3	0	0	3	3	40	60	100
21CS4016-20	PE	Professional Elective IV	3	0	0	3	3	40	60	100
21CS4021-25	PE	Professional Elective V	3	0	0	3	3	40	60	100
21CS2510	PC	Mobile Application Development Lab	0	0	2	2	1	40	60	100
21CS2511	PC	Machine Learning Lab	0	0	3	3	1.5	40	60	100
21CD6005	SC	Career Competency Development V	0	0	2	2	1	40	60	100
21CC6501	SC	Skill Development Training	0	0	2	2	1	40	60	100
21CS7502	PR	Internship II/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			
			17	**0**	**12**	**29**	**23**	**440**	**660**	**1100**

SEMESTER –VIII

Course Code	Category	Course Title	Contact Periods per week				Credits	Scheme of Examination Max. Marks		
			L	T	P	Total		Int. Marks	Ext. Marks	Total marks
21CS7503	PR	Project work, Seminar and internship	0	0	0	0	12	60	140	200
			0	**0**	**0**	**0**	**12**	**60**	**140**	**200**

OPEN ELECTIVES (OE) – FOR OTHER BRANCHES

OPEN ELECTIVES OFFERED BY DEPARTMENT OF CSE	
Course code	**TITLE OF THE COURSE**
21CS3001	Data Structures and Algorithms
21CS3002	Python Programming and Data Science
21CS3003	Object Oriented Programming through JAVA
21CS3004	Advanced Java Programming
21CS3005	Database Management Systems
21CS3006	Operating Systems
21CS3007	Computer Networks
21CS3008	Mobile Application Development
21CS3009	Web Technologies
21CS3010	Artificial intelligence
21CS3011	Cryptography and Network Security
21CS3012	Cloud Computing

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	Sensor Networks 21CS4001	Ethical Hacking 21CS4006	Information and Cyber Security 21CS4011	Computer Forensics 21CS4016	Block chain Technologies 21CS4021
Software Engineering	Software Project Management 21CS4002	Software Architecture 21CS4007	Software Testing 21CS4012	Object Oriented Analysis and Design 21CS4017	DEVOPS 21CS4022
Data Science and Engineering	Data warehousing and data mining 21CS4003	Business Intelligence and Analytics 21CS4008	Information Storage and Retrieval Systems 21CS4013	Predictive Modeling and Analytics 21CS4018	Tools and Techniques for Data Science 21CS4023
Cloud Computing	Distributed Systems 21CS4004	Service Oriented Architecture 21CS4009	Cloud Computing 21CS4014	High Performance Computing 21CS4019	Cloud Security 21CS4024
Virtualization and Others	Game Development 21CS4005	Robotic Process Automation 21CS4010	Deep Learning 21CS4015	Augmented and Virtual Reality 21CS4020	Virtualization Technologies 21CS4025
MOOCS	MOOCS-1 21CS4026	MOOCS-2 21CS4027	MOOCS-3 21CS4028	MOOCS-4 21CS4029	MOOCS-5 21CS4030

LIST OF HONOR SUBJECTS

Course code	Course Name	L-T-P	Credits
21CSH001	Secure Software Engineering	3-1-0	4
21CSH002	Multicore Architecture & Programming	3-1-0	4
21CSH003	Reinforcement Learning	3-1-0	4
21CSH004	Trusted Network Systems	3-1-0	4
21CSH005	Parallel Database Systems		

LIST OF MINOR SUBJECTS

Course code	Course Name	L-T-P	Credits
21CSM001	Design and Analysis of Algorithms	3-1-0	4
21CSM002	Database Management Systems	3-1-0	4
21CSM003	Software Engineering	3-1-0	4
21CSM004	Operating Systems	3-1-0	4
21CSM005	Artificial Intelligence	3-1-0	4

Humanities and Social Science Elective

S. NO	SUBJECT	CREDITS
1	Managerial Economics & Financial Analysis	3
2	Management Science	3
3	E-Business	3
4	Organizational Behavior	3
5	Enterprise Resource Planning	3

HUMANITIES AND SOCIAL SCIENCES (HS)

SEMESTER	Course code	SUBJECT	CREDITS
I Sem	21EN1001	English	2
	21EN1501	English Language Lab	1.5
II Sem	21EN1502	Communication Skills Lab	1
III Sem	21EN1002	Universal Human Values	3
VI Sem	21HS5001-05	Humanities and Social Science Elective	2
		TOTAL	**9.5**

BASIC SCIENCES (BS)

SEMESTER	Course code	SUBJECT	CREDITS
I Sem	21MA1001	Algebra and Calculus	4
	21CH1001	Chemistry	3
	21CH1501	Chemistry Lab	1.5
II Sem	21MA1002	Probability and Statistics	4
	21PH1004	Semiconductor Physics	3
	21PH1504	Semiconductor physics lab	1.5
IV Sem	21MA1007	Exploratory Data Analysis with R	3
	21MA1501	Exploratory Data Analysis with R Lab	1.5
		TOTAL	**21.5**

ENGINEERING SCIENCES (ES)

SEMESTER	Course code	SUBJECT	CREDITS
I Sem	21ES1001	Problem Solving and Programming	3
	21ES1503	Engineering Graphics Lab	3
	21ES1501	Problem Solving and Programming lab	1.5
II Sem	21ES1004	Basic Electrical and Electronics Engineering	3
	21ES1005	Python Programming and Data Science	3
	21ES1507	Basic Electrical and Electronics Engineering lab	1
	21ES1505	Engineering and IT Workshop	1.5
	21ES1508	Python Programming and Data Science Lab	1.5
III Sem	21ES1009	Data Structures and Algorithms	3
	21ES1513	Data Structures and Algorithms lab	1.5
		TOTAL	**22**

PROFESSIONAL CORE (PC)

SEMESTER	Course code	SUBJECT	CREDITS
III Sem	21CS2001	Computer Organization and Architecture	3
	21CS2002	Database Management Systems	3
	21CS2003	Mathematical Foundation for Computer Science	3
	21CS2004	Object Oriented Programming through Java	3
	21CS2501	Database Management Systems lab	1.5
	21CS2502	Object Oriented Programming through Java Lab	1.5
IV Sem	21CS2005	Computer Networks	3
	21CS2006	Operating Systems	3
	21CS2007	Software Engineering	3
	21CS2503	Operating Systems and Computer Networks Lab	1.5
	21CS2504	Software Engineering Lab	1.5
V Sem	21CS2008	Artificial Intelligence	3
	21CS2009	Design and Analysis of Algorithms	3
	21CS2010	Theory of Computation	3
	21CS2505	Artificial intelligence lab	1
	21CS2506	Coding Lab	1
	21CS2507	Design and Analysis of Algorithms Lab	1
VI Sem	21CS2011	Data Analytics	3
	21CS2012	Web Technologies	3
	21CS2508	Data Analytics Lab	1
	21CS2509	Web Technologies Lab	1.5
VII Sem	21CS2013	Cryptography and Network Security	3
	21CS2014	Mobile Application Development	3
	21CS2015	Machine Learning	2
	21CS2510	Mobile Application Development Lab	1.5
	21CS2511	Machine Learning Lab	1
		TOTAL	**58**

PROFESSIONAL ELECTIVES (PE)

SEMESTER	Course code	SUBJECT	CREDITS
V Sem	21CS4001-05	Professional elective 1	3
VI Sem	21CS4006-10	Professional elective 2	3
	21CS4011-15	Professional elective 3	3
VII Sem	21CS4016-20	Professional elective 4	3
	21CS4021-25	Professional elective 5	3
		TOTAL	**15**

OPEN ELECTIVES (OE)

SEMESTER	Course code	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	Course code	SUBJECT	CREDITS
III SEM	21CD6001	Career competency development I	1
	21CC6001	Value added course/Certificate course I	1
IV SEM	21CD6002	Industry oriented Course-I	1
	21IC6001	Career Competency development II	1
V SEM	21CD6003	Career competency development III	1
	21CC6002	Value added Course/Certificate Course II	1
VI SEM	21CD6004	Career competency Development IV	1
	21IC6002	Industry oriented Course-II	1
VII SEM	21CD6005	Career competency Development V	1
	21CC6501	Skill development Training	1
		TOTAL	10

PROJECT (PR)

SEMESTER		SUBJECT	CREDITS
V Sem	21CS7501	Internship I/On job Training/Comm. Service Project	1.5
VII Sem	21CS7502	Internship II/On job Training/Comm. Service Project	1.5
VIII Sem	21CS7503	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	3	0	0	2	0	0	**9.5**
BS	8.5	8.5	0	4.5	0	0	0	0	**21.5**
ES	7.5	10	4.5	0	0	0	0	0	**22**
PC	0	0	15	12	12	8.5	10.5	0	**58**
OE	0	0	0	3	3	3	3	0	**12**
PE	0	0	0	0	3	6	6	0	**15**
PR	0	0	0	0	1.5	0	1.5	12	**15**
SC	0	0	2	2	2	2	2	0	**10**
TOTAL	**19.5**	**19.5**	**24.5**	**21.5**	**21.5**	**21.5**	**23**	**12**	**163**

SEMESTER-I

NARAYANA ENGINEERING COLLEGE: GUDUR								
I-B. Tech	ALGEBRA AND CALCULUS							R-2021
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
I	3	1	0	64	4	40	60	100

Pre-requisite: Intermediate Mathematics

Course Objectives:

1. To familiarize the students with the theory of matrices and quadratic forms.
2. To analyze second order ordinary differential equations.
3. To explain the series expansions using mean value theorems and the concepts of multivariable calculus.
4. To summarize the procedure to solve the partial differential equations.
5. To explain the student with mathematical tools needed in evaluating multiple integrals and its applications.

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

CO 1	**Make use** the concepts of Matrices **to solve various Engineering problems. (BL-3)**
CO 2	**Identify** different types of higher order differential equations and their applications **in solving engineering problems. (BL-3)**
CO 3	**Apply** Mean value theorems, Multi variable calculus **to solve engineering problems. (BL-3)**
CO 4	**Apply** a range of techniques **for solutions of first order Linear and non-Linear Partial Differential Equations (PDE). (BL-3)**
CO 5	**Apply** the techniques of multiple integrals **for the area and volume of the region bounded by curves. (BL-3)**

CO-PO Mapping

CO	PO												PSO	
	PO1	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												
CO2	3	3												
CO3	3	3												
CO4	3	3												
CO5	3	3												

1- Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1	Matrices	Hours: 16h(12L+4T)

Rank of a matrix by echelon form, normal form. Solving system of homogeneous and non-homogeneous linear equations. Eigen values and Eigenvectors and their properties (without proof), Cayley-Hamilton theorem (without proof), finding inverse and powers of a matrix by Cayley-Hamilton theorem, Diagonalization.

