SEMESTER - I

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

SEMESTER -II

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

SEMESTER - III

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

SEMESTER -IV

CourseCode	Cat.	Course Title	Contact Periods per week				Credits	Scheme of Examination Max. Marks		
			L	T	P	Total		Int. Marks	Ext. Marks	Total marks
20MA1007	BS	Statistical Analysis and Techniques using R	3	0	0	3	3	40	60	100
20CS2005	PC	Computer Networks	3	0	0	3	3	40	60	100
20CS2006	PC	Operating Systems	3	0	0	3	3	40	60	100
20CS2007	PC	Software Engineering	3	0	0	3	3	40	60	100
20EC3011	OE	Open Elective I-Digital Logic Design	3	0	0	3	3	40	60	100
20MA1501	BS	Statistical Analysis and Techniques using R Lab	0	0	3	3	1.5	40	60	100
20CS2503	PC	Operating Systems & Computer Networks Lab	0	0	3	3	1.5	40	60	100
20CS2504	PC	Software Engineering Lab	0	0	3	3	1.5	40	60	100
20CD6002	SC	Career Competency development II	0	0	2	2	1	40	60	100
20CC6002	SC	Value added course/Certificate course II	0	0	0	0	1	40	60	100
20MC8002	MC	Mandatory course III- Environmental Science	2	0	0	2	0	--	--	--
		Counselling/Mentoring	0	0	1	1	0	--	--	--
		Sports/Hobby Clubs/Activities	0	0	2	2	0	--	--	--
		Activity Point Programme	During the semester				20 Pts			
			17	**0**	**14**	**31**	**21.5**	**400**	**600**	**1000**

SEMESTER -V

Course Code	Cat	Course Title	Contact Periods per week				Credits	Scheme of Examination Max. Marks		
			L	T	P	Total		Int. Marks	Ext. Marks	Total marks
20CS2008	PC	Artificial Intelligence	3	0	0	3	3	40	60	100
20CS2009	PC	Design and Analysis of Algorithms	3	0	0	3	3	40	60	100
20CS2010	PC	Theory of Computation	3	0	0	3	3	40	60	100
20EC3007	OE	Open Elective II- Microprocessors and Microcontrollers	3	0	0	3	3	40	60	100
20CS4026	PE	Professional Elective I- Software Project Management	3	0	0	3	3	40	60	100
20CS2505	PC	Artificial intelligence lab	0	0	2	2	1	40	60	100
20CS2506	PC	Coding Lab I	0	0	2	2	1	40	60	100
20CS2507	PC	Design and Analysis of Algorithms Lab	0	0	2	2	1	40	60	100
20CD6003	SC	Career competency development III	0	0	2	2	1	40	60	100
20CC6003	SC	Value added Course/Certificate Course III	0	0	0	0	1	40	60	100
20CS7501	PR	Internship I/On job Training/Comm. Service Project	0	0	0	0	1.5	40	60	100
		Counselling/Mentoring	0	0	1	1	0	--	--	--
		Sports/Hobby Clubs/Activities	0	0	2	2	0	--	--	--
		Activity Point Programme	During the Semester				20 Pts			
			15	**0**	**11**	**26**	**21.5**	**440**	**560**	**1100**

SEMESTER -VI

CourseCode	Cat	Course Title	Contact Periods per week				Credits	Scheme of Examination Max. Marks		
			L	T	P	Total		Int. Marks	Ext. Marks	Total marks
20HS5001	HS	Managerial Economics & Financial Analysis	2	0	0	2	2	40	60	100
20CS2012	PC	Mobile Application Development	2	0	0	2	2	40	60	100
20CS2013	PC	Web Technologies	3	0	0	3	3	40	60	100
20EC3006	OE	Open elective III- Internet of Things	3	0	0	3	3	40	60	100
20CS4007	PE	Professional elective II- Software Architecture	3	0	0	3	3	40	60	100
20CS4014	PE	Professional Elective III- Cloud Computing	3	0	0	3	3	40	60	100
20CS2508	PC	Coding Lab II	0	0	2	2	1	40	60	100
20CS2509	PC	Mobile Application Development Lab	0	0	2	2	1	40	60	100
20CS2510	PC	Web technologies Lab	0	0	3	3	1.5	40	60	100
20CD6004	SC	Career competency Development IV	0	0	2	2	1	40	60	100
20CC6004	SC	Value added course/Certificate Course IV	0	0	0	0	1	40	60	100
20MC8011	MC	Mandatory course IV- Business Communication	2	0	0	2	0	--	--	--
		Counselling/Mentoring	0	0	1	1	0	--	--	--
		Sports/Hobby Clubs/Activities	0	0	2	2	0	--	--	--
		Activity Point Programme	During the semester				20 Pts			
			18	**0**	**12**	**30**	**21.5**	**440**	**660**	**1100**

SEMESTER -VII

Course Code	Cat.	Course Title	Contact Periods per week				Credits	Scheme of Examination Max. Marks		
			L	T	P	Total		Int. Marks	Ext. Marks	Total marks
20CS2013	PC	Cryptography and Network Security	3	0	0	3	3	40	60	100
20CS2014	PC	Data Science	3	0	0	3	3	40	60	100
20CS2015	PC	Machine Learning	2	0	0	2	2	40	60	100
20EE3008	OE	Open Elective IV- Renewable Energy Sources	2	0	2	4	3	40	60	100
20CS4029	PE	Professional Elective IV- Ethical Hacking	3	0	0	3	3	40	60	100
20CS4030	PE	Professional Elective V- Cyber Security & Privacy	3	0	0	3	3	40	60	100
20CS2511	PC	Data Science Lab	0	0	3	3	1.5	40	60	100
20CS2512	PC	Machine Learning Lab	0	0	2	2	1	40	60	100
20CD6005	SC	Career competency Development V	0	0	2	2	1	40	60	100
20CC6501	SC	Skill development Training	0	0	2	2	1	40	60	100
20CS7002	PR	Internship 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			
			16	**0**	**14**	**30**	**23**	**440**	**660**	**1100**

SEMESTER -VIII

Course Code	Cat.	Course Title	Contact Periods per week				Credits	Scheme of Examination Max. Marks		
			L	T	P	Total		Int. Marks	Ext. Marks	Total marks
20CS7503	PR	Project work, seminar and internship	0	0	0	0	12	60	140	200
		Activity Point Programme	During the Semester				20 Pts			
			0	**0**	**0**	**0**	**12**	**60**	**140**	**200**

OPEN ELECTIVES (R20) REGULATIONS

OPEN ELECTIVES OFFERED BY DEPARTMENT OF CSE

S. No	Course Code	Subject	L-T-P	Credits
1	20CS3001	Introduction to Data Structures	3-0-0	3
2	20CS3002	Introduction to Python	3-0-0	3
3	20CS3003	JAVA Programming	3-0-0	3
4	20CS3004	Advanced Java Programming	3-0-0	3
5	20CS3005	Principles of Databases	3-0-0	3
6	20CS3006	Operating System Concepts	3-0-0	3
7	20CS3007	Computer Communication Networks	3-0-0	3
8	20CS3008	Mobile Application Development	3-0-0	3
9	20CS3009	Web Technologies	3-0-0	3
10	20CS3010	Applied Artificial intelligence	3-0-0	3
11	20CS3011	Information & Cyber Security	3-0-0	3
12	20CS3012	Cloud Computing	3-0-0	3
13	20CS3013	Introduction to Machine Learning	3-0-0	3

THE PROFESSIONAL ELECTIVES (R20) REGULATIONS

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

Electives Track/ Groups	Professional Elective-1	Professional Elective-2	Professional Elective-3	Professional Elective-4	Professional Elective-5
Computer Networks and Securities	Network Protocols and Programming 20CS4001	Software Defined Networks 20CS4006	Information and Cyber Security 20CS4011	Web Application and security 20CS4016	Block chain Technologies 20CS4021
Software Engineering	Software Project Management 20CS4002	Software Architecture 20CS4007	Software Testing 20CS4012	Object Oriented Analysis and Design 20CS4017	Agile Software Development 20CS4022
Data Science and Engineering	Data warehousing and data mining 20CS4003	Business Intelligence and Analytics 20CS4008	Information Storage and Retrieval Systems 20CS4013	Deep Learning 20CS4018	Programming for Data Science 20CS4023
Cloud Computing	Distributed Systems 20CS4004	Green Computing 20CS4009	Cloud Computing 20CS4014	High Performance Computing 20CS4019	Cloud Security 20CS4024
Virtualization and Others	Compiler Design 20CS4005	obotic Process Automation 20CS4010	Digital Marketing 20CS4015	Augmented and Virtual Reality 20CS4020	Virtualization Technologies 20CS4025
Moocs	Moocs-1 20CS4026	Moocs-2 20CS4027	Moocs-3 20CS4028	Moocs-4 20CS4029	Moocs-5 20CS4030

HONORS DEGREE UNDER R20 REGULATIONS

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

MINORS DEGREE UNDER R20 REGULATIONS

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

HUMANITIES AND SOCIAL SCIENCES (R20) REGULATIONS

Semester	Course Code	Subject	L-T-P	Credits
I Sem	20EN1001	English	2-0-0	2
	20EN1501	English language Lab	0-0-3	1.5
II Sem	20EN1502	Oral Communication Skills lab	0-0-2	1
VI Sem	20HS5001	Managerial Economics & Financial Analysis	2-0-0	2
			TOTAL	6.5

BASIC SCIENCES (R20) REGULATIONS

Semester	Course Code	Subject	L-T-P	Credits
I Sem	20MA1001	Algebra and Calculus	3-1-0	4
	20CH1001	Chemistry	3-0-0	3
	20CH1501	Chemistry Lab	0-0-3	1.5
II Sem	20MA1002	Number Theory and Applications	3-1-0	4
	20PH1004	Semiconductor Physics	3-0-0	3
	20PH1504	Semiconductor physics lab	0-0-3	1.5
IV Sem	20MA1007	Statistical Analysis and Techniques using R	3-0-0	3
	20MA1501	Statistical Analysis and Techniques using R Lab	0-0-3	1.5
			TOTAL	21.5