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

1. Solving system of linear equations. (BL-3)
2. Determine the rank, eigen values and eigenvectors. (BL-3)
3. Find the inverse and powers of a square matrix by Cayley-Hamilton Theorem. (BL-1)

MODULE -2	Higher Order Ordinary Differential Equations with Constant Coefficients	Hours: 14h(11L+3T)

Definitions, homogenous and non-homogenous, Complimentary function, general solution, particular integral, method of variation of parameters. applications to L-C-R Circuits

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

1. Identify the essential characteristics of linear differential equations with constant coefficients. (BL-3)
2. Solve the linear differential equations with constant coefficients by appropriate method. (BL-3)
3. Classify and interpret the solutions of linear differential equations. (BL-2)
4. Solve the higher order differential equation by analyzing physical situations. (BL-3)

MODULE-3	Mean Value Theorems and Multivariable Calculus	Hours: 12h (9L+3T)

Taylor's and Maclaurin's theorems with remainders (without proof), related problems, Partial differentiation, Chain rule, Total derivative, Jacobians, maxima and minima of functions of two variables, method of Lagrange's multipliers.

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

1. Translate the given function as series of Taylor's and Maclaurin's with remainders. (BL-2)
2. Find the maximum and minimum values of the function for two variables. (BL-1)
3. Apply Jacobian concept to deal with problems in change of variables. (BL-3)

MODULE-4	Partial Differential Equations	Hours: 10h (7L+3T)

Introduction and formation of Partial Differential Equations by elimination of arbitrary constants and arbitrary functions, Solutions of first order linear partial differential equations using Lagrange's method, Solutions of first order non-linear partial differential equations- Standard forms-I, II, III and IV, Method of separation of variables.

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

1. Identify the basic properties of partial differential equations. (BL-3)
2. Outline partial differential equations. (BL-2)
3. Solve the applications of PDE by using the method of separation of variables. (BL-3)
4. Apply the PDE techniques in various engineering fields. (BL-3)

MODULE-5	Multiple Integrals	Hours: 12h(9L+3T)

Double integrals, change of order of integration, change of variables. Evaluation of Triple integrals, change of variables between Cartesian, Cylindrical and Spherical polar coordinates. Finding areas and volumes using double and triple integrals.

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

1. Find the area bounded by a region using double integration. (BL-1)
2. Solve triple integrals. (BL-3)
3. Make Use of multiple integral techniques in engineering problems. (BL-3)

Total hours	64h (48L+16T)

Content beyond syllabus:

1. L-U decomposition.
2. Deflection of Beams.
3. Taylor's series for function of two variables.
4. Homogeneous Linear Partial differential equations with constant coefficients.
5. Calculation of mass, Centre of gravity, moment of inertia.

Self-Study:
Contents to promote self-Learning:

SNO	Topic	CO	Reference
1	Matrices	CO1	https://youtu.be/P2pL5VThrzQ
2	Higher Order Ordinary Differential equations with constant coefficients	CO2	https://youtu.be/P7gVp333B6M https://youtu.be/btOCUmJkrrg
3	Mean value theorems & Multivariable Calculus	CO3	https://youtu.be/bJPuy0QZ-tE https://youtu.be/0apMXhWG_W8
4	Partial Differential Equations	CO4	https://youtu.be/kZ7Oa7iMiCs
5	Multiple Integrals	CO5	https://youtu.be/mIeeVrv447s

Text Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2011.
2. B.S. Grewal, Higher Engineering Mathematics, 44/e, Khanna publishers, 2017.

Reference Book(s):

1. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 5/e, 2019 Narosa Publishing house
2. B. V. Ramana, Higher Engineering Mathematics, McGraw Hill Education,2017
3. H. K. Das, Er. RajnishVerma, Higher Engineering Mathematics, S. Chand,2014
4. N. Bali, M. Goyal, C. Watkins, Advanced Engineering Mathematics, Infinity Science Press,9th edition 2020.

Online Resources/ Web References:

1. http://www.macs.hw.ac.uk/~simonm/linalg.pdf
2. http://www.efunda.com/math/math_home/math cfm
3. http://www.ocw.mit.edu/resources/#Mathematics
4. http://www.sosmath.com/
5. http://www.mathworld.wolfram.com/

NARAYANA ENGINEERING COLLEGE :: GUDUR								
21CH1001	CHEMISTRY							**R21**
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: Basic concepts in chemistry, Advanced engineering materials, chemistry in day to day life, Fossil fuels

Course Objectives:

1. To impart technological aspects of modern chemistry and its applications.
2. Understand the chemistry behind electrochemical energy systems.
3. To train the students on the principles and applications of polymers.
4. To acquire knowledge of engineering materials and fuels.

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

CO 1	**Outline** the molecular orbital energy level diagram **of different molecular species.(BL-2)**
CO 2	**Interpret** the knowledge about various kinds **of electro chemical cells. (BL-2)**
CO 3	**Describe** various energy storage devices and emerging technologies **in engineering applications.(BL-2)**
CO 4	**Demonstrate** the various preparation mechanisms of different polymers **in engineering applications.(BL-3)**
CO 5	**Interpret** calorific values, refining **of petroleum and cracking of oils.(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													
CO2	3	2				2	2							
CO3	3					2	2							
CO4	3					2	2							
CO5	3	2				2	2							

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1	Structure and Bonding Models	10 Hrs

Structure and Bonding Models: Dual nature of matter- De Broglie's equation, Schrodinger wave equation, Molecular orbital theory – bonding in homo and hetero nuclear diatomic molecules– energy level diagrams of O_2 and CO, etc. π-molecular orbital's of butadiene and benzene, calculation of bond order and magnetic properties, Crystal field theory – salient features – splitting in octahedral and tetrahedral complex.

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

1. **Understand** the fundamental concepts of chemistry to predict the structure, properties and bonding of Engineering materials**.(BL-2)**
2. **Explain** the calculation of bond order of O_2 and Co molecules**.(BL-2)**
3. **Discuss** the magnetic behavior and colour of coordination compounds**.(BL-2)**

MODULE -2	Electro Chemistry	10 Hrs

Electro chemistry: Electrode potential, EMF of an electrochemical cell, Nernst equation, Electrodes – concepts, reference electrodes (standard hydrogen, Calomel electrode, and glass electrode), potentiometry- potentiometric titrations (red ox titrations), concept of conductivity, conductometric titrations (acid- base titrations). PV Cell and its applications.

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

1. **Demonstrate** competency in the basic concepts of electrochemical cells. **(BL-3)**
2. **Explai**n the significance of electrode potentials. **(BL-2)**
3. **List** the different types of electrodes. **(BL-1)**
4. **Differentiate** between Potentiometric and conductometric titrations. **(BL-2)**
5. **Illustrate** the construction of PV cell. **(BL-3)**

MODULE-3	Battery Technology	09 Hrs

Battery Technology: Introduction, classification of batteries, Important applications of batteries, Modern batteries- zinc-air, lithium cells,Li- MnO_2 cell, Ni-Cd cell, lead acid storage cell. Fuel cells- Introduction – classification, hydrogen - oxygen fuel cell, methanol - oxygen fuel cell, SOFC - Merits and demerits of fuel cell.

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

1. **Classify** batteries into different types. **(BL-3)**
2. **Explain** the concept involved in the construction of batteries. **(BL-2)**
3. **Identify** the significance of batteries**.(BL-1)**
4. **Compare** the merits of different fuel cells. **(BL-2)**

MODULE-4	Polymer Chemistry	10 Hrs

Polymer Chemistry: Introduction to polymers, polymerization, types of polymerization, mechanism of polymer formation. Plastics - Thermoplastics and Thermosetting, Preparation, properties and applications of –PVC,PTFE, Bakelite, Urea- formaldehyde resin, Nylons. Natural Rubber, processing, vulcanization. Elastomers–Buna-S, Buna-N–preparation, properties and applications. Conducting polymers – poly acetylene, poly aniline, mechanism of conduction and applications.

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

1. **Identify** different types of polymers. **(BL-1)**
2. **Distinguish** between thermoplastic and thermo setting resins. **(BL-2)**
3. **Explain** the preparation, properties and applications of some plastic materials. **(BL-2)**
4. **Apply** the knowledge of advanced polymers, conducting polymers for different Applications. **(BL-3)**

MODULE-5	Fuel Technology	09 Hrs

Fuel Technology: Introduction, Types of fuels, characteristics of good fuel, units, calorific value, HCV &LCV,Solid fuels, Analysis of coal-proximate and ultimate. Liquid Fuels: refining of petroleum, synthetic petrol preparation by Fischer- tropsch Process,Gaseous fuels;Natural gas,water gas,producer gas and coal gas.

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

1. **Differentiate** petroleum, petrol, synthetic petrol and have knowledge how they are produced. **(BL-2)**
2. **Select** suitable fuels for IC engines. **(BL-1)**
3. **Explain** calorific values, octane number, refining of petroleum and cracking of oils. **(BL-2)**

Total hours:	**48 Hours**

Content beyond syllabus:

1. Valency bond theory
2. Compounding of natural rubber
3. Fuel analysis and methods for preparation of synthetic petrol

Self-Study:

Contents to promote self-Learning:

SNO	Module	Reference
1	Molecular orbital theory	https://www.youtube.com/watch?v=FMxuss0RXOU
2	Reference electrodes	https://www.youtube.com/watch?v=WMfXlncyMDc
3	Battreies	https://nptel.ac.in/courses/103/108/103108162/
4	Plastics	https://www.youtube.com/watch?v=FATc12opDCA
5	Refining of petroleum	https://www.youtube.com/watch?v=INqhbII8r4Q

Text Book(s):

1.P. C. Jain & Monika Jain, *Engineering Chemistry*, Dhanpat Ray Publishing Company (P) Ltd, New Delhi, 16th edition, 2013.
2.K. N. Jayaveera, G. V. Subba Reddy and C. Ramachandraiah, *Engineering Chemistry*, McGraw Hill Publishers, New Delhi.
3.Energy scenario beyond2100,by S.Muthu Krishna Iyer.

Reference Book(s):

1.J. D. Lee, *Concise Inorganic Chemistry*, Oxford University Press, 5th edition 2010.
2.Skoog and West, *Principles of Instrumental Analysis*, Thomson, 6th edition, 2007.
3.Peter Atkins, Julio de Paula and James Keelar, *Atkins' Physical Chemistry*, Oxford University Press, 10th edition, 2010.

Online Resources /Web References:

1. https://drive.google.com/file/d/0Bz82vSA0C1xlWC11WkpsTmlwQVk/view
2. https://www.cgaspirants.com/2017/08/engineering-chemistry-by-jain-jain.html
3. https://www.pdfdrive.com/concise-inorganic-chemistry-d33405948.html
4. https://chemistry.com.pk/books/skoog-principles-of-instrumental-analysis1/
5. https://www.thermalfluidscentral.org/e-books/book-intro.php?b=39
6. file:///C:/Users/DELL/Downloads/HandbookOfInstrumentalTechniquesForAnalyticalChemistryPDFDrive.com.pdf
7. https://nptel.ac.in/courses/104/106/104106096/
8. https://youtu.be/KHh_IX1G6uA
9. https://www.youtube.com/watch?v=MfbxR9ZDs0s&feature=youtu.be
10. https://nptel.ac.in/courses/113/105/113105028/
11. https://www.youtube.com/watch?v=15MY7abeCDk

NARAYANA ENGINEERING COLLEGE::GUDUR								
ENGLISH								
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
I	2	0	0	32	2	40	60	100
Pre-requisite: ENGLISH								

Course Objectives :

1. To explore the students to develop knowledge and awareness of English sentence structure, construction and improvement.
2. To develop the students in getting the information of word power and able them to fit for the competition.
3. To enhance the ability of writing the structural English among the students.
4. To demonstrate the ability to write error free written communication.
5. To distinguish main ideas from specific details and make use of contextual clues to inform meanings of un familiar words.

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

CO 1	**Acquire** in-depth knowledge on formulating appropriate sentences with Grammatical accuracy and also develop concept of word formation. .(BL2)
CO 2	**Use** coherent and unified paragraphs with adequate support and detail and can write a topic sentence, support and concluding sentence. (BL2)
CO 3	**Analyze** the concepts of various real time scenarios to represent in an effective model. (BL - 4)
CO 4	**Understand** the grammar rules for synthesis of sentences and use pre writing strategies to plan to write dialogues, reviews and edit the text effectively.(BL - 2)
CO 5	**Relate** the skills and sub skills of reading effectively and provide knowledge on the structure and format of technical writing.(BL - 2)

CO-PO Mapping

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

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1

Grammar: Parts of Speech - Kinds of Sentences – Sentence structures: Identifying the sentences, Sentence Pattern, Sentence Improvement and Construction, Sentence Completion, Sentence Arrangement, Joining sentences, Para jumbles.

Vocabulary: Concept of word formation – Synonyms & Antonyms – Homonyms Homophones – Prefixes & suffixes – Commonly confused Words – One word substitutes – Idioms & Phrasal Verbs.

After the completion of this Module 1 students are able to:

1. write the sentence on his/her own (L2)
2. understand the structure of the sentences and usage(L2)
3. know the formation of words by using Affix (L1)
4. Understand the similar words and their usage in different words(L1)
5. enhance the knowledge of idiomatic language and its usage (L2)

MODULE -2

Grammar & Vocabulary : Cohesive devices - linkers, sign posts and transition signals - Articles – Prepositions – Gerund - Verbs: Auxiliary verbs (Primary & Modal) – Tenses – Subject Verb agreement.

Writing : Principles of writing: clarity, simplicity, brevity, single focus, organization of thoughts - sequencing the ideas – Punctuation - Question formation (Wh-questions, Yes or No questions, Tag questions) - Letters (Formal & Informal) and Emails : Structure / template of common formal letters and emails: inquiry /complaint / placing an order.

At the end of the Module 2, students are able to:

1. use the sign posts and transition signals in his/her daily life (L2)
2. develop the knowledge in the use of preposition and Articles. (L2)
3. Know the use the different types of tenses in his/her conversation.(L2)
4. Improve the knowledge grammar and can be able to attain the success in competitive exams (L2)
5. attain the idea of how to write the different types of letters which can improve his/her writing skills (L2)
6. possess the knowledge of writing and formation of E mails (L2)

MODULE-3

Grammar : Active and Passive Voice - Direct & Indirect Speech – Comparison of Adjectives – Cause and effect – Verb noun Collocations & Adjective - Noun Collocations.

Writing: Note Making – Summarizing - Paragraph Writing – Paraphrasing: Techniques of paraphrasing - Replacement of words and phrases, change of sentence structures.

At the end of this Module 3, students are able to:

1. Speak or write the sentences either in active form or in passive form.(L2).
2. Develop the knowledge of verbal and adjective collocations.(L2).
3. Know how to summarize paragraphs.(L2).
4. Enhance the writing skills by using the techniques of paragraph writing. (L2).

MODULE-4

Grammar : Misplaced modifiers - If Clauses - Simple, Compound, Complex Sentences -Spotting Errors.

Writing : Dialogue writing (Formal & Informal) - compare and contrast paragraphs- Writing of Reviews: Book / Play / Movie.

At the end of the Module 4, students are able to:

1. develop the writing skills by using simple compound, complex sentences.(L2)
2. spot the error of the writing and speaking skills.(L2)
3. make conversations in formal and informal situations.(L2)
4. Write the reviews by using good writing skills.(L2)

MODULE-5

Reading Skills : Types of reading: Skimming, Scanning, Intensive & Extensive Reading – Reading Comprehension - Scramble Sentences - Complete the passage using contextual clues Identifying Main Ideas using Scanning - Technique Identifying Specific Ideas using Skimming Technique - Studying the use of graphic elements in texts to convey information, reveal trends/patterns/relationships, communicate processes or display complicated data.

Writing : Describing – Report Writing: definition - purpose – types – structure - formal and informal reports - stages in developing report- proposal, progress and final reports –examples.

After the completion of this module 5 students are able to:

1. gain the knowledge of different types of reading.(L2)
2. attain the good writing skills by using skimming and scanning.(L2)
3. enhance the idea of getting the information by using pie, cycle, tree, graph, flow charts.(L2)
4. write good reports on various incidents of her/his life.(L2)

Self-Study:

Contents to promote self-Learning:

SNO	Topic	CO	Reference
1	**Grammar, vocabulary**	CO1	https://www.youtube.com/watch?v=nQkwdAxF4xA https://www.youtube.com/watch?v=rl85jxktfms

	2	Grammar, writing	CO2	https://www.youtube.com/watch?v=XzkbcWh8s4w https://www.youtube.com/watch?v=t6eQAQE1F10
	3	Grammar, writing	CO3	https://www.youtube.com/watch?v=0IFDuhdB2Hk https://www.youtube.com/watch?v=yqyZwm6QDWI
	4	Grammar, writing	CO4	https://www.youtube.com/watch?v=-ouWOpo2Uh8 https://www.youtube.com/watch?v=RnTpYKOLca4
	5	Grammar, writing	CO5	https://www.youtube.com/watch?v=yqyZwm6QDWI
			Total hours:	**32 hours**

1 Text Books:

1. Contemporary English Grammar –Structures and Composition by David Green, MacMillanIndia, 2014.
2. Effective Technical Communication by Ashraf, M Rizvi,Tata McGraw-Hill, 2006.

Reference Book(s):

1. English Conversation Practice by Grant Taylor, Tata McGraw Hill,2009.
2. Practical English Usage by Michael Swan, OUP, 4th Edition.
3. Technical Communication by Meenakshi Raman & Sangeeta Sharma, Oxford UniversityPress,2009.
4. English Vocabulary in Use Advanced by Michael McCarthy, Felicity O'Dell, Cambridge University Press,2008.
5. English for Technical Communication for Engineering Students, Aysha Vishwamohan,Tata Mc Graw-Hill 2009.

Online Resources:

https://www.youtube.com/watch?v=nQkwdAxF4xA
https://www.youtube.com/watch?v=rl85jxktfms
https://www.youtube.com/watch?v=XzkbcWh8s4w
https://www.youtube.com/watch?v=t6eQAQE1F10
https://www.youtube.com/watch?v=0IFDuhdB2Hk
https://www.youtube.com/watch?v=yqyZwm6QDWI

Web Resources:

- *Grammar/Listening/Writing 1-language.com*
- *http://www.5minuteenglish.com/*
- *https://www.englishpractice.com/ Grammar/Vocabulary*
- *English Language Learning Online*
- *http://www.bbc.co.uk/learningenglish/*
- *http://www.better-english.com/*
- *BBC Vocabulary Games*
- *Free Rice Vocabulary Game Reading*
- *https://www.usingenglish.com/comprehension/*

- *https://www.englishclub.com/reading/short-stories.htm*

Online Dictionaries

- *Cambridge dictionary online : https://dictionary.cambridge.org/*
- *MacMillan dictionary : https://www.macmillandictionary.com/*
- *Oxford learner's dictionaries : https://www.oxfordlearnersdictionaries.com/*

NARAYANA ENGINEERING COLLEGE::GUDUR								
21ES1001	PROBLEM SOLVING AND PROGRAMMING							R21
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:

- To understand various steps in Program development.
- To understand the basic concepts in C Programming Language.
- To learn how to write modular and readable C Programs.
- To learn the syntax and semantics of a C Programming language.
- 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 operators and input/output. **(BL - 2)**
CO 3	Understand the difference and the usage of various control statements and Functions**(BL - 2)**
CO 4	Apply the Arrays and Pointers for solving problems. **(BL - 3)**
CO 5	Explain User-Defined Data Types and Files. **(BL - 2)**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2			2							1	3	1
CO2	3	1			1								3	
CO3	3	1		1	2								3	1
CO4	3				1								1	
CO5	3		2		2							3	3	2
C06	3		2		2								3	1

COURSE CONTENT		
MODULE – 1	**Fundamentals of Computers and Programming**	**10 HOURS**

Introduction to Programming, Algorithms and Flowcharts: Programs and Programming, Programming languages, Compiler, Interpreter, Algorithms, Flowcharts, How to Develop a Program.
Basics of C: Introduction**,** Character Set, Structure of a C Program, A Simple C Program, Variables, Data Types and Sizes, Declaration, Identifiers, Keywords, Constants, Assignment, and Initialization.