ENGINEERING SCIENCES (R20) REGULATIONS

Semester	Course Code	Subject	L-T-P	Credits
I Sem	20ES1001	Problem Solving and programming	3-0-0	3
	20ES1504	Engineering Graphics Lab	0-1-4	3
	20ES1506	Problem Solving and programming lab	0-0-3	1.5
II Sem	20ES1003	Basic Electrical and Electronics Engineering	3-0-0	3
	20ES1009	Python Programming	3-0-0	3
	20ES1508	Basic Electrical and Electronics Engineering lab	0-0-2	1
	20ES1505	Engineering and IT Workshop	0-0-4	2
	20ES1512	Python Programming Lab	0-0-2	1
III Sem	20ES1012	Data Structures and Algorithms	3-0-0	3
	20ES1515	Data Structures and Algorithms lab	0-0-3	1.5
			TOTAL	**22**

PROFESSIONAL CORE (R20) REGULATIONS

Semester	Course Code	Subject	L-T-P	Credits
SEM-III	20CS2001	Computer Organization and Architecture	3-0-0	3
	20CS2002	Database Management systems	3-0-0	3
	20CS2003	Mathematical Foundation for Computer Science	3-0-0	3
	20CS2004	Object Oriented Programming using Java	3-0-0	3
	20CS2501	Database Management Systems lab	0-0-3	1.5
	20CS2502	Object Oriented Programming using Java Lab	0-0-3	1.5
SEM-IV	20CS2005	Computer Networks	3-0-0	3
	20CS2006	Operating Systems	3-0-0	3
	20CS2007	Software Engineering	3-0-0	3
	20CS2503	Operating Systems & Computer Networks Lab	0-0-3	1.5
	20CS2504	Software Engineering Lab	0-0-3	1.5
SEM-V	20CS2008	Artificial Intelligence	3-0-0	3
	20CS2009	Design and Analysis of Algorithms	3-0-0	3
	20CS2010	Theory of Computation	3-0-0	3
	20CS2505	Artificial intelligence lab	0-0-2	1
	20CS2506	Coding Lab I	0-0-2	1
	20CS2507	Design and Analysis of Algorithms Lab	0-0-2	1
SEM-VI	20CS2012	Mobile Application Development	2-0-0	2
	20CS2013	Web Technologies	3-0-0	3
	20CS2508	Coding Lab II	0-0-2	1
	20CS2509	Mobile Application Development Lab	0-0-2	1
	20CS2510	Web technologies Lab	0-0-3	1.5
SEM-VII	20CS2013	Cryptography and Network Security	3-0-0	3
	20CS2014	Data science	3-0-0	3
	20CS2015	Machine Learning	2-0-0	2
	20CS2511	Data Science Lab	0-0-3	1.5
	20CS2512	Machine Learning Lab	0-0-2	1
		TOTAL		**58**

PROFESSIONAL ELECTIVES (R20) REGULATIONS

Semester	Course Code	Subject	L-T-P	Credits
V Sem	20CS4026	**Professional Elective 1** Software Project Management	3-0-0	3
VI Sem	20CS4007	**Professional Elective 2** Software Architecture	3-0-0	3
	20CS4014	**Professional Elective 3** Cloud Computing	3-0-0	3
VII Sem	20CS4029	**Professional Elective 4** Ethical Hacking	3-0-0	3
	20CS4030	**Professional Elective 5** Cyber Security & Privacy	3-0-0	3
TOTAL				**15**

OPEN ELECTIVES (R20) REGULATIONS

(OTHER DEPARTMENTS)

Semester	Course Code	Subject	L-T-P	Credits
IV Sem	20EC3011	**Open Elective 1** Digital Logic Design	3-0-0	3
V Sem	20EC3007	**Open Elective 2** Microprocessors and Microcontrollers	3-0-0	3
VI Sem	20EC3006	**Open Elective 3** Internet of Things	3-0-0	3
VII Sem	20EE3008	**Open Elective 4** Renewable Energy sources	3-0-0	3
			TOTAL	**12**

SKILL ORIENTED COURSES IN R20 REGULATIONS

Semester	Course Code	Subject	L-T-P	Credits
SEM III	20CD6001	Career competency Development I	0-0-2	1
	20CC6001	Value added course/Certificate course I	0-0-0	1
SEM IV	20CD6002	Career competency Development II	0-0-2	1
	21CC6002	Value added course/Certificate course II	0-0-0	1
SEM V	20CD6003	Career competency Development III	0-0-2	1
	20CC6003	Value added course/Certificate Course III	0-0-0	1
SEM VI	20CD6004	Career competency Development IV	0-0-2	1
	20CC6004	Value added course/Certificate course IV	0-0-0	1
SEM VII	20CD6005	Career competency Development V	0-0-2	1
	20CC6501	Skill development Training	0-0-0	1
			TOTAL	**10**

PROJECT (PR) AND INTERNSHIP (R20) REGULATIONS

Semester	Course Code	Subject	L-T-P	Credits
V Sem	20CS7501	Internship I/on job training/Community Service Project	**0-0-0**	**1.5**
VII Sem	20CS7002	Internship II/on job training/Community Service Project	0-0-0	1.5
VIII Sem	20CS7503	Project work, seminar and internship	0-0-0	12
			TOTAL	**15**

MANDATORY COURSES (R20) REGULATIONS

Semester	Course Code	Subject	L-T-P	Credits
I SEM	20MC8001	Mandatory course I :Induction Program	2-0-0	0
II SEM	20MC8002	Mandatory course II :Induction Program	2-0-0	0
IV SEM	20MC8002	Environmental Science	2-0-0	0
VI SEM	20MC8011	Business Communication	2-0-0	0
TOTAL				0

CREDITS TABLE R20 REGULATIONS

SUBJECTAREA	CREDITS PER SEMESTER								CREDITS
	I	II	III	IV	V	VI	VII	VIII	
Basic Sciences	8.5	8.5		4.5					21.5
Engineering Sciences	7.5	10	4.5						22
Humanities and Social Sciences	3.5	1				2			6.5
Program Core			15	12	12	8.5	10.5		58
Professional Electives					3	6	6		15
Open Electives				3	3	3	3		12
Project(s)								12	12
Internships/Seminars					1.5		1.5		3
Any other (Please specify) Skill Oriented Courses			2	2	2	2	2		10
TOTAL	19.5	19.5	21.5	21.5	21.5	21.5	23	12	160

COMPONENTS OF CURRICULUM R20 REGULATIONS

Curriculum Component	Curriculum Content (% of total number of credits of the program)	Total number of contact hours	Total number of credits
R20 Regulations			
Basic Sciences	13.44%	644	21.5
Engineering Sciences	13.75%	660	22
Humanities and Social Sciences	4.06%	195	6.5
Program Core	36.25%	1732	58
Professional Electives	9.38%	450	15
Open Electives	7.50%	359	12
Project(s)	7.50%	360	12
Internships/Seminars	1.88%	92	3
Any other (Please specify) Skill Oriented Courses	6.25%	300	10
Total	**100.00%**	**4792**	**160**

SEMESTER - I

NARAYANA ENGINEERING COLLEGE:GUDUR							
20MA1001	**ALGEBRA & CALCULUS(CSE, ECE, EEE, CE, ME)**						R20
I-B.Tech	Hours / Week			Total hrs	Credit	Max Marks	
	L	T	P		C	CIE	SEE	TOTAL
I-Semester	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 first order ordinary differential equations.
3. To enlighten the learners in the concepts of higher order differential equation an its applications
4. To explain the series expansions using mean value theorems and the concepts of multivariable differential calculus.
5. To summarize the procedure to solve the partial differential equations.
6. 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	Solve the system of linear equations, using technology to facilitate row reduction determine the rank, eigenvalues and eigenvectors.
CO 2	Analyze the ordinary differential equations to provide solutions of various engineering applications.
CO 3	Apply the mathematical knowledge of higher order differential equations to solve various engineering problems.
CO 4	Describe the knowledge of Mean Value theorems and functions of several variables for engineering applications.
CO 5	Analyze the partial differential equations to provide solutions of various engineering applications.
CO 6	Apply the techniques of Multiple integrals for the Area of the region bounded by curves and volume.