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

1. Solve problems using language independent notations. **(BL - 3)**
2. Understand the compilers and interpreters. **(BL - 2)**
3. Understand Basic Structured of Programming in C. **(BL - 2)**
4. Develop algorithms and flowcharts for problems.**(BL - 3)**
5. Understand various Tokens in C language.**(BL - 2)**

MODULE -2	**Operators and Input and Output**	**9 HOURS**

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

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

1. Illustrate the working of expressions.**(BL - 2)**

2. Understand the precedence and Associativity rules of operators. **(BL - 2)**
3. Understand the rules of type conversion. **(BL - 2)**
4. Explain the Formatted and Unformatted I/O functions. **(BL - 2)**

MODULE-3	**Control Statements and Functions**	**10 HOURS**

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

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

1. Understand Selection Statements. **(BL - 2)**
2. Understand Looping and Unconditional Statements. **(BL - 2)**
3. Understand the basic concept of functions. **(BL - 2)**
4. Understand concepts of Recursion, Preprocessor and storage classes. **(BL - 2)**

MODULE-4	**Arrays and Pointers**	**10 HOURS**

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 4, 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-5	**User-Defined Data Types and Files**	**9 HOURS**

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 Data Files in C, Working with Text Files, Random Accesses to Files.

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

1. Explain user defined data types like structures and unions. **(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. Text Vs. 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. R.G. Dromey, "How to Solve it by Computer". 2014, Pearson.
2. Computer Fundamentals by Anita Goel, 2010, Pearson Publication
3. Brian W. Kernighan, and Dennis M. Ritchie, "The C Programming Language", 2ndEdition, Pearson.
4. Programming in C, 3/e : A Practical Approach by Ajay Mittal, Pearson Publication
5. C: The Complete Reference by SCHILDT and HERBERT, McGraw Hill, 4th Edition, 2020
6. Problem Solving with C by SOMASHEKARA, M. T., GURU, D. S., MANJUNATHA, K. S., PHI Learning, 2nd Edition, 2018
7. C How to Program,Paul Deitel, Deitel & Harvey Deitel, 6th Edition, Pearson Education
8. Programming in C and Data Structures, Jeri R. Hanly, Elliot B. Koffman, Ashok Kamthane and A.Ananda Rao, Pearson Education, 1st Edition, 2010.
9. C for Engineers and Scientists, H.Cheng, Mc.Graw-Hill International Edition Education / PHI,

2009
10. Programming in C – Stephen G. Kochan, 4th Edition, PearsonEductaion, 2015
11. Programming in ANSI in C, E Balaguruswamy, Tata McGraw Hill, 8th Edition, 2019
12. Computer Concepts and Programming in C, R.S. Salaria, Khanna Publishing, 2017
13. Let us C, Yashavant P. Kanetkar, BBP Publications, Delhi, 16th Edition, 2017

NARAYANA ENGINEERING COLLEGE::GUDUR

PROBLEM SOLVING AND PROGRAMMING LABORATORY

I year I Semester: Common to All

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
21ES1501		-	-	3	1.5	40	60	100
Contact Classes: Nil	**Tutorial Classes: Nil**	**Practical Classes: 36**				**Total Classes: 36**		

OBJECTIVES:

The course should enable the students to:

I. Formulate problems and implement algorithms using C programming language.
II. Develop programs using decision structures, loops and functions.
III. Learn memory allocation techniques using pointers.
IV. Use structured programming approach for solving of computing problems in real world.

LIST OF EXPERIMENTS

Week-1 **OPERATORS AND EVALUATION OF EXPRESSIONS**

a. Write a C program to check whether a number is even or odd using ternary operator.
b. Write a C program to perform the addition of two numbers.
c. Write a C program to evaluate the arithmetic expression ((a + b / c * d - e) * (f - g)). Read the values a, b, c, d, e, f, g from the standard input device.
d. Write a C program to find the sum of individual digits of a 3 digit number.
e. Write a C program to read the values of x and y and print the results of the following expressions in one line:
   i. (x + y) / (x - y)
   ii. (x + y)(x - y)

Week-2 **CONTROL STRUCTURES**

a. Write a C program to find the given year is leap or not
b. A Fibonacci sequence is defined as follows: The first and second terms in the sequence are 0 and 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.
c. Write a C program to generate all the prime numbers between 1 and n, where n is a value supplied by the user.
d. Write a C program to check largest number among three numbers

Week-3	CONTROL STRUCTURES

a. Write a C program, which takes two integer operands and one operator from the user, performs the operation and then prints the result. (Consider the operators +, -, *, /, % and use switch statement).
b. Write a C program to calculate sum of n natural numbers
c. Write a C program to find the roots of a quadratic equation.
d. Write a C program to check whether a given 3 digit number is Armstrong number or not.
e. Write a C program to factorial value for a given positive integer
f. Write a C program to reverse the number

Week-4	ARRAYS

a. Write a C program to find the sum of n array elements.
b. Write a C program to perform the following:
   i. Addition of two matrices
   ii. Multiplication of two matrices
c. Write a C program to count and display positive, negative, odd and even numbers in an array.

Week-5	STRINGS

a. Write a C program that uses functions to perform the following operations:
   i) String reverse
   ii) String length
   iii) String conversion
   iv) String copy
b. Write a C program to determine if the given string is a palindrome or not.
c. Write a C program that reads a line of text and counts all occurrence of a particular word.

Week-6	FUNCTIONS

a. Write C programs that use both recursive and non-recursive functions
   i. To find the factorial of a given integer.
   ii. To find the greatest common divisor of two given integers.
b. Write C programs that use both recursive and non-recursive functions
   i. To print Fibonacci series.
   ii. To solve towers of Hanoi problem.
c. Write a C program to print the transpose of a given matrix using function.
d. Write a C program to call by value

Week-7	POINTERS

a. Write a C program to concatenate two strings using pointers.
b. Write a C program to find the length of string using pointers.
c. Write a C program to compare two strings using pointers.
d. Write a C program to copy a string from source to destination using pointers.
e. Write a C program to pass pointers to a function(call-by-reference) .

Week-8	STRUCTURES AND UNIONS

a. Write a C program to compute the monthly pay of 100 employees using each employee's name, basic pay. The DA is computed as 52% of the basic pay. Gross-salary (basic pay + DA). Print the employees name and gross salary.
b. Create a Book structure containing book_ id, title, author name and price. Write a C program to pass a structure as a function argument and print the book details.
c. Create a union containing 6 strings: name, home_ address, hostel_ address, city, state and zip. Write a C program to display your present address.
d. Write a C program to define a structure named DOB, which contains name, day, month and year. Using the concept of nested structures display your name and date of birth.

Week-9	FILES

a. Write a C program to display the contents of a file.
b. Write a C program to copy the contents of one file to another.
c. Write a C program for fseek() function
d. Two files DATA1 and DATA2 contain sorted lists of integers. Write a C program to merge the contents of two files into a third file DATA
e. Write a C program to count the no. of characters present in the file.

Reference Books:

1. Yashavant Kanetkar, "Let Us C", BPB Publications, New Delhi, 13th Edition, 2012.
2. Oualline Steve, "Practical C Programming", OReilly Media, 3rd Edition, 1997.
3. King K N, "C Programming: A Modern Approach", Atlantic Publishers, 2nd Edition, 2015.
4. Kochan Stephen G, "Programming in C – A Complete Introduction to the C Programming Language", Sams Publishers, 3rd Edition, 2004.
5. Linden Peter V, "Expert C Programming: Deep C Secrets", Pearson India, 1st Edition, 1994.

NARAYANA ENGINEERING COLLEGE: GUDUR								
I-B. Tech	PROBABILITY AND STATISTICS							R-2021
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
II	3	1	0	64	4	40	60	100

Pre-requisite: inter mathematics

Course Objectives: This course aims to providing the knowledge for the student about on

1. Analysis the data by using descriptive statistic techniques.
2. Estimate business Trend values by using regression techniques.
3. The theory of Probability Distributions is used to Determine the expected life time and variance of a components.
4. Test the data by using inferential techniques for large sample case.
5. Test the data by using inferential techniques for small sample case.

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

CO 1	Estimate business and Engineering Trend values by using regression analysis	(L-6)
CO 2	Apply the probability basic concepts to predict the information about on data	(L-3)
CO 3	Evaluate expected mean life time, mean failure rate, service rates of equipment	(L-5)
CO 4	Test the hypothesis to Interpret the results by using Large sample Tests	(L-4)
CO 5	Test hypothesis to Interpret the results by using small sample Tests	(L-4)

SEMESTER-II

CO-PO Mapping														
CO	**PO**												**PSO**	
	PO1	**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										
CO2	3	3	-	2										
CO3	3	2	-	2										
CO4	3	3	-	3										
CO5	3	3	-	3										

1- Low, 2-Medium, 3- High

COURSE CONTENT		
MODULE – 1	**Descriptive Statistics**	**Hours: 16h(12L+4T)**

Statistics Introduction, Measures of Variability(dispersion), Skewness, Kurtosis, correlation, correlation coefficient, rank correlation, principle of least squares, method of least squares for regression lines, regression coefficients and their properties.

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

1. summarize the basic concepts of data science and its importance in engineering (L-2)
2. Analyse the data by using quantitative measure like averages, variability, Skewness and Kurtosis (L-4)
3. Evaluate correlation coefficient and analysis the data (L-4)
4. Estimate Trend values by using regression analysis (L-5)

MODULE -2	Probability and Random variable	Hours: 12h(9L+3T)

Probability, Axioms of probability, additive and multiplicative law of probability, conditional probability, Bayes' theorem, random variables (discrete and continuous). Probability mass and density functions, properties of distribution function.

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

1. Apply the probability basic concepts to predict the information and occurrence of a chance. (L-3)
2. Acquire the knowledge about classification of the variables (L-3)
3. Apply the Baye's theorem to find out which of the machine to processes defective items (L-3)

MODULE-3	Probability Distributions	Hours: 12h(9L+3T)

Discrete distribution: Binomial, Poisson approximation to the Binomial distribution and their properties. Continuous distribution**:** Normal distribution, Exponential distribution and their properties.

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

5. Apply Probability Distributions is used to Determine mean life time, mean failure rate, service rates of equipment L-3)
6. Evaluate probabilities by using probability distributions. (L-5)
7. Find the expected frequencies by using probability distribution (L-1)

MODULE-4	Statistical Inference	Hours: 14h(11L+3T)

Estimation: parameter, statistics, point-estimation, interval-estimation, sampling distribution. Formulation of null hypothesis, alternative hypothesis, critical and acceptance regions, level of significance, types of errors and power of the test. Large Sample Tests: Test for single proportions, difference of proportions, Test for single mean and difference of means, confidence intervals for proportions and means.