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										
CO2	3	3	2	2										
CO3	3	3	2	3										
CO4	3	3	2	3										
CO5	3	3	1	2										
CO6	3	3	2	2										

1: Low, 2-Medium, 3- High

COURSE CONTENT		
MODULE – 1	**MATRICES**	**14H**
Introduction to matrices, Definition of Rank Definition of Echelon form, Problems, Solving System of Non-Homogeneous equations Definition, Conditions for Consistency, Problems, Solving System of Homogeneous equations- Definition, Problems, Eigen values & Eigen Vectors- Definition, Problems, properties of Eigen values & Eigen Vectors(Without proof), Cayley Hamilton Theorem -Statement (Without proof), finding inverse and power of a matrix by Cayley-Hamilton Theorem, Diagonalization of a Matrix-Definition, similarity of a matrix, modal matrix, spectral matrix, powers of a matrix, problems on Diagonalization of a matrix, Quadratic Forms- Definition, Finding Matrix from Q.F, Index, signature, rank and nature of the quadratic forms, Reduction of Q.F. into a canonical form by linear transformation, Reduction of Q.F. into a canonical form by orthogonal transformation.		
At the end of the Module 1, students will be able to: 1. Solve the system of homogenous and non-homogenous linear equations.(BL-3) 2. Obtain the Eigen values and Eigen vectors of a matrix.(BL-2) 3. Identify special properties of matrix and for using this information to study the nature of the linear equations. (BL-3) 4. Find the inverse and powers of a square matrix. (BL-1) 5. Obtain the diagonalization form of the matrix. (BL-2) 6. Apply the techniques of matrices in various engineering problems. (BL-3)		
MODULE -2	**FIRST ORDER ORDINARY DIFFERENTIAL EQUATIONS**	**9H**
Exact Differential equation Definition, condition for exactness, problems, Non Exact Differential equations- Integrating factor, Method1: Integrating factor by inspection, problems, Method2:Finding Integrating factor, problems, Method3: Finding Integrating factor, problems, Method4:Finding Integrating factor, problems, Method5:Finding Integrating factor, problems, Linear differential Equation- Definition, Working rule to find general solution, problems, Bernoulli's differential Equation- Definition, Working rule to find general solution, problems, Applications of Differential equation of First order: Newton's law of Cooling-Explanation of the concept, problems, Law of natural growth and Decay- Explanation of the concept, problems and Simple Electric Circuits-Explanation of the concept, problems.		
At the end of the Module 2, students will be able to: 1. Identify the first order ordinary differential equations. (BL-3) 2. Solve the first order ordinary differential equations. (BL-3) 3. Apply the techniques of first order ordinary differential equations in Newton's law of cooling, Natural growth & Decay problems. (BL-3) 4. Make Use of the first order ordinary differential equation techniques in simple electric circuits. (BL-3)		
MODULE-3	**HIGHER ORDER ORDINARY DIFFERENTIAL EQUATIONS**	**10H**
Non-Homogenous Linear Differential equation of second and higher order with constant coefficients-Definition, complete solution, operator D, rules for finding Complimentary function, problems, inverse operator, General method for finding Particular Integral. Non-homogeneous Linear Differential Equations of Second & Higher order with Constant coefficients with RHS term of the type^{ax}, sinax, cosax, Polynomial in X, $e^{ax}V(x)$, X.V(x)-Explanation of the concept& problems, Method of variation of parameters- Explanation of the concept& problems, Euler-		

Cauchy equation- Definition, problems,Legendre'sLinear equation- Definition, problems. Applications to Higher order Differential Equations - L-C-R circuits, problems.

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

1. Identify the higher order ordinary differential equations. (BL-3)
2. Solve the linear differential equations with constant coefficients by appropriate methods (BL-3)
3. Solve the linear differential equations with variable coefficients by appropriate methods (BL-3)
4. Make Use of the higher order ordinary differential equations techniques in electrical circuits. and in various engineering problems. (BL-3)

MODULE-4	**MEAN VALUE THEOREMS & MULTIVARIABLE CALCULUS**	**9H**

Taylor's and Maclaurin's theorems with remainders-Statements (without proof), problems on Taylor's series, problems on Maclaurin's series, Jacobean-Definition, Properties, problems, Functional dependence -Definition, problems, Maxima & Minima of function of two variables Rules, Maxima & Minima of function of two variables without constraint-problems, Maxima & Minima of function of two variables with constraint- problems, Lagrange's Method of Undetermined multipliers, problems.

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

1. Demonstrate the given function as a series of Taylor's and maclurin's with remainders.(BL-2)
2. Illustrate series expansions of functions using mean value theorems. (BL-2)
3. Apply Jacobean concept to deal with problems in change of variables. (BL-3)
4. Obtain the maxima and minimum values of the function for two variables.(BL-2)
5. Apply mean value theorems to check continuity of function in given interval. (BL-3)

MODULE-5	**PARTIAL DIFFERENTIAL EQUATIONS**	**11H**

Definition Formation of PDE by the Method of Elimination of arbitrary constants, problems, Method of Elimination of arbitrary functions, problems, Method of Separation of Variables-Explanation of the concept& problems, First order linear partial differential equations-Definition, Solutions of first order linear PDE-Working rule of Lagrange's Method, problems, First order non-linear partial differential equations Definition, Solutions of first order non-linear partial differential equations-Standard form-1 problems, Standard form-II, problems, Standard form-III, problems, Standard form-IV, problems.

At the end of the Module 5, 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-6	**MULTIPLE INTEGRALS**	**11H**

Double Integrals- Introduction, Evaluation in Cartesian coordinates, problems, Evaluation in Polar coordinates, change of variables - Problems on Cartesian to Polar, Change of Order of Problems, Triple integrals -Integration- Problems, Area enclosed by plane curves Introduction, Evaluation of Triple Integrals, Volume by Triple Integrals - Problems, Change of variables between Cartesian, cylindrical and spherical polar coordinates- Problems.

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

1. Obtain double integrals in Cartesian and polar co-ordinates. (BL-2)
2. Obtain the area bounded by a region using double integration techniques. (BL-2)
3. Solve triple integrals. (BL-3)
4. Obtain volumes by using triple integrals.(BL-2)
5. Make Use ofmultiple integral techniques in engineering problems. (BL-3)

	Total Hours	**64 Hours**

Content beyond syllabus:

1. Orthogonal Trajectories.
2. Deflection of Beams.
3. Simultaneous Linear equations with constant coefficients
4. Taylor's series for function of two variables.
5. Homogeneous Linear Partial differential equations with constant coefficients.
6. 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	First Order Ordinary Differential Equations	CO2	https://youtu.be/P7gVp333B6M
3	Higher Order Ordinary Differential Equations	CO3	https://youtu.be/btOCUmJkrrg
4	Mean value theorems & Multivariable Calculus:	CO4	https://youtu.be/bJPuy0QZ-tE https://youtu.be/0apMXhWG_W8 https://youtu.be/aqfSOOiO2kI
5	Partial Differential Equations	CO5	https://youtu.be/kZ7Oa7iMiCs
6	Multiple Integrals	CO6	https://youtu.be/mIeeVrv447s

Text Book(s):

1. Erwin Kreyszig. Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2011.
2. B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna Publishers, 2017
3. N. Bali, M. Goyal, C. Watkins, Advanced Engg. Mathematics, Infinity Science Press.

Reference Book(s):

1. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 3/e, Alpha Science International Ltd., 2002.
2. George B. Thomas, Maurice D. Weir and Joel Hass, Thomas Calculus, 13/e, Pearson Publishers, 2013.
3. B. V. Ramana, Higher Engineering Mathematics, Mc Graw Hill Education
4. H. k Das, Er. Rajnish Verma, Higher Engineering Mathematics, S. Chand.

Online Resources/Web Resources:

1. http://www.macs.hw.ac.uk/~simonm/linalg.pdf
2. http://www.e-booksdirectory.com/details.php?ebook=7400re
3. http://www.efunda.com/math/math_home/math.cfm
4. http://www.ocw.mit.edu/resources/#Mathematics
5. http://www.sosmath.com/
6. http://www.mathworld.wolfram.com/

NARAYANA ENGINEERING COLLEGE:GUDUR								
20CH1001	**CHEMISTRY(COMMON TO ECE,EEE&CSE)**							**R20**
I-B.Tech	**Hours / Week**			**Total hrs**	**Credit**	**Max Marks**		
	L	**T**	**P**		**C**	**CIE**	**SEE**	**TOTAL**
II-Semester	3	0	0	48	3	40	60	100

Pre-requisite: Nil

Course Objectives:

1. To impart technological aspects of modern chemistry and its applications.
2. Understands the chemistry behind electrochemical energy systems.
3. To train the students on the principles and applications of polymer.
4. Learn analytical methods useful in characterization of compounds.

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

CO 1	Illustrate the molecular orbital energy level diagram of different molecular species.
CO 2	Achieve the knowledge about various kinds of electro chemical cells.
CO 3	Describe various energy storage devices and emerging technologies.
CO 4	Understand the mechanism and applications of different polymers in electronic devices.
CO 5	Familiarize the various sources of renewable energy and their harnessing.
CO 6	Apply the spectroscopy methods for the analysis of engineering materials.

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	1							
CO2	3	2				2	1							
CO3	3					2	1							
CO4	3					2								
CO5	3	2				2								
CO6	3	2				2	1							
1: Low, 2-Medium, 3- High														

COURSE CONTENT		
MODULE – 1	**STRUCTURE AND BONDING MODELS**	**8H**
Planks quantum theory, photo electric effect, dual nature of matter -Debroglies equation Heisenberg uncertainty principle, 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, crystal field theory-salient features splitting in octahedral and tetrahedral geometry.		
At the end of the Module 1, students will be able to: 1. Understand the fundamental concepts of chemistry to predict the structure, properties and bonding of Engineering materials.(BL-1) 2. Illustrate the molecular orbital energy level diagram of different molecular species. (BL-2) 3. Apply crystal field theory for octahydral and tetrahydral complexes. (BL-3) 4. Outline the planks quantum theory. (BL-2) 5. Explain Heisenberg uncertainty principle. (BL-2)		
MODULE -2	**ELECTRO CHEMISTRY**	**8H**
Electrode potential, EMF of an electrochemical cell, problems on Emf, Nernst equation. Electrodes concepts, reference electrodes (standard hydrogen, Calomel electrode, and glass electrode), potentiometry- potentiometric titrations (redox titrations), concept of conductivity, conductometric titrations (acid-base titrations), photovoltaic cell-working and applications.		
At the end of the Module 2, students will be able to: 1. Demonstrate competency in the basic concepts of electrochemical cells. (BL-2) 2. Explain 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-2)		
MODULE-3	**BATTERY TECHNOLOGY**	**7H**
Basic concepts, classification of batteries, Important applications of batteries, Modern batteries-zincair, lithium cells- Li ion cell, Li-MnO_2cell, ni-cd cell, lead acid storage cell. Fuel cells Introduction-classification of fuel cells-hydrogen and oxygen fuel cell, methanol and oxygen fuel cell, SOFC - Merits of fuel cell.		
At the end of the Module 3, students will be able to: 1. Classify batteries into different types.(BL-2) 2. Explain the concept involved in the construction of batteries. (BL-2) 3. Identify the significance of batteries. (BL-3) 4. Compare the merits of different fuel cells.(BL-2) 5. Distinguish between different types of batteries.(BL-2)		
MODULE-4	**POLYMER CHEMISTRY**	**9H**
Basic concepts of polymers, chain growth and step growth polymerization, coordination polymerization, copolymerization with specific examples and mechanisms of polymer formation. Plastics - Thermoplastics and Thermosetting, Preparation, properties and applications of-pvc, Bakelite, urea-formaldehyde, Nylons- 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-3) 2. Distinguish between thermoplastic and thermosetting resins. (BL-2) 3. Explain the preparation, properties and applications of some plasticmaterials.(BL-2)		