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

1. Understand the concepts of point, interval estimations and confidence intervals (L-2)
2. Apply the concept of hypothesis to test the large samples (L-3)
3. Evaluate point, interval estimations to the given data (L-5)

MODULE-5	Small Sample Tests	Hours: 10h(7L+3T)

Student t-Tests (test for single mean, two means and paired t-test), testing of equality of variances (F-test), $\chi 2$-test for goodness of fit, $\chi 2$-test for independence of attributes.

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

1. Determine the product came from same company or not. (L-5)
2. Applying t-test techniques, to determine the experimentation useful or not (L-3)
3. Use the chi-square test techniques to select the appropriate distribution (L-3)
4. Applying the chi-square test to test whether the attributes are independent or not (L-3)

Total hours	64

Content beyond syllabus:

1. Analysis variance.
2. lognormal distribution.
3. Multiple regression analysis .

Self-Study:

Contents to promote self-Learning:

SNO	Topic	CO	Reference
1	Disruptive statistics	**CO1**	**https://www.youtube.com/watch?v=5USozryiBxo**
2	Probability & Random variables	**CO2**	**https://www.youtube.com/watch?v=80YzzIm8NK8**
3	Probability distribution	**CO3**	**https://www.youtube.com/watch?v=6x1pL9Yov1k**
4	Large sample tests	**CO4**	**https://www.youtube.com/watch?v=80YzzIm8NK8**
5	Small sample tests	**CO5**	**https://www.youtube.com/watch?v=c5YTyGWpcmw**

Text Book(s):

1. Iyengar T.K.V., Krishna Gandhi B. & Others., (2013), Probability and Statistics Revised Edition, New Delhi, S.Chand & Co.Ltd.
2. Miller and Freund's, Probability and Statistics for Engineers, 8/e, Pearson, 2016.
3. S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, 11/e, Sultan Chand & Sons Publications, 2012.

Reference Book(s):

1. S. Ross, a First Course in Probability, Pearson Education India, 10th editon,2018.
2. Peyton Z. Peebles, Probability, Random Variables & Random Signal Principles -, McGraw Hill Education, 4th Edition, 2001.
3. W. Feller, An Introduction to Probability Theory and its Applications, Wiley, 2019.

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Online Resources/ Web References:

1. **https://www.vfu.bg/en/e-Learning/Math_Soong_Fundamentals_of_ probability and statistics for engineers.pdf**
2. **http://www.math.ust.hk/~machas/numerical-methods.pdf**
3. **https://www.khanacademy.org/math/statistics-probability**
4. **http://www.randomservices.org/random/dist/index.htm l**
5. **https://global.oup.com/uk/orc/biosciences/maths/reed/01student/numerical_tutorials/pdf**

NARAYANA ENGINEERING COLLEGE:GUDUR								
	SEMICONDUCTOR PHYSICS							R2021
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: Fundamental concepts of Physics

Course Objectives:

1. To enable the students in understanding the importance of quantum physics
2. To learn the dynamics of free electrons in metals by applying Free electron theories on metals.
3. To explain and provide the knowledge about semiconductors and photo electronic devices
4. To teach the concepts related to superconductivity & magnetic materials
5. To impart knowledge in basic concepts of LASERs and optical along with their Engineering applications

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

CO 1	Comprehend and explain the concepts of matter waves, wave functions and its interpretation to understand the matter at atomic scale.
CO 2	Comprehend Free electron theories on metals and apply them to learn the dynamics of free electrons in metals
CO 3	Recognize the importance of semiconductors and photo electronic devices
CO 4	Understand the concepts related to superconductivity & magnetic materials
CO 5	Realize importance of LASERs and optical fibers in Engineering and Medical 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	2												
CO2	3	1												
CO3	3	2												
CO4	3	2				1								
CO5	3	1				1								

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1

INTRODUCTION TO QUANTUMMECHANICS **9h**

Matter waves –de-Broglie hypothesis- properties, G.P.Thomson experiment, Phase and group velocities—Expression for group velocity; Heisenberg's uncertainty principle; Schrodinger's time dependent and independent wave equations – Physical significance of wave function-important characteristics of wave function, Eigen values and Eigen functions of a particle confined to one dimensional infinite square well (potentialwell).

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

1. understand the concept of matter waves (L2)
2. Recognize the difference between phase velocity and group velocity (L2).

3. understand Physical significance of wave function (L2)
4. Identify the importance of Schrodinger's wave equation in describing the motion of elementary particles (L3) **.**

MODULE -2

FREE ELECTRON THEORYOFMETALS **10h**

Classical free electron theory-assumptions, expression for electrical conductivity, merits and demerits; Quantum free electron theory of metals-expression for electrical conductivity; Fermi-Dirac distribution, Mathiesson rule, causes of electrical resistance in metals, Bloch's theorem (Qualitative), Kronig - Penny Model (Qualitative), Classification of solids into conductors, semiconductors and insulators based on energy band gap.

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

1. explain Classical, Quantum free electron theory of metals (L2).
2. apply these theories to explain electrical conductivity in metals (L3)
3. explain formation of energy bands in solids(L2) .
4. Understand the band structure of a solid and Classify materials as metals, insulators, or semiconductors, and sketch a schematic band diagram for each one (L2).

MODULE-3

SEMICONDUCTORS AND PHOTO ELECTRONIC DEVICES **10h**

Semiconductors- Introduction – Intrinsic and Extrinsic semiconductors– Density of charge carriers Electrical conductivity, Fermi level of intrinsic semiconductors; Hall effect – Hall coefficient - Applications of Hall effect.

Diodes: Open circuited PN junction, forward and reverse bias characteristics of PN junction diode- Current components in a PN diode, -Energy band diagram of PN Diode- Principle, construction and working of photodiode, solar cell and light emitting diode

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

1. outlinethe properties of n-type and p-type semiconductors (L2).
2. interpretthe direct and indirect band gap semiconductors(L2).
3. identifythe type of semiconductor using Hall effect(L3) .
4 describe the characteristics and operation of p-n junction diode. (L1)
5 **identify** applications of semiconductors in photo electronic devices(L3)

MODULE-4

SUPERCONDUCTORS AND MAGNETIC MATERIALS **10h**

Superconductors- Introduction-Properties of superconductors- Meissner effect-Type I and Type II superconductors-BCS theory-Josephsoneffects (ACandDC)-Applications of superconductors.

Magnetic materials: Introduction-Magnetic dipole moment-Magnetization-Magnetic susceptibility and permeability-Origin of magnetic moment-Classification of Magnetic materials-Domain theory of ferromagnetism (qualitative)-Hysteresis-soft and hard magnetic materials-Magnetic device applications (Magnetic bubble memory).

1. Explain **how** electrical resistivity of solids changes with temperature(L2)
2. Classify **superconductors** based on Meissner's effect (L2)
3. Explain **Meissner's** effect, BCS theory & Josephson effect in superconductors (L2)

4. Classify the magnetic materials based on susceptibility and their temperature dependence (L2)

MODULE-5

LASERS & OPTICAL FIBERS **9h**

Lasers: Introduction, Properties of lasers: monochromaticity, coherence, directionality, brightness; Spontaneous & stimulated emission of radiation, Einstein coefficients, Population inversion, Pumping methods, Types of lasers: Nd- YAG Laser, He–Ne Laser, Semiconductor laser; Applications.

Introduction to Optical Fibers-Total Internal Reflection-Critical angle of propagation-Acceptance angle-Numerical Aperture- Classification of optical fibers based on materials, modes and refractive index profile-Applications: fiber optic communication system and sensors.

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

8. describe Spontaneous& stimulated emission of radiation (L2)
9. Understandthe basic concepts of LASER light Sources (L2)
10. describe the construction and working of different types of Lasers (L2)
11. realize the basic characteristics and classification of optical fibers (L2)
12. identify the applications of lasers and optical fibers in various fields (L3)

Total hours: 48 hours

Content beyond syllabus:

Quantum dots and quantum wells

Self-Study:

Contents to promote self-Learning:

SNO	Topic	CO	Reference
1	Quantum Mechanics	CO1	https://youtu.be/w7wf3wr0gua?list=pl1955a15b7f282a7f https://youtu.be/nfkjkioexyo?list=pl1955a15b7f282a7f
2	Free Electron Theory Of Metals	CO2	https://youtu.be/l-eodzft9by https://youtu.be/g2zgas5o7i8
3	Semiconductors And Photo Electronic Devices	CO3	https://youtu.be/BQijtvYxgIM https://youtu.be/rzxCRJcFaIw https://youtu.be/L28F1Oenyds https://youtu.be/Dfdzz64gux8?list=PL350612601E2DBFDE https://youtu.be/dZhgOuG4C0A https://youtu.be/WWjldCmRteg
4	Superconductors And Magnetic Materials	CO4	https://youtu.be/GglT1RoBPzg https://youtu.be/QQZ6EGf0Ju8 https://youtu.be/6QUFuZpCgGw
5	Lasers & Optical Fibers	CO5	https://youtu.be/eoOM0Gx6GJc https://youtu.be/RyY4PEpV2RQ https://youtu.be/j4qbhVQQdBQ https://youtu.be/TQXuUpkAr6U
6		CO6	

Text Book(s):

1. M. N. Avadhanulu, P.G. Kshirsagar& TVS Arun Murthy" AText book of Engineering Physics"- S. Chand Publications, 11th Edition 2019.
2. B.K. Pandey and S. Chaturvedi, Engineering Physics, Cengage Learning, 2012.

3.Jasprit Singh, ―Semiconductor Devices: Basic Principles‖, Wiley 2012.
4.. Kasap, S.O. ―Principles of Electronic Materials and Devices‖, McGraw-Hill Education, 2007.

Reference Book(s):

1. Shatendra Sharma, Jyotsna Sharma, " Engineering Physics", Pearson Education,2018
2 Garcia, N. & Damask, A. ―Physics for Computer Science Students‖. Springer-Verlag, 2012.
3. J. Milliman and C Halkias, "Integrated electronics", 2nd Edition, Tata McGraw Hill, 1991.
4. Kittel, C. ―Introduction to Solid State Physics‖. Wiley, 2005.
5.S.O.Pillai, "Solid State Physics", 8th edition, New Age International Publishers, 2018.
6. Donald A. Neamen, "Semiconductor Physics and Devices:Basic Principle", 4th edition, Mc Graw-Hill, 2012.