4. Apply the knowledge of advanced polymers, conducting polymers for different applications (BL-3)
5. Outline the properties of polymers and various additives added and different methods of forming plastie materials. (BL-2)

MODULE-5	ENERGY SCIENCE	7H

Fuels-classification of fuels characteristics solid fuels-coal, analysis of coal, refining of petroleum, alternative and non-conventional sources of Energy-solar, wind, Geo, Hydro powe Bio mass advantages and disadvantages, Nuclear energy-Nuclear fission and fusion reactions, Nuclear waste disposal

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. Elucidate alternative and non-conventional energy resources. (BL-2)
3. Distinguish between Nuclear fission and fusion. (BL-2)
4. outline the fuel characteristics. (BL-2)
5. Explain the nuclear waste disposal. (BL-2)

MODULE-6	INSTUMENTAL METHODS AND APPLICATIONS	9H

Electronic Spectroscopy -EMR, Beer-Lambert's law and its applications, instrumentation of UV-visiblespectrophotometer.IR Spectroscopy Types of vibrations, Instrumentation of IR spectrophotometer and its applications. Chromatography-Introduction, Principle and instrumentation of Gas Chromatography (GC) and thin layer chromatography, separation of gaseous mixtures and liquid mixtures.

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

1. Explain the different types of spectral series in electromagnetic spectrum. (BL-2)
2. Understand the principles of different analytical instruments. (BL-2)
3. Explain the different applications of analytical instruments. (BL-2)
4. Outline the Beers lamberts law. (BL-2)

Total Hours	48 Hours

Content beyond syllabus:

Band theory, vulcanization and compounding of rubber.

Self-Study:

Contents to promote self-Learning:

SNO	Topic	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	Non conventional energy recourses	https://swayam.gov.in/nd1_noc20_ge06/preview
6	Fundamentals of spectroscopy	https://swayam.gov.in/nd1_noc20_cy08/preview

Text Book(s):

1. P.C.Jain & MonikaJain, Engineering Chemistry, DhanpatRayPublishing 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.

Reference Book(s):

1. J. D. Lee, Concise Inorganic Chemistry, Oxford University Press, 5th edition2010.
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.
4. S.Muthu Krishna Iyer, Energy scenario beyond 2100,

Online Resources/Web Resources:

1. https://drive.google.com/file/d/0Bz82vSA0C1xIWC11WkpsTmlwQVk/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-analysis 1/
5. https://nptel.ac.in/courses/104/106/104106096/
6. https://youtu.be/KHh_IX1G6uA
7. https://www.youtube.com/watch?v=MfbxR9ZDs0s&feature=youtu.be
8. https://nptel.ac.in/courses/113/105/113105028/
9. https://www.youtube.com/watch?v=15MY7abeCDk
10. 10. https://www.youtube.com/watch?v=UeGJpwClaiQ&feature=youtu.be

NARAYANA ENGINEERING COLLEGE:GUDUR								
20ES1001	**PROBLEM SOLVING AND PROGRAMMING**							**R20**
I-B.Tech	**Hours / Week**			**Total hrs**	**Credit**	**Max Marks**		
	L	**T**	**P**		**C**	**CIE**	**SEE**	**TOTAL**
I-Semester	3	0	0	48	3	40	60	100
Pre-requisite: Mathematics Knowledge, Analytical and Logical skills								
Course Objectives: 1. To understand various steps in Program development. 2. To understand the basic concepts in C Programming Language. 3. To learn how to write modular and readable C Programs. 4. To learn the syntax and semantics of a C Programming language. 5. To learn structured programming approach for problem solving.								
Course Outcomes: After successful completion of the course, the student will be able to:								
CO 1	Identify methods to solve a problem through computer programming. (BL - 3)							
CO 2	Understand the use of basic elements of C language. (BL - 2)							
CO 3	Understand the difference and the usage of various control statement. (BL - 2)							
CO 4	Apply the modular approach for solving the problems. (BL - 3)							
CO 5	Apply the Arrays and Pointers for solving problems. (BL - 3)							
CO 6	Explain User-Defined Data Types and Files. (BL - 2)							

CO-PO Mapping														
CO	**PO**												**PSO**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	3	3										3	
CO2	1	2	3										1	
CO3	1	2	2		2								2	2
CO4	2	2	3		1								3	2
CO5	3	3	3										2	
CO6	1	2	3										1	
1: Low, 2-Medium, 3- High														

COURSE CONTENT		
MODULE – 1	**FUNDAMENTALS OF COMPUTERS AND PROGRAMMING**	**8H**

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

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

Fundamental Algorithms: Exchanging the values of Two Variables, Counting, Summation of a set of numbers, Factorial computation, Generation of the Fibonacci Sequence, Reversing the digits of aninteger.

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

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

MODULE -2	BASIC ELEMENTS OF C	7H

Basics of C: Introduction**,** Character Set, Structure of a C Program, A Simple C Program, Variables, Data Types and Sizes, Declaration, How does The Computer Store Data in Memory, Identifiers, Keywords, Constants, Assignment, and Initialization.

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

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

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

MODULE-3	DATA INPUT / OUTPUT AND CONTROL STATEMENTS	8H

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

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

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

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

MODULE-4	FUNCTIONS AND PROGRAM STRUCTURE	8H

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

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

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

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

3. Explain storage specifiers. (BL - 2)		
MODULE-5	**ARRAYS AND POINTERS**	**8H**
Arrays and Strings: Introduction, One-Dimensional Array, Multidimensional Arrays, Passing Arrays to Function, Strings - Declaration, Initialization, Printing Strings, String Input, Character Manipulation, String Manipulation, Arrays of Strings. **Pointers:** Fundamentals, Pointer Declarations, Operations on pointers, Passing Pointers to a Function, Pointers and Arrays, Arrays of Pointers, Pointer to Pointer, Pointer to Functions, Command line arguments, Dynamic Memory Management.		
At the end of the Module 5, students will be able to: 1. Understand the concept of Arrays. (BL - 2) 2. Understand the concept of pointers. (BL - 2) 3. Explain Dynamic Memory Management. (BL -2)		
MODULE-6	**USER-DEFINED DATA TYPES AND FILES**	**9H**
Structures and Unions: Basics of Structures, Nesting of Structures, Arrays of Structures, Structures and Pointers, Structures and Functions, Self-Referential Structures, Unions, Bit-fields, Enumerations, typedef. **Files:** Introduction, Using Files in C, Working with Text Files, Random Accesses to Files of Records.		
At the end of the Module 6, students will be able to: 1. Explain user defined data types. (BL - 2) 2. Understand the concept of Self-Referential Structures. (BL - 2) 3. Understand the working of files. (BL - 2)		
	Total Hours	**48 Hours**

Content Beyond Syllabus:

1. Analysis of Algorithms
2. Binary Files
3. Variable Length Argument Lists

Self-Study:

Contents to promote self-Learning:

SNO	Topic	Reference
1	Fundamentals of Computersand Programming	https://nptel.ac.in/courses/106/106/106106127/ [Lec1] https://nptel.ac.in/courses/106/105/106105214/ [Week 1 - Lec 1 To 2] https://nptel.ac.in/courses/106/105/106105171/[Week 1 - Lec 1 To 4]
2	Basic Elements of C	https://nptel.ac.in/courses/106/105/106105171/ [Week 1 - Lec5] https://nptel.ac.in/courses/106/105/106105171/ [Week 2 - Lecture 7 To 10] https://nptel.ac.in/courses/106/105/106105171/ [Week 3 - Lec 11 To 14] https://nptel.ac.in/courses/106/106/106106127/ [Lec2] https://nptel.ac.in/courses/106/106/106106127/ [Lec3]

		https://nptel.ac.in/courses/106/106/106106127/[Lec4]
3	Data Input / Output andControl Statements	https://nptel.ac.in/courses/106/106/106106127/ [Lec5] https://nptel.ac.in/courses/106/105/106105171/ [Week 3 - Lec15] https://nptel.ac.in/courses/106/105/106105171/ Week 4 - Lec 16 To 20] [Week 5 - Lec 21 To 25] https://nptel.ac.in/courses/106/106/106106127/ [Lec 6 &7]
4	Functions and ProgramStructure	https://nptel.ac.in/courses/106/105/106105171/ [Week 7 - Lec35] [Week 8 - Lecture 36 To 40] https://nptel.ac.in/courses/106/105/106105171/ [Week 11 - Lec 53 To 54] https://nptel.ac.in/courses/106/106/106106127/[Lec 20 To 27]
5	Arrays and Pointers	https://nptel.ac.in/courses/106/105/106105171/ [Week 6 - Lec 26 To 30][Week 7 - Lec 32 To 34,48] [Week 12 - Lec 58, 59, 61] https://nptel.ac.in/courses/106/106/106106127/[Lec 9 To 19]
6	User-Defined Data Types and Files	https://nptel.ac.in/courses/106/105/106105171/ [Week 11 - Lec 55, 56, 57, 60] https://nptel.ac.in/courses/106/106/106106127/ [Lec 36, 37, 38] https://nptel.ac.in/courses/106/106/106106127/[Lec60]

Text Book(s):

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

Reference Books :

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

Online Resources / Web Resources:

1. https://nptel.ac.in/courses/106/105/106105171/
2. https://nptel.ac.in/courses/106/106/106106127/
3. https://www.youtube.com/playlist?list=PLVIQHNRLfIP81Gz6OXwIV IgHgc72aXIh
4. https://www.youtube.com/watch?v=8PopR3x-VMY
5. https://www.youtube.com/watch?v=vl794HKeXug
6. https://books.goalkicker.com/CBook/
7. https://www.tutorialspoint.com/cprogramming/index.
8. https://www.programiz.com/c-programming
9. https://www.javatpoint.com/c-programming-language-tutorial
10. https://www.edureka.co/blog/c-programming-tutorial/
11. https://data-flair.training/blogs/c-tutorial/
12. https://www.programmingsimplified.com/c-program-examples
13. https://www.w3schools.in/category/c-tutorial/
14. C Programming Notes for Professionals book: https://books.goalkicker.com/CBook

NARAYANA ENGINEERING COLLEGE:GUDUR								
20EN1001	**ENGLISH**							**R20**
I-B.Tech	**Hours / Week**			**Total hrs**	**Credit**	**Max Marks**		
	L	**T**	**P**		**C**	**CIE**	**SEE**	**TOTAL**
I-Semester	2	0	0	32	2	40	60	100

Pre-requisite: Knowledge of fundamentals of English Language & Grammar

Course Objectives:

1. To enhance the linguistic and communicative competence.
2. To improve the Language proficiency of students in English with an emphasis on Vocabulary, Reading and Writing skills.
3. To provide knowledge of grammatical structures & rules and encourage their appropriate use.
4. To expose the students to Reading skills and apply the skill & strategies of a successful reader
5. To acquaint the students with effective strategies of paragraphs, note making, text editing, review writing and formal correspondence such as letter writing, e mail, and memos.
6. To aid the students acquire appropriate and adequate knowledge on writing Technical Reports.

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

CO 1	Acquire in-depth knowledge on formulating appropriate sentences with Grammatical accuracy and also develop concept of word formation. .
CO 2	Describe coherent and unified paragraphs with adequate support and detail and can write a topic sentence, support and concluding sentence.
CO 3	Develop the writing and life skills in structural manner of real time scenarios.
CO 4	Understand the grammar rules for synthesis of sentences and use prewriting strategies to plan to write dialogues, reviews and edit the text effectively.
CO 5	Interpret the skills and sub skills of reading and use strategies for reading effectively and provide knowledge on the structure and format of technical writing.
CO 6	Use the concepts of various real time scenarios to represent in an effective model.

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									2	3				
CO3										3				
CO4									3	3				
CO5									3	3				
CO6									3	3				
1: Low, 2-Medium, 3- High														

COURSE CONTENT		
MODULE – 1		**5H**
Grammar: Parts of speech: Noun (Countables & Uncountables, Singulars & Plurals, Kind of Nouns), Pronoun, Verb, Adverb, Adjective Kinds of Sentences & Sentence Structures Question forms Word order in Sentence. **Vocabulary Building:** Concept of word formation Synonyms & Antonyms Homonyms & Homophones Prefixes & suffixes substitutes-Idioms & Phrasal Verbs.		
At the end of the Module 1, students will be able to: 1. Acquire in depth knowledge on basic grammar concepts. (BL-2) 2. Understand the meaning of suffixes & Prefixes, idioms and phrasal verbs. (BL-2) 3. Learn meaning and usage of Vocabulary. (BL-2)		
MODULE -2		**6H**
Grammar: Subject Verb agreement - Pronoun-antecedent agreement Verbs - auxiliary verbs (Primary & Modal)- Tenses. **Writing:** Principles of writing: clarity, simplicity, brevity, single focus, organization of thoughts Sentence Structure - Joining the sentences sequencing the ideas introduction and conclusion - Punctuation.		
At the end of the Module II, students will be able to: 1. Learn to use sentences clearly. (BL-2) 2. Understand the usage of grammar. (BL-2) 3. Learn the importance of use of Auxiliary verbs. (BL-2)		
MODULE-3		**6H**
Grammar: Direct & Indirect Speech - Active and Passive Voice - Comparison of Adjectives - Articles - Prepositions. **Writing:** Paragraph Writing - Phrases & Clauses - Conditionals - Business letters and Emails and Memos - Structure/ template of common business letters and emails: inquiry complaint/placing an order.		
At the end of the Module III, students will be able to: 1. Understand and learn the nuance of writing business letters, e-mails, memos and effective paragraphs. (BL-2) 2. Learn to use devices of coherence & cohesion with adequate support &detail. (BL-2) 3. Learn the use of prepositions and scientific contexts. (BL-2) active &		
MODULE-4		**5H**
Grammar: Phrasal Verb Cause and effect Verb noun Collocations & adjective-noun collocations correcting common errors in grammar and usage Misplaced modifiers, idiomatic expressions **Writing:** Note Making- organizing techniques: providing a suitable title, headings and sub headings; methods of sequencing - Paraphrasing -techniques of paraphrasing: Replacement of words and phrases, change of sentence structures.		
At the end of the Module IV, students will be able to: 1. Understand the usage of phrases and clauses in sentences. (BL-2) 2. Learn grammatical rules to encourage their appropriate use inwriting. (BL-2) 3. Learn to write effective note making and paraphrase. (BL-2)		
MODULE-5		**5H**
Grammar: Question formation (Wh-questions, Yes or No questions, Tag questions)-If Clauses-Simple, Compound, Complex Sentences - Correcting common errors in grammar and usage **Writing**: Editing short texts Dialogue writing Writing Definitions (short and long) -compare and		

contrast paragraphs- Writing of Reviews: Book/Play/ Movie focus on appropriate vocabulary and structure language items like special vocabulary and idioms used.		
At the end of the Module V, students will be able to: 1. Acquire the knowledge of applying the grammatical rules for synthesis of sentences. (BL-2) 2. Learn to write dialogues for various contexts. (BL-2) 3. Learn to edit the text and writing reviews. (BL-2)		
MODULE-6		**5H**
Reading Skills: Types of reading: Skimming, Scanning, Intensive & Extensive Reading - Effective Reading-Tips, Reading Comprehension, Scramble Sentences, Complete the passage using contextual clues, Identifying Main Ideas using Scanning Technique, Identifying Specific Ideas using Skimming Technique. **Writing:** Describing Report Writing: definition purpose types structure formal and informal reports-stages in developing report- proposal, progress and final reports-examples		
At the end of the Module VI, students will be able to: **1.** Master the skills and sub skills of reading. (BL-2) 2. Learn the structure and format of technical reports. (BL-2) 3. Learn to write description of things, process, places and persons. (BL-2)		
	Total Hours	**32 Hours**

Content beyond syllabus:

Self-Study:

Contents to promote self-Learning:

SNO	Topic	CO	Reference
1	Vocabulary for Aptitude & Recruitment Tests | Campus Jobs	CO1	**https://youtu.be/uzvZa2qEuWo**
2	Tips to Improve Verbal and WrittenCommunication Skills	CO2	**https://youtu.be/6Y3NY0ERBxY**
3	How to write professional emails inEnglish	CO3	**https://youtu.be/3Tu1jN65slw**
4	Introduction to Collocation	CO4	**https://youtu.be/-ouWOpo2Uh8**
5	**Error Spotting Questions in Campus Recruitment Tests**	CO5	**https://youtu.be/Rz6-qjNrzCU**
6	Reading Skills: How To Skim, Scanand Read for Detail Effectively	CO6	**https://youtu.be/SRHNKzXxu6o**

Text Books:

1. Green, David Contemporary English Grammar -Structures and Composition, MacMillan India, 2014
2. Raymond Murphy's English Grammar with CD, Murphy, Cambridge University Press, 2012
3. Michael Swan, (2017) Practical English Usage (Practical English Usage), 4th edition, UK: Oxford University Press.
4. Ashraf, M Rizvi. Effective Technical Communication. Tata McGraw-Hill,2006.

Reference Books

1. English Conversation Practice-Grant Taylor, Tata McGraw Hill, 2009.
2. Hewings, Martin. Cambridge Academic English (B2). CUP,2012
3. Meenakshi Raman and Sangeeta Sharma, Professional Communication, Second Edition, Oxford University Press, India, 2017
4. Michael McCarthy, Felicity O'Dell, (2015) English Vocabulary in Use Advanced(South Asian Edition), UK: Cambridge University Press
5. Spoken English, R.K. Bansal & JB Harrison, Orient Longman, 2013, 4th edition.

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/*
- *http://www.nonstopenglish.com/*
- *https://www.vocabulary.com/*
- *BBC Vocabulary Games*
- *Free Rice Vocabulary Game*

Reading

- *https://www.usingenglish.com/comprehension/*
- *https://www.englishclub.com/reading/short-stories.htm*
- *https://www.english-online.at/*

Listening

- *https://learningenglish.voanews.com/z/3613*
- *http://www.englishmedialab.com/listening.html*

Speaking

- *https://www.talkenglish.com/*
- *BBC Learning English – Pronunciation tips*
- *Merriam-Webster – Perfect pronunciation Exercises*

All Skills

- *https://www.englishclub.com/*
- *http://www.world-english.org/*
- *http://learnenglish.britishcouncil.org/*

NARAYANA ENGINEERING COLLEGE:GUDUR								
20CH1501	**CHEMISTRY LAB (COMMON TO ECE,EEE&CSE)**							**R20**
I-B.Tech	**Hours / Week**			**Total hrs**	**Credit**	**Max Marks**		
	L	**T**	**P**		**C**	**CIE**	**SEE**	**TOTAL**
I-Semester	0	0	3	39	1.5	40	60	100
Pre-requisite: Nil								
Course Objectives: 1. To enable the learners to get hands-on experience on the principles discussed in 2. To understand the applications of these concepts in engineering.								
Course Outcomes: After successful completion of the course, the student will be able to:								
CO 1	Identify basic laboratory apparatus, chemicals, safety rules, and experimental procedures. (BL-1)							
CO 2	Explain the principles of volumetric analysis, water quality, pH, conductivity, and chemical reactions. (BL-2)							
CO 3	Perform standard chemistry experiments using suitable apparatus, measurements, calculations, and procedures. (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				2	2		2	2				
CO2	2	2				2	3	2	2	2				
CO3	3	3						2	3	3				
1: Low, 2-Medium, 3- High														

COURSE CONTENT		
TASK – 1		**CO2**
Conductometric titration of (i) strong acid vs. strong base, (ii) weak acid vs. strong base **Objective** 1. To perform a conductometric titration of a mixture of strong acid and weak acid with a strong base. 2. To determine the equivalence point of the titration by plotting titration curve using conductance values and amount of the base added during titration. 3. state the advantages conductometric titrations,		
TASK -2		**CO1**
Determination of cell constant and conductance of solutions **Objective:** 1. To determine conductivity of the given water sample by using conductivity meter. 2. To understand the specific conductance.		
TASK -3		**CO2**
Verify Lambert-Beer'slaw **Objective:** 1. To use spectroscopy to relate the absorbance of a colored solution to its concentration. 2. To prepare a Beer's Law Plot to determine the concentration of an unknown.		
TASK -4		**CO2**
PH metric titration of (i) strong acid vs. strong base, (ii) weak acid vs. strong base **Objective:** 1. To perform a potentiometric titration of an acidic solution of known molarity. 2. To graph the volume of base added vs the pH and to determine the equivalence point 3. To calculate the molarity of the basic solution		
TASK -5		**CO3**
Estimation of Ferrous Iron by Dichrometry. **Objective:** 1. To determine the percentage of ferrous iron in an unknown sample by redox titration with potassium dichromate solution. 2. To pre-treat the sample and obtain the iron in the reduced(+2 oxidation) state.		
TASK -6		**CO3**
Potentiometry determination of redox potentials and emfs **Objective:** 1. To determine the concentration of an unknown iron(II) solution. By using potentiometer 2. To discuss how the potential changes with relative concentration of oxidised/reduced from. 3. To perform a redox titration of ammonium iron (II) sulphate using potassium dichromate as oxidizing agent, 4. To determine the equivalence point of the redox titration by plotting titration curve using potential change values and amount of oxidizing agent added during titration.		
TASK -7		**CO4**
Preparation of a polymer **Objective:** To prepare phenol formaldehyde resin. (Bakelite) 1. To understand the differences between linear and cross linked polymers. 2. To compare and contrast the recycling properties of linear and cross linked polymers. 3. To compare the combustion properties of various types of material. 4. To define the following terms: polymer, monomer, repeat unit, cross linking, biopolymer		

TASK -8		CO2

Thin layer chromatography

Objective:

1. To separate spinach pigments using thin layer chromate graphy
2. To describe the method of chromatography and its applications

TASK -9		CO3

Identification of simple organic compounds by IR

Objective:

1. To learn various function groups encountered in organic chemistry
2. To learn important roll of IR spectroscopy in the study of structure of organic compounds
3. To develop skill in the recognition of characteristic absorption bands
4. To identify compound by an investigation of its IR spectrum

TASK -10		CO4

Determination of Strength of an acid in Pb-Acid battery

Objective:

1. To determine the half-reactions involved in spontaneous oxidation reduction reactions.
2. To explain the function of the lead storage and dry cell batteries...electrolysis involving two lead strips immersed in sulfuric acid.

ADDITIONAL EXPERIMENTS:

TASK -11		CO4

Measurement of 10Dq by spectro photometric method

Objective:

The purpose of the experiment is three-fold. First, the student verifies that the spectrochemical series based on this model are generally in poor agreement with experimental values obtained from visible spectra (3). However, because of the octahedral symmetry it is true that the splitting of the d levels predicted by crystal field
theory is qualitatively correct.

TASK -12		CO4

Models of potential energy surfaces

Objective:

1. To distinguish between potential energies and potential energy surfaces (PESs).
2. To identify the saddle point, the reactant and product valleys and plateaus on the contour diagram of PESs
3. To distinguish between attractive and repulsive potential energy surfaces.

Total Hours	39Hours

Virtual Labs:

1. http://vlab.amrita.edu/?sub=2&brch=190&sim=338&cnt=1
2. http://vlab.amrita.edu/?sub=2&brch=190&sim=339&cnt=1
3. http://vlab.amrita.edu/?sub=2&brch=190&sim=606&cnt=1

Self-Study:

Contents to promote self-Learning:

SNO	Topic	CO	Reference
1	Vocabulary for Aptitude & Recruitment Tests Campus Jobs	CO1	**https://youtu.be/uzvZa2qEuWo**
2	Tips to Improve Verbal and WrittenCommunication Skills	CO2	**https://youtu.be/6Y3NY0ERBxY**

3	How to write professional emails in English	CO3	**https://youtu.be/3Tu1jN65slw**
4	Introduction to Collocation	CO4	**https://youtu.be/-ouWOpo2Uh8**
5	Error Spotting Questions in Campus Recruitment Tests	CO5	https://youtu.be/Rz6-qjNrzCU
6	Reading Skills: How To Skim, Scanand Read for Detail Effectively	CO6	**https://youtu.be/SRHNKzXxu6o**

Text Book(s):

1. Arthur J. Vogel, A Textbook of Quantitative Analysis
2. Jain & Jain. Engineering Chemistry: Dhanapathrai Publications., 2015.
3. S.S.Dara, Experiments and Calculations in Engineering Chemistry: S-Chand Publications, Revised edition, 2008.

Reference Book(s):

1. S.K. Bhasin and Sudha Rani, "Laboratory Manual on Engineering Chemistry", Dhanpat Rai Publishing Company, New Delhi, 2nd edition.
2. Sunitha Rattan, "Experiments in Applied Chemistry", S.K. Kataria& Sons, New Delhi, 2nd edition.

Web References:

1. https://nptel.ac.in/courses/122101001/23
2. https://nptel.ac.in/courses/104103071/39

NARAYANA ENGINEERING COLLEGE:GUDUR								
20ES1504	**ENGINEERING GRAPHICS LAB**							**R20**
I-B.Tech	**Hours / Week**			**Total hrs**	**Credit**	**Max Marks**		
	L	**T**	**P**		**C**	**CIE**	**SEE**	**TOTAL**
I-Semester	0	1	4	72	3	40	60	100
Pre-requisite: Basic Mathematics(Geometry)								
Course Objectives: 1. To impart skills on using drawing instruments 2. To convey exact and complete information of any physical object. 3. To Construct Engineering Curves. 4. To Learn and practice basic AutoCAD commands. 5. To instruct the utility of drafting & modelling packages in orthographic and isometric drawings 6. To understand the applications of AUTOCAD for modeling physical objects								
Course Outcomes: After successful completion of the course, the student will be able to:								
CO 1	Recall drawing instruments, scales, lettering, geometric constructions, conventions, and projection principles. (BL-1)							
CO 2	Explain projections of points, lines, planes, solids, sections, and development of surfaces. (BL-2)							
CO 3	Apply graphics principles to construct accurate engineering drawings using manual or CAD tools. (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				2			3	3				
CO2	2	2	2			2			3	3				
CO3	3	3	3	2		2			3	3				
1: Low, 2-Medium, 3- High														

COURSE CONTENT		
Part-A Manual Drawing		
TASK – 1	**INTRODUCTION AND CONIC SECTIONS**	**10H**
Introduction to Engineering graphics: Principles of Engineering Graphics and their significance; various instruments used, drawing sheet sizes and title block, lettering, BIS conventions, types of lines and dimensioning methods. **Geometrical constructions:** simple constructions, construction of Pentagon, Hexagon by general method only. **Conic Sections:** Types of conics: Ellipse, Parabola and Hyperbola (Eccentricity method only),		
At the end of the TASK-1, students will be able to: 1. Understand of Geometrical Constructions. (BL-2) 2. Draw Conic Sections by using eccentricity method.(BL-3)		
TASK -2	**ORTHOGRAPHIC PROJECTIONS**	**10H**
Objectives and Principle of projection, Methods of projections, Comparison between first angle and third angle projection. **Projections of points:** Projection of points placed in different quadrants, **Projection of straight lines:** Fundamental concepts, Line parallel, perpendicular and inclined to one and two reference planes placed in first quadrant only, **Projections of planes:** Projection of planes (Triangle, Square, Pentagon, Circle) parallel, perpendicular and inclined to one and two reference planes placed in first quadrant only		
At the end of the TASK-2, students will be able to: 1. Understand Orthographic Projection of points.(BL-2) 2. Draw Projection of lines inclined to one and two reference planes. (BL-3) 3. construct the Projection of planes inclined to one and two reference planes. (BL-3)		
TASK -3	**PROJECTIONS OF SOLIDS**	**11H**
Types of solids; Polyhedra, Solids of revolution, Projections of regular solids(Prisms, Pyramids, Cylinders and Cone), with its axis perpendicular to one plane and parallel to other plane, Axis inclined to one plane and parallel to other plane.		
At the end of the TASK-3, students will be able to: 1. Understand Projections of regular Solids.(BL-2) 2. Draw projections of Prisms, Pyramids, Cylinders and Cones(BL-3)		
TASK -4	**ISOMETRIC AND ORTHOGRAPHIC VIEWS**	**10H**
Isometric Projections: Principles, Isometric scale, Isometric views, Conventions, Isometric views of lines, planes, simple solids (Cube, Cylinder, Cone), Conversion of Isometric views to Orthographic views.		
At the end of the TASK-4, students will be able to: 1. Understand Principles of Isometric Projections and Isometric scale. (BL-2) 2. Draw isometric views of simple solids (BL-2) 3. Apply principles in Conversion of lsometric views into Orthographic views. (BL-3)		
(PART B COMPUTER AIDED DRAFTING)		
TASK -5	**INTRODUCTION TO AUTOCAD**	**14H**
Basic drawing and editing commands: line, circle, rectangle, erase, view, undo, redo, snap, object editing, moving, copying, rotating, scaling, mirroring, layers, templates, polylines,		

trimming, extending, stretching, fillets, arrays, dimensions. Dimensioning principles and conventional representations.