Online Resources / Web Resources:

http://www.peaceone.net/basic/Feynman/
http://physicsdatabase.com/free-physics-books/
http://www.damtp.cam.ac.uk/user/tong/statphys/sp.pdf
http://www.freebookcentre.net/Physics/Solid-State-Physics-Books.html
http://link.springer.com/book
http://www.thphys.physics.ox.ac.uk
http://www.sciencedirect.com/science
http://www.e-booksdirectory.com

NARAYANA ENGINEERING COLLEGE::GUDUR								
21ES1005	PYTHON PROGRAMMING AND DATA SCIENCE							R21
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: Basics of programming Language.

Course Objectives:

1. To learn about Python programming language syntax, semantics, and the runtime environment
2. To be familiarized with general computer programming concepts like conditional execution, loops & functions
3. To learn about mutable and immutable types.
4. To learn about the data science related functions in NUMPY.
5. To solve data science problems using PANDAS.

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

CO 1	Demonstrate various operators, data types and decision structures in python. (BL - 3)
CO 2	Solve problems using Functions and data structures in Python (BL - 3)
CO 3	Implement the concept of Files and Modules (BL - 3)
CO 4	Implement Data Science queries using NUMPY module (BL - 3)
CO 5	Solve data manipulation task using PANDAS module (BL - 3)

CO-PO Mapping

CO	PO												PSO	
	PO 1	PO2	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	
CO2	2	2											2	
CO3	2	1											2	
CO4	2	2											1	
CO5	2	2											1	1

1: Low, 2-Medium, 3- High

COURSE CONTENT		
MODULE – 1	**I/O and Decision Structures**	**10H**

Input and Output: Introduction to Python and installation, Input and Output, Comments, Variables, Operators. Type conversions, Expressions, Data types.

Decision Structures and Boolean Logic: if, if-else, if-elif-else Statements, Nested Decision Structures. Looping: while loop, for loop, Nested Loops.

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

1. Describe python expressions, data types (BL-2)
2. Perform various Arithmetic calculations using Operators in Python(BL-3)

3. Demonstrate the usage of looping structures in python Language.(BL-3)		
MODULE -2	**Functions and Data structures**	10H
Functions: Definition, Function Arguments, Anonymous Function, Scope of the variable and name spacing, Recursion, Map, Filter and Reduce Functions **Strings**, **Lists, Tuples and Dictionaries**: String Methods and Operations, Lists: Operations and Methods, Tuples: Operations and Methods, Dictionaries: Operations and Methods.		
At the end of the Module 2, students will be able to: 1. Implement Functions to solve problems.(BL-3) 2. Describe various String handling functions in python(BL-2) 3. Describe the various **Lists, Tuples and Dictionaries** in python(BL-2)		
MODULE-3	**Files and Modules**	10H
Files: Text Files, File Operations, File Functions, Copying the Files, Two Files Merging into Single File. **Modules:** Modules, Standard Modules, Packages.		
At the end of the Module 3, students will be able to: 1. Describe the concepts of Files (BL-2). 2. Describe the importance of Modules and packages (BL-2).		
MODULE-4	**Introduction to Numpy**	9H
Introduction to Numpy: Fixed-Type Arrays in Python, Creating Arrays from Lists, Creating Arrays from Scratch Numpy Standard Data Types, The Basics of Numpy Arrays, Numpy Array Attributes. **Array Indexing**: Accessing Single Elements, Array Slicing: Accessing Subarrays, Reshaping of Arrays, Array Concatenation and Splitting. Computation on Numpy Arrays: Universal Functions.		
At the end of the Module 4, students will be able to: 1. Describe the concept of Numpy Module(BL-2) 2. Solve numerical problems related to data science using Numpy Arrays.(BL-3) 3. Apply Universal **Functions** for Data Science problems(BL-3)		
MODULE-5	**Data Manipulation with Pandas**	**9H**
Data Manipulation with Pandas: Installing and Using Pandas, Introducing Pandas Objects, Pandas Series Object, Pandas DataFrame Object, Pandas Index Object, Data Indexing and Selection Data Selection in Series. **Data Selection in DataFrame Operating on Data in Pandas Ufuncs**: Index Preservation UFuncs: Index Alignment, Operations Between DataFrame and Series, Handling Missing Data, Trade-Offs in Missing Data Conventions, Missing Data in Pandas, Operating on Null Values.		
At the end of the Module 5, students will be able to: 1. Describe the concept of Data Manipulation (BL-2). 2. Describe the concept of Pandas for Data Science(BL-2) 3. Apply Ufunctions in pandas to generate Data Frame (BL-3) 4. Implement Pandas Module to handle **Missing Data**(BL-3)		
	Total hours:	**48 HOURS**
Content Beyond Syllabus: 1. Regular Expressions		

2. Matplotlib

Text Books:

1. Fundamentals of Python First Programs, Kenneth. A. Lambert, Cengage.
2. Python Data Science Hand Book, Jake Vanderplas, First Edition, Oreilly

Reference Book(s):

1. Introduction to Python Programming, Gowrishankar. S, Veena A, CRC Press.
2. Python Programming: A Modern Approach, Vamsi Kurama, Pearson.
3. Python for Data Analysis-Wes McKinney, 2nd-Edition, Oreilly.
4. Python Programming: A Modern Approach, Vamsi Kurama, Pearson. Braun W. J., Murdoch D. J., A First Course in Statistical Programming with R, Cambridge University Press, 2007

NARAYANA ENGINEERING COLLEGE:GUDUR								
21ES1508	**Python Programming and Data Science Lab**							R21
Semester	**Hours / Week**			**Total hrs**	**Credit**	**Max Marks**		
	L	**T**	**P**		**C**	**CIE**	**SEE**	**TOTAL**
II	0	0	2	32	1.5	40	60	100

Pre-requisite: Programming Knowledge

Course Objectives:

1. To gain knowledge on python program basics
2. To prepare students for building programs using control statements
3. To prepare students for solving the problems involving functions and files.
4. To gain knowledge Python Numpy module to solve complex mathematical problems involving matrices.
5. To gain Knowledge of data cleaning using Pandas.

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 problems using python Iterative Statements**(BL -3)**
CO3	Understand the concepts of files, modules**(BL -2)**
CO4	Solve the Numerical problems that involve Matrices **(BL -3)**
CO5	Provide solutions for data cleaning tasks**(BL-3)**

CO-PO Mapping

CO	PO												PSO	
	PO1	**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 that draws a Pyramid with # symbols	CO 2

 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.	
TASK-4 -Strings (4H)	
1. Write a program to use split and join methods in the string and trace a birthday with Dictionary data structure. 2. Write a program using map, filter and reduce functions	CO 2
TASK-5 - Lists (2H)	
1. Write program which performs the following operations on lists. 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-6 - Files (4H)	
1. Write a program to read the file content and count the number of vowels, consonants, digits and special characters in a given file. 2. Write a program to perform the following operations in Files: a. Copy from one file to another file b. Merge two files	CO3
TASK-7 –- Introduction to Numpy (4 H)	
1. Write a NumPy program to compute the outer product of two given vectors. 2. Write a Numpy program to compute the determinant of a given square array.	CO 4
TASK-8 - Introduction to Numpy (2H)	
1. Write a Numpy program to calculate the difference between the maximum and the minimum values of a given array along the second axis. Expected Output: Original array: [[0 1 2 3 4 5] [6 7 8 9 10 11]] Difference between the maximum and the minimum values of the said array: [5 5]	CO 4
TASK-9 - Introduction to Pandas (4 H)	
1. Write a Pandas program to convert a Panda module Series to Python list and it's type. 2. Write a Pandas program to display most frequent value in a given series and replace everything else as 'Other' in the series	CO 5
TASK-10 - Introduction to Pandas (4 H)	
1. Write a Pandas program to identify the column(s) of a given DataFrame which have at least one missing value.	CO 5

2. Write a Pandas program to replace NaNs with a single constant value in specified columns in a DataFrame.	

ADDITIONAL EXPERIMENTS	
TASK – 11 – Lists, Strings, Tuples	
1. Write a python programs on lists 2. Write a python program on strings 3. Write a python program on tuples	CO2
TASK – 12 - Pandas	
1. Write a Pandas program to interpolate the missing values using the Linear Interpolation method in a given DataFrame. 2. Write a Pandas program to import excel data (coalpublic2013.xlsx) into a Pandas DataFrame.	CO5

Virtual Labs	
Python Lab (IIT Bombay) : 1. http://vlabs.iitb.ac.in/vlabs-dev/labs/python-basics/experimentlist.html 2. https://pythoninstitute.org/free-python-courses/?gclid=EAIaIQobChMI4u7Uw-mZ8wIVTR0rCh0CYw2FEAAYAiAAEgL5GPD_BwE	
List of Experiments	
1. Arithmetic Operations 2. Built-in Functions 3. Loops 4. Data Types 5. Strings	6. Classes and Objects 7. Built-in Modules 8. Constructors and Inheritance 9. Numpy basics. 10. Pandas

Text Book(s):

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

Reference Book(s):

1. Think Python, Allen Downey, Green Tea Press, 2nd Edition
2. Core Python Programming, W.Chun, Pearson, 2nd Edition, 2007
3. Fundamentals of Python, Kenneth A. Lambert, Cengage Learning, 1st Edition, 2015
4. R. Nageswara Rao, "Core Python Programming", 2nd edition, Dreamtech Press, 2019
5. Allen B. Downey, "Think Python", 2ndEdition, SPD/O'Reilly, 2016
6. Martin C.Brown, "The Complete Reference: Python", McGraw-Hill, 2018.
7. Michael Dawson, ―Python Programming for absolute beginners, 3rd Edition, CENGAGE Learning Publications, 2018.
8. Taming Python by Programming, Jeeva Jose,Khanna Publishing House, 1st Edition, 2018
9. Introduction to Computing and Problem Solving with Python, J. Jose, Khanna Publications, 1st Edition, 2019.
10. Guido Van Rossum and Fred L. Drake Jr, "An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.

NARAYANA ENGINEERING COLLEGE::GUDUR								
21ES1505	IT WORKSHOP							R21
Semester	Hours / Week			Total hrs	Credits	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
II	0	0	3	32	1.5	40	60	100

Pre-requisite:

Course Objectives:

1. To know about the internal parts of a computer, assembling a computer from the parts, preparing a computer for use by installing the operating system
2. To gain knowledge about the usage of tools like Word processors, Spreadsheets, Presentations.
3. To learn about Networking of computers and use Internet facility for Browsing and Searching

CourseOutcomes:Aftersuccessfulcompletionofthecourse,thestudentwillbeableto:

CO1	Build a Personal Computer and prepare the computer ready to use(BL-2)
CO2	Apply knowledge to Interconnect two or more computers for information sharing (BL-3)
CO3	Prepare documentation for projects and other assignments (BL-3)
CO4	Demonstrate seminars and other assignments using presentation tools (BL-3)
CO5	Analyze data using spread sheets (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				3								1	3
CO2	2				3								1	3
CO3	2				3								1	3
CO4	2				3								1	3
CO5	2				3								1	3

1: Low, 2-Medium, 3- High

Course contents	CO
Task 1:Learn about Computer (3H)	CO1
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.	
Task 2:Assembling a Computer(3H)	CO1
Disassemble and assemble the PC back to working condition. Students should be able to trouble shoot the computer and identify working and non-working parts.	

Student should identify the problem correctly by various methods	
Task 3:Install Operating system (3H)	CO1
Student should install Linux on the computer. Student may install another operating system (including proprietary software) and make the system dual boot or multi boot. Students should record the entire installation process.	
Task 4:Operating system features: (3H)	CO1
Students should record the various features that are supported by the operating system(s) installed. They have to submit a report on it. Students should be able to access CD/DVD drives, write CD/DVDs, access pen drives, print files, etc. Students should install new application software and record the installation process.	
Task 5:Networking:(3H)	CO2
Students should connect two computers directly using a cable or wireless connectivity and share information. Students should connect two or more computers using switch/hub and share information. Crimpling activity, logical configuration etc. should be done by the student. The entire process has to be documented.	
Task 6:Browsing Internet: (3H)	CO2
Student should access the Internet for Browsing. Students should search the Internet for required information. Students should be able to create e-mail account and send email. They should get acquaintance with applications like Face book, Skype etc. If Intranet mailing facility is available in the organization, then students should share the information using it. If the operating system supports sending messages to multiple users (LINUX supports it) in the same network, then it should be done by the student. Students are expected to submit the information about different browsers available, their features, and search process using different natural languages, and creating email account.	
Task 7:Antivirus:(3H)	CO2
Students should download freely available Antivirus software, install it and use it to check for threats to the computer being used. Students should submit information about the features of the antivirus used, installation process, about virus definitions, virus engine etc.	
Task 8:Word Processor: (3H)	CO3
Students should be able to create documents using the word processor tool. Some of the tasks that are 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. Students should be able to prepare project cover pages, content sheet and chapter pages at the end of the task using the features studied. Students should submit a user manual of	

the word processor considered, Image Manipulation tools.	
Task 9:Presentations: (3H)	CO4
creating, opening, saving and running the presentations, selecting the style for slides, formatting the slides with different fonts, colours, creating charts and tables, inserting and deleting text, graphics and animations, bulleting and numbering, hyper linking, running the slide show, setting the timing for slide show.	
Task 10:Spreadsheet: (3H)	CO5
Students should be able to create, open, save the application documents and format them as per the requirement. Some of the tasks that may 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. Students should submit a user manual of the Spreadsheet	
Additional Experiments	
Task 1:LateX :(2H)	CO5
Introduction to Latex and its installation and different IDEs. Creating first document using Latex, using content into sections using article and book class of LaTeX . Styling Pages: reviewing and customizing different paper sizes and formats. Formatting text (styles, size, alignment, colors and adding bullets and numbered items, inserting mathematical symbols, and images, etc.). Creating basic tables, adding simple and dashed borders, merging rows and columns. Referencing and Indexing: cross-referencing (refer to sections, table, images), bibliography (references).	

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, Powerpoint& 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								
21ES1009	**DATA STRUCTURES AND ALGORITHMS**							**R21**
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**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO 2**
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 Binary Tree, Binary Search Tree, Height balanced Binary Tree, 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

Text Book(s):

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

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								
21CS2001	**COMPUTER ORGANIZATION & ARCHITECTURE**							**R21**
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**	
	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	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. **Machine Instructions and Programs:** 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. Define Input/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 non-numeric data (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**
Memory System: Basic concepts, Semiconductor RAM memories, Read only memories, speed, size and cost, Cache memories, performance considerations, Virtual memory, Memory management requirements, Secondary storage. **Large Computer Systems:** Forms of Parallel Processing, Array Processors, The Structure of		

General-Purpose multiprocessors, Interconnection Networks, Data Hazards, 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								
21CS2002	**DATABASE MANAGEMENT SYSTEMS**							**R21**
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	
	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
CO5	2	3	3										3	2

1: Low, 2-Medium, 3- High

COURSE CONTENT

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

Conceptual Modelling Introduction: Introduction to Data bases, Purpose of Database Systems, View of Data, Data Models, Database Languages, Database Users, Database Systems architecture.

The Entity-Relationship Model: 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

Relational Model: Introduction to the Relational Model – Integrity Constraints over Relations, Enforcing Integrity constraints, querying relational data, Logical data base Design, Views.

Relational Algebra: Introduction to Relational algebra, selection and projection, set operations, renaming, joins, division.

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

4. Understand Basics of Relational Model. (BL-2)
5. Describe phases of Logical Database Design.(BL-2)
6. 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

Relational database design: Introduction, Functional Dependencies (FDs), Normalization for relational databases: 1NF, 2NF, 3NF and BCNF, Basic definitions of Multi Valued Dependencies, 4NF and 5NF.

Transaction Management: 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

Concurrency Control: Lock-Based Protocols, Timestamp- Based Protocols, Validation-Based Protocols, Multiple Granularity.

Recovery: Failure Classification, Recovery and Atomicity, Log-Based Recovery.

Indexing: 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								
21CS2003	**MATHEMATICAL FOUNDATION FOR COMPUTER SCIENCE**							**R21**
Semester	**Hours / Week**			**Total hrs**	**Credit**	**Max Marks**		
	L	**T**	**P**		**C**	**CIE**	**SEE**	**TOTAL**
III	3	0	0	60	3	40	60	100

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

Course Objectives:

- To covert 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	**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	**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

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								
21CS2004	**OBJECT ORIENTED PROGRAMMING THROUGH JAVA**							R21
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	Describe the basic Elements of Java for problem solving.(BL-2)
CO2	Demonstrate the concepts of arrays and strings for organizing data. (BL-3)
CO3	Describe the concepts of object oriented programming. (BL-2)
CO4	Design the web applications through java applets. .(BL-3)
CO5	Develop Multi-threaded programs to improve the system performance. (BL-6)

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	2	2	2										2	2
CO3	2	3	2										2	3
CO4	2	3	3										3	2
CO5	3	3	3										3	3

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**

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

Strings: 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**
Introducing classes: Class fundamentals. Declaration objects, Assigning object reference variables, Introducing Methods, Constructors, this keyword, Garbage collection. **Inheritance and Polymorphism:**: Inheritance basics, Types of inheritance, Benefits, Member access rules, Constructor and calling sequence, Abstract Classes, Super and final keywords**.** Method overloading and Method overriding. **Interfaces**: Defining an interface, Extending interfaces, 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: 13. Develop user defined packages.(BL-3) 14. Implement Exception Handling.(BL-3) 15. Write our own Exceptions (BL-1) 16. 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: 5. Explain the concept of multi threaded concept.(BL-2) 6. Discuss thread states and its priorities.(BL-3) 7. Understand the concept of Synchronization.(BL-2) 8. 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								
21ES1513	**Data Structures and Algorithms Lab**							**R21**
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														
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	**(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 Sort b) Quick Sort	C04
TASK-7	**(3H)**
1. 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	
Write Program to Implement Fibonacci Search 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								
21CS2501	**DATABASE MANAGEMENT SYSTEMS LAB**							R21
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 File and Record Structures, Data Structures

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	PSO 1	PSO 2
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	CO 1

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**
Branchname	Varchar2(20)
Branch city	Varchar2(20)
asserts	Number

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. c. Add constraints like unique and not null to the department table. d. 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. c. Delete any three records in the department table and use rollback. d. 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.	CO 1

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 d**.** Delete constraint not null to the table column	
Task -3 QUERIES 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 the lowest 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. 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.	CO2

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-4 PROGRAMS 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 display the grade. 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. Write a PL/SQL program 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 radius varying from 3 to 7. Store the radius and the corresponding values of calculated area in an 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 the world Hello). b. Write a PL/SQL program to accept a number and a divisor. Make sure the divisor is less than or equal to 10. Else display an error message. Otherwise Display the remainder in nwords.	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	CO 3

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

TASK-6 TRIGGERS **(3H)**

CO 3

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

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 one or 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 -9 CAR 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. All major repairs and maintenance are done by subcontractors (i.e. franchised	CO 4

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 with primary keys and foreign keys where ever required. 5. Insert values into the tables created (Be vigilant about Master- Slave tables).	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 the Module table.	

Additional Experiments:	
TASK -1 – PROCEDURES	
1. Create the procedure for palindrome of given number. 2. Create the procedure for GCD: Program should load two registers with two Numbers and then apply the logic for GCD of two numbers. GCD of two numbers is performed by dividing 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 are the new set of two numbers. The process is repeated by dividing greater of the two numbers 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 -2 – CURSORS	
1. Write a PL/SQL block that will display the name, dept no, salary of fist highest paid employees**.** 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	CO 3

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

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								
21CS2502	**OBJECT ORIENTED PROGRAMMING THROUGH JAVA LAB**							**R21**
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 understand fundamentals of object-oriented programming in Java, defining classes, invoking methods, using class libraries, etc.
3. To develop programs on object-oriented programming concepts through java.
4. To develop programs on Exception Handling and multi-threading concepts.

Course Outcomes: After successful completion of the course, the 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 Control-flow, Strings	**(4H)**
a). The Fibonacci sequence is defined by the following rule. The first two values in the sequence are 1 and 1. Every subsequent value is the sum of the two values preceding it. b) Write a java program to multiply two given matrices. c) Write a JAVA program using String Buffer to delete, remove character. ? d) 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 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 isAlive 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. ?	CO 4
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 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 colours using Applet. ? d). Write an applet illustrating sequence of events in an applet. ?	
TASK -2 Files	
a) Write a java program that reads a file name from the user, and then displays information about whether the file exists, whether the file is readable, whether the file is writable, the type of file and the length of the file in bytes. b) Write a java program that displays the number of characters, lines and words in a text file. c) Write a java program that reads a file and displays the file on the screen with line number before each line.	
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.