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

1. Understand the Basic AutoCAD commands.(BL-2)
2. Draw the templates of simple physical objects.(BL-3)
3. Apply the utility of drafting & modelling packages in orthographic and isometric drawings

TASK -6	ORTHOGRAPHIC AND ISOMETRIC PROJECTIONS	18H

Transformation of Isometric Projections into orthographic projections such as simple solids such as cylinder, cone, square prism, pentagonal pyramid, Draw 3D model of mechanical components such as Stepped block, Bush bearing.

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

1. Develop the usage of 2D and 3D modelling.(BL-3)
2. Create the various views of machines components.(BL-3)

Total Hours	**72 Hours**

Content beyond syllabus:

1. Development of surfaces, Section of solids

Self-Study:

Contents to promote self-Learning:

SNO	Topic	Reference
1	Introduction to BasicEngineering Scales	https://mrcet.com/downloads/hs/Engineering%20Graphics%20Manual%20final.pdf
2	Engineering curves	www.nptel.ac.in/courses/112104019/
3	Orthographic Projections	www.nptel.ac.in/courses/112104019/
4	Projections of Solids	www.nptel.ac.in/courses/105104148/
5	AutoCAD	https://www.autodesk.in/campaigns/education/fusion-360?mktvar002=3510851|SEM|APAC_GGL_0025&gclid=EAIaIQobChMI25i62KuD6wIVj3wrCh1V1AUJEAAYASAAEgLpmfD_BwE
6	Isometric and Orthographic Projections	https://www.youtube.com/watch?v=iXgCzZFrYlg

Text Book(s):

1. Bhatt N.D. "Elementary Engineering Drawing", Charotar Publishers, 2014.
2. Shah and Rana, Engineering Drawing, 2/e, Pearson Education, 2009
3. K.L.Narayana&P.Kannaiah, Engineering Drawing, 3/e, ScitechPublishers, Chennai, 2012.
4. Engineering Drawing by Dr AVS Sridhar Kumar, Dr Krishnaiah, TP Vara Prasad. Spectrum education, Sun techno Publications, 2019

Reference Book(s):

1. Engineering Drawing and Graphic Technology -International Edition, Thomas E.French, Charles J. Vierck, Robert J. Foster, McGraw-Hill, 2014
2. Venugopal.K "Engineering Drawing and Graphics", New Age International (P) Ltd., New Delhi, 2010.

Online Resources/ Web Resources:

1. www.nptel.ac.in/courses/112104019/
2. www.nptel.ac.in/courses/105104148/
3. www.vlab.co.in
4. https://mrcet.com/downloads/hs/Engineering%20Graphics%20Manual%20final.pdf
5. http://cbseacademic.nic.in/web_material/CurriculumMain21/SrSecondary/Engineering_Graphics_Sr.Sec_2020-21.pdf
6. http://cbseacademic.nic.in/web_material/Curriculum19/Main-/11_Engineering_Graphics.pdf

NARAYANA ENGINEERING COLLEGE::GUDUR								
20ES1506	**Problem Solving and Programming Lab**							R20
I-B.Tech	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
I-Semester	0	0	3	39	1.5	40	60	100

Pre-requisite: Mathematics Knowledge, Analytical & Logical Skills

Course Objectives:

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

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

CO 1	Identify programming constructs, data types, operators, input/output statements, and problem-solving steps. (BL-1)
CO 2	Explain algorithms, flowcharts, control structures, functions, arrays, strings, pointers, and programming concepts. (BL-2)
CO 3	Develop and execute programs for numerical, logical, iterative, array, string, and function-based problems. (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			3	3
CO2	2	2	2	2	2				2	2			2	2
CO3	3	3	3	2	3				3	3			3	3

1: Low, 2-Medium, 3- High

COURSE CONTENT	CO
TASK-1 (3H)	
1. Practice DOS and LINUX Commands necessary for execution of C Programs. 2. Study of the Editors, Integrated development environments, and Compilers in chosen platform. 3. Write, Edit, Debug, Compile and Execute Sample C programs to understand the programming environment.	CO 1
TASK-2 (6H)	
1. Practice programs: Finding the sum of three numbers, exchange of two numbers, largest of two numbers, to find the size of data types, Programs on precedence and associativity of operators, sample programs on various library functions.	CO 1
TASK-3 (6H)	
1. Write a C program to calculate the factorial of a given number 2. Fibonacci sequence is defined as follows: the first and second terms in the sequence are 0 & 1. Subsequent terms are found by adding the preceding two terms in the sequence. Write a C program to generate the first n terms of the sequence. 3. Write a program to find the roots of a Quadratic equation.	CO1
TASK-4 (6H)	
1. Write a program to generate the series of prime numbers in the given range. 2. Write a program to reverse the digits of a number. 3. Write a C program to find the sum of individual digits of a positive integer.	CO 2
TASK-5 (3H)	
1. Write a program to check for number palindrome. 2. Write a program to find the maximum of a set of numbers. 3. Write a C program to find the GCD (greatest common divisor) of two given integers	CO 2
TASK-6 (3H)	
1. Write a program to find the sum of positive and negative numbers in a given set of numbers. 2. Write C code to reverse the elements of the array. For example, [1,2,3,4,5] should become [5,4,3,2,1] 3. Write a C program to find factorial of a given integer number using recursion	CO 3
TASK-7 (6H)	
1. Write a C program that use pointers to find Addition of Two Matrices 2. Write a C program that use functions to find Multiplication of Two Matrices	CO 3
TASK-8 (3H)	
1. Write a program to accept a line of characters and print the number of Vowels, Consonants, blank spaces, digits and special characters. 2. Write a C program to check whether a given string is a palindrome or not, without using any built-in functions.	CO 3
TASK-9 (6H)	
1. Illustrate the use of auto, static, register and external variables. 2. Write a program to read and print student information using structures 3. Write a C program to define a union and structure both having exactly the same numbers using the size of operators print the size of structure variables as well as union variable	CO 4
TASK-10 (6H)	

1. Write a program to split a "file" into two files, say file1 and file2. Write lines into the 'file' from standard input. Read the contents from 'file' and write odd numbered lines into file1 and even numbered lines into file2. 2. Write a program to merge two files.	CO 4
Total Hours	**39H**

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

Virtual Labs:

1. Problem Solving Lab (IIIT HYDERABAD) :http://ps-iiith.vlabs.ac.in/

List of Experiments

1. Numerical Representation	6. Recursion
2. Beauty of Numbers	7. Advanced Arithmetic
3. More on Numbers	8. Searching and Sorting
4. Factorials	9. Permutation
5. String Operations	10. Sequences

Computer Programming Lab (IIIT HYDERABAD) :http://cse02-iiith.vlabs.ac.in/

List of Experiments

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

Text Book(s):

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

Reference Book(s):

1. "The C Programming Language", Brian W. Kernighan, Dennis M. Ritchie, 2nd Edition, Pearson.
2. "Let us C", Yeswant Kanetkar, BPB publications
3. "Pointers in C", Yeswant Kanetkar, BPB publications, 16th Edition, 2017
4. Computer Science, A Structured Programming Approach Using C by Behrouz A. Forouzan& Richard F. Gilberg, 3rd Edition, Cengage Learning
5. C Programming A Problem-Solving Approach, Behrouz A. Forouzan & E.V. Prasad, F. Gilberg, 3rd

Edition, Cengage Learning
6. Programming with C RemaTheraja, Oxford, 2018
7. Programming in C, 3rd Edition, 2015, Ashok N. Kamthane, Pearson Education
8. Programming in C, 3/e : A Practical Approach by Ajay Mittal, Pearson Publication
9. Problem Solving with C by SOMASHEKARA, M. T., GURU, D. S., MANJUNATHA, K. S., PHI Learning, 2nd Edition, 2018
10. C Programming with problem solving, J.A. Jones & K. Harrow, Dreamtech Press, 2001
Byron Gottfried, Schaum's Outline of Programming with C, 4th Edition, 2018, McGraw-Hill

Web Resources:

1. https://www.includehelp.com/c-programs/advacnce-c-examples.aspx
2. https://www.programiz.com/c-programming/examples
3. https://www.javatpoint.com/c-programs
4. https://www.w3resource.com/c-programming-exercises/
5. https://www.sanfoundry.com/simple-c-programs/
6. https://www.includehelp.com/c-programming-examples-solved-c-programs.aspx
7. http://www.c4learn.com/c-programs/tag/c-programs-typical-programs

NARAYANA ENGINEERING COLLEGE:GUDUR								
20EN1501	**ENGLISH LANGUAGE LAB**							R20
I-B.Tech	**Hours / Week**			**Total hrs**	**Credit**	**Max Marks**		
	L	T	P		C	CIE	SEE	TOTAL
I-Semester	0	0	3	39	1.5	40	60	100

Pre-requisite: Basic English Grammar

Course Objectives:

1. To expose the students to develop knowledge and awareness of English phonetics be able to read and produce phonemic transcriptions
2. To sensitize the students to the nuances of English speech sounds, word accent, intonation and rhythm
3. To develop strategies appropriately to improve one's ability to listen and Use listening skills to create more effective, less confrontational, more productive professional and personal communication
4. To demonstrate his/her ability to write error free written communication
5. To distinguish main ideas from specific details and make use of contextual clues to infer meanings of unfamiliar words from context
6. To provide a structured methodology for participants to prepare and deliver an effective, high impact presentation that meets the objectives and brings results

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

CO 1	Identify basic grammar, vocabulary, pronunciation, listening, speaking, reading, and writing conventions. (BL-1)
CO 2	Explain effective communication, sentence formation, pronunciation, presentation, and professional language use. (BL-2)
CO 3	Apply English skills in conversations, group discussions, role plays, presentations, interviews, and workplace communication. (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				
CO2									3	3				
CO3									3	3				
1: Low, 2-Medium, 3- High														

COURSE CONTENT	
Module - 1	**7H**
Introduction to Phonetics : Introduction to Sounds of Speech – Vowels – Consonants - Listening with a focus on pronunciation Reading Newspaper – Highlighting Vowels and Consonants	**CO1**
Module – 2	**6H**
Syllabification: Word Stress, Rules of word stress Practice on Intonation and Stress	**CO2**
Module – 3	**6H**
Listening Skills : Types of Listening Skills Active listening and anticipating the speaker Listening for Specific & General Details Listening Comprehension	**CO3**
Module – 4	**6H**
Defining & Describing: Objects, Places and Events Video Speech Writing Review Writing (Books / Movies / Products..etc.,)	**CO4**
Module – 5	**7H**
Reading Comprehension Everyday English – Grammar, Vocabulary, LSRW Skills, Summarizing and Note making Vocabulary Building	**CO5**
Module – 6	**7H**
JAM Role Play Giving and Asking Directions Information Transfer	**CO6**
Total Hours	**39H**

Reference Books:

1. A Textbook of English Phonetics for Indian Students 2nd Ed T. Balasubramanian. (Macmillian), 2012
2. Skillful Level 2 Reading & Writing Student's Book Pack (B1) Macmillan Educational.
3. English Pronunciation in Use. Intermediate & Advanced, Hancock, M. 2009. CUP
4. Rizvi, Ashraf. M., Effective Technical Communication, Mc Graw Hill, New Delhi. 2005
5. Raman, Meenakshi & Sangeetha Sharma. Technical Communication: Principles andPractice, Oxford University Press, New Delhi. 2011.

Web Resources:

1. Grammar/Listening/Writing 1-language.com
2. http://www.5minuteenglish.com/
3. https://www.englishpractice.com/Grammar/Vocabulary
4. English Language Learning Online
5. http://www.bbc.co.uk/learningenglish/
6. http://www.better-english.com/
7. http://www.nonstopenglish.com/
8. https://www.vocabulary.com/
9. BBC Vocabulary Games
10. Free Rice Vocabulary GameReading
11. https://www.usingenglish.com/comprehension/
12. https://www.englishclub.com/reading/short-stories.htm
13. https://www.english-online.at/Listening
14. https://learningenglish.voanews.com/z/3613
15. http://www.englishmedialab.com/listening.htmlSpeaking
16. https://www.talkenglish.com/
17. BBC Learning English – Pronunciation tips
18. Merriam-Webster – Perfect pronunciation ExercisesAll Skills
19. https://www.englishclub.com/
20. http://www.world-english.org/
21. http://learnenglish.britishcouncil.org/

Online Dictionaries

1. Cambridge dictionary online : https://dictionary.cambridge.org/
2. MacMillan dictionary : https://www.macmillandictionary.com/
3. Oxford learner's dictionaries : https://www.oxfordlearnersdictionaries.com/

NARAYANA ENGINEERING COLLEGE::GUDUR								
20MA1002	**NUMBER THEORY AND APPLICATIONS**							**R20**
I-B.Tech	**Hours / Week**			**Total hrs**	**Credit**	**Max Marks**		
	L	**T**	**P**		**C**	**CIE**	**SEE**	**TOTAL**
II-Semester	3	1	0	64	4	40	60	100

Pre-requisite: Basic mathematics

Course Objectives:

1. This course enables the students to learn the concepts of number theory and its applications to information security.
2. Understand various areas of number theory, such as combinatorial, algebraic, analytic and transcendental aspects, arithmetic algebraic geometry
3. Teach applications in areas like error-correcting codes and cryptography
4. Understand the concept of a congruence and use various results related to congruences including the Chinese Remainder Theorem.
5. Solve certain types of Diophantine equations.
6. Identify how number theory is related to and used in n-crypting.

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

CO 1	Solve problems on prime numbers.
CO 2	Apply Euclidean algorithm and its applications.
CO 3	Apply Chinese remainder theorem and its applications.
CO 4	Apply the concept of congruences to various applications.
CO 5	Make use of rho method and fermat factorization.
CO 6	Develop various encryption methods and its 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	2	3	3											1
CO2	2	3	2											1
CO3	3	3	3											2
CO4	2	3	2											3
CO5	3	3	3											2
CO6	1	3	3											3

1: Low, 2-Medium, 3- High

COURSE CONTENT		
MODULE – 1	**BASIC CONCEPTS OF INTEGER**	**10H**
The well, ordering property, Divisibility, Representation of integers, Computer operations with integers, Prime numbers, Greatest common divisors		
At the end of the Module 1, students will be able to: 1. Understand basics of number theory concepts. (BL-2) 2. Apply prime numbers theory to Solve problems. (BL-3) 3. Understand Computer operations with integers. (BL-2) 4. Find Greatest common divisors. (BL-1)		
MODULE -2	**GREATEST COMMON DIVISORS AND PRIME FACTORIZATION**	**10H**
The Euclidean algorithm, The fundamental theorem of arithmetic, Factorization of integers and the Fermat numbers, Linear Diophantine equations.		
At the end of the Module 2, students will be able to: 1. Understand Euclidean algorithm and its applications. (BL-2) 2. Understand Linear Diophantine equations. (BL-2) 3. Solve problems by using Factorization of integers and the Fermat numbers. (BL-3) 4. Apply Linear Diophantine equations to solve linear congruencies. (BL-3)		
MODULE-3	**CONGRUENCES**	**10H**
Introduction to congruence's, Linear congruence's, The Chinese remainder theorem, Systems of linear congruence's.		
At the end of the Module 3, students will be able to: 1. Understand Congruence and its basic properties. (BL-2) 2. Understand Chinese remainder theorem and its applications. (BL-2) 3. Solve problems on congruence's. (BL-2) 4. Determine multiplicative inverses, modulo n to solve linear congruence. (BL-2)		
MODULE-4	**APPLICATIONS OF CONGRUENCES & MULTIPLICATIVE FUNCTIONS**	**12H**
Divisibility tests, the perpetual calendar, Round, robin tournaments, Computer file storage and hashing functions. Wilson's theorem and Fermat's little theorem, Pseudo primes, Euler's theorem, phi-function, the sum and number of divisors, Perfect numbers and Mersenne primes		
At the end of the Module 4, students will be able to: 1. Understand divisibility tests and solve the problems. (BL-2) 2. Apply the concept of congruences to various applications. (BL-3) 3. Utilize Euler's theorems to solve its applications. (BL-3) 4. Apply the Phi-function to solve the problems. (BL-3)		
MODULE-5	**QUADRATIC RESIDUES AND RECIPROCITY**	**12H**
Finite fields, quadratic residues and reciprocity, Pseudo primes, rho method, Fermat factorization and factor bases.		
At the end of the Module 5, students will be able to: 1. Understand the terminology of finite fields. (BL-2) 2. Apply rho method and Fermat factorization to solve the problems. (BL-3) 3. Solve problems Pseudo primes, rho method. (BL-3) 4. Utilize the factor base method to solve its application. (BL-3)		
MODULE-6	**THEORY OF CIPHERS**	**10H**

Basic terminology, complexity theorem, Character ciphers, Block ciphers, Exponentiation ciphers, Public, key cryptography, Discrete logarithm. Knapsack ciphers, RSA algorithm Some applications to computer science	
At the end of the Module 6, students will be able to: 1. Understand the terminology of cryptology and Write coding. (BL-2) 2. Understand different encryption mechanisms. (BL-2) 3. Apply the RSA cipher in n-crypt in security system. (BL-3) 4. Utilize Knapsack ciphers write the security codes. (BL-3)	
Total Hours	**64 Hours**

Content beyond syllabus:

1. Arithmetic modulo n, theory and examples
2. Solving linear polynomials modulo n
3. Primitive roots, Structure of Un

Self-Study:

Contents to promote self-Learning:

SNO	Topic	Reference
1	Divisibility and primes, Integers, GCD	https://nptel.ac.in/courses/111/101/111101137/Lecture 1, 2, 4
2	Fundamental theorem of arithmetic	https://nptel.ac.in/courses/111/101/111101137/Lecture 6
3	Congruences	https://nptel.ac.in/courses/111/101/111101137/Lecture 8,9
4	Chinese remainder theorem	https://nptel.ac.in/courses/111/101/111101137/Lecture 18, 19
5	Wilson's theorem, Roots of polynomials, Euler's phi-function	https://nptel.ac.in/courses/111/101/111101137/Lecture 21, 22, 23
6	Public Key Cryptology Introduction RSA	https://nptel.ac.in/courses/106/107/106107155/Lecture 11 (unit-3)
7	Block Cipher, Modes of Operation for Block Cipher	https://nptel.ac.in/courses/106/107/106107155/Lecture 06 (unit-2)

Text Book(s):

1. Kenneth H Rosen "Elementary number theory and its applications", AT & T Information systems & Bell laboratories.
2 Neal Koblitz "A course in Number theory & Cryptography", Springer

Reference Book(s):

1. Herbert S. Zuckerman, "