SEMESTER-IV

NARAYANA ENGINEERING COLLEGE::GUDUR								
21MA1007	**EXPLORATORY DATA ANALYTICS WITH R**							R21
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**	
	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	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**	**9H**
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.		
MODULE – 2	**Objects in R and Probability methods**	**9H**
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.		
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		
MODULE – 4	**Hypothesis Testing & Graphical Analysis**	**10H**
Using the Student's t-test, The Wilcox on 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.		
MODULE – 5	**Complex Statistical analysis and Regression**	**10H**
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.		
	Total hours:	**48 hours**

TEXTBOOK:

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

REFERENCES:

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								
21CS2005	**COMPUTER NETWORKS**							R21
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	
	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										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		
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.		
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. Internetworking, IPV4 Addresses, IPV6, OSPF, BGP, IP.		
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.		
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.		
	Total hours:	**48 hours**

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								
21CS2006	**OPERATING SYSTEMS**							R21
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	
	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										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**.**		
MODULE – 2	**PROCESS AND CPU SCHEDULING, PROCESS COORDINATION**	**10H**
The process, process state, process control block, threads; Scheduling queues, context switch, pre-emptive 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**.**		
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**.**		

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**.**		
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		
	Total hours:	**48 hours**

TEXTBOOK:

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.

REFERENCES:

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. Andrew S Tanenbaum, "Modern Operating Systems", 3rd Edition, PHI, 2007.

NARAYANA ENGINEERING COLLEGE:GUDUR							
21CS2007	**SOFTWARE ENGINEERING**						R21
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:

6. To understand the software life cycle models.
7. To understand the software requirements and SRS document.
8. To understand the important of modeling and modeling languages
9. To design and develop correct and robust software products
10. 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 technique uses 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**	
	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
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**.**		
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**.**		
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**.**		
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		
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.		
	Total hours:	**48 hours**

TEXTBOOK:

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.

REFERENCES:

1. Ian Somerville, Software Engineering, 9th Edition Pearson Education Asia,2011.
2. Pankaj Jalote, A concise introduction to software Engineering, Springer
3. Pankaj Jalote, 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).
1. K.K. Agarwal & Yogesh Singh, Software Engineering, New Age International Publishers, 2007

NARAYANA ENGINEERING COLLEGE::GUDUR								
21MA1501	**EXPLORATORY DATA ANALYTICS WITH R LABORATORY**							R21
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
IV	0	0	2	48	1	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

	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	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		
TASK-1	**1Installing Packages**	**3H**
Installing R tools and Exploring packages in R. Managing user workspace		
TASK– 2	**Basic Programs**	**3H**
Programs on data types in R. Programs on Creating and manipulating a vector in R.		
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.		
TASK-4	**Data Frames and Operators**	**6H**
Programs on Data Frames in R. Programs on Operators in R. Programs on Data Sets.		
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		
TASK-6	**Data distribution**	**6H**
Programs on Random Number Generation and Control Programs on Random Numbers and Sampling Programs on Creating Random Data Partitions		
TASK-7	**Hypothesis Testing**	**3H**
Programs on Simple Hypothesis Testing Programs on Correlation and Covariance.		

TASK-8	ANOVA	6H
Simple Programs on Analysis of Variance (ANOVA) Programs on One-Way ANOVA Programs on Two-Way ANOVA		
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.		
TASK-10	**Data Summary**	**6H**
Programs on Extracting Means Programs on Creating Standard Data Summaries Programs on Summary Statistics		
Additional Experiments:		
TASK-1	**Complex Analysis**	
Programs on Manipulating Data and Extracting Components Programs on Creating Data for Complex Analysis, Summarizing Data.		
TASK -2	**Multiple Regression**	
Programs on Multiple Regression Building Regression Trees		
		48 hours

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								
21CS2503	**OPERATING SYSTEMS AND COMPUTER NETWORKS LAB**							R21
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:

10. To demonstrate the working principle of various communication protocols.
11. To implement data link layer and Network layer protocols.
12. To implement various CPU Scheduling, Deadlock Avoidance and detection Algorithms
13. 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	
	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**										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 algorithms to find turnaround time and waiting time. (a) Round Robin (b) Priority	CO 1
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.	CO 2

(a) Sequential (b) Indexed (c) Linked	
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								
21CS2504	SOFTWARE ENGINEERING LAB							R21
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
IV	0	0	2	48	1	40	60	100

Pre-requisite: Problem solving skills

Course Objectives:

1. To gain knowledge on various tools for applying it in the software modeling 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 4	Apply testing principles for validating software project.(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	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

COURSE CONTENT		
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 1. Health Care 2. Airlines 3. Banking Insurance 4. Retail 5. Education Summary Identify 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		
TASK-3	**SOFTWARE REQUIREMENTS SPECIFICATION**	**6H**
Draw use case diagram for Online Movie ticket reservation. Prepare use case diagram for Online airline reservation system		
TASK-4	**DATA MODELLING**	**6H**
Draw use case diagram for Online Movie ticket reservation. Prepare use case diagram for Online airline reservation system		
TASK-5	**CLASS MODELLING**	**6H**
Draw class diagram for Health care center. Draw class diagram for inventory system.		
TASK-6	**DATA MODELLING**	**6H**
Draw the class and use case diagram for Hospital management system?		
TASK-7	**SOFTWARE TESTING**	**3H**
Write the test cases for Banking application		
TASK-8	**SOFTWARE TESTING**	**3H**

Create a test plan documentation for Library management system.		
TASK-9	**SOFTWARE TESTING**	**3H**
UML Diagrams for develop the AUTOMATED TELLER MACHINE (ATM) application		
TASK-10	**SOFTWARE TESTING**	**3H**
UML Diagrams for develop the LIBRARY INFORMATION SYSTEM application.		
Additional Experiments:		
TASK-1	**SOFTWARE METRICS**	
Take ATM system study its system specification and report various bugs		
TASK -2	**SOFTWARE DESIGN**	
A program written in c language for Matrix multiplication fails. Introspect the causes for failure and write down the possible reasons for failure		
Total Hours		**45 hours**

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

OPEN ELECTIVES(OE)

NARAYANA ENGINEERING COLLEGE:GUDUR							
21CS3001	**DATA STRUCTURES AND ALGORITHMS**						R21
	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 Trees, Binary Search Trees, 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: Heap Sort, Insertion Sort, Merge Sort, Optimum Sorting Algorithms

Text Book(s):

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

Reference Books:

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

NARAYANA ENGINEERING COLLEGE:GUDUR								
21CS3002	**PYTHON PROGRAMMING AND DATA SCIENCE**							R21
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	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 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: 1. Learn the basics of python. (BL - 1) 2. Write the python programs. (BL - 1) **3.** 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: 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, 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: 1. Write programs for manipulating the strings. (BL - 1) 2. Understand the knowledge of data structures like Tuples, Lists, and Dictionaries.(BL - 2) 3. 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: 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**	**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: 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)	
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								
21CS3003	**OBJECT ORIENTED PROGRAMMING THROUGH JAVA**							R21
	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: 17. Demonstrate interface and its implementation. (BL-2)		

18. Develop user defined packages. (BL-3)
19. 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								
21CS3004	**ADVANCED JAVA PROGRAMMING**							R21
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: 5. Understand J2EE Architecture Types, containers and servers. (BL 2) 6. Gain knowledge on HTTP Protocols and APIs. (BL 2) 7. Discuss web applications and models. (BL 2) 8. 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, Prepared Statement, Callable Statement The Result Set 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:

1. Explain struts frame work. (BL 2)
2. Implement the Struts Framework. (BL 3)
3. Understand Spring Architecture(BL-2)
4. 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								
21CS3005	**DATABASES MANAGEMENT SYSTEM**							R21
	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: 9. Understand the Purpose of Database Systems, Data Models, View of Data. (BL-2) 10. Summarize the concept of Database Languages, Users, Architecture. (BL-2) 11. Design ER diagrams for given database. (BL-2) 12. 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: 4. Construct SQL queries in RDBMS. (BL-3) 5. Understand integrity and security Constraints in SQL (BL-2) 6. 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								
21CS3006	**OPERATING SYSTEMS**							R21
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	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: 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; 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: 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: 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: 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								
21CS3007	**COMPUTER NETWORKS**							R21
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	Determine 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: 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, 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: 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	(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: 1. Explain the working of world wide web with HTTP, DNS. (BL-2) 2. Describe the protocols for mail, remote system login. (BL-2) 3. Discuss file transfer, network management protocols. (BL-2)		
	Total hours:	**48 hours**

Content beyond syllabus:

1. Connecting Devices and VPN
2. 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								
21CS3008	**MOBILE APPLICATION DEVELOPMENT**							R21
	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):

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

Reference Book(s):

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

NARAYANA ENGINEERING COLLEGE::GUDUR								
21CS3009	**WEB TECHNOLOGIES**							R21
	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**	
	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										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):

8. Deitel and Deitel and Nieto, Internet and World Wide Web - How to Program, , 5th Edition, Prentice Hall, 2011.
9. ELad Elrom, Pro Mean Stack Development, 1st Edition, Apress O'Reilly, 2016
10. David sawyer mcfarland, Java Script & jQuery the missing manual, 2nd Edition, O'Reilly, 2011
11. Peter Pollock, Web Hosting for Dummies, 1st Edition, John Wiley & Sons, 2013
12. Tom Christiansen, Jonathan Orwant, Programming Perl, 4th Edition, O'Reilly, 2012
13. Kogent L S, Web Technologies: HTML, JavaScript, PHP, Java, JSP, XML and AJAX, Black book, 1st Edition, Dream Tech, 2009
14. 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								
21CS3010	**ARTIFICIAL INTELLIGENCE**							R21
	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::GUDUR							
21CS2013	**CRYPTOGRAPHY AND NETWORK SECURITY**						R21
SEMESTER	Hours / Week			Total hrs	Credit	Max Marks	
	L	T	P		3	CIE	SEE	TOTAL
VII	3	0	0	50		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	Understand and apply the cryptographic algorithms to safeguard from intruders(BL-2,3)
CO 2	Compare 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::GUDUR								
	CLOUD COMPUTING							R21
Course Code	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
21CS3012	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**

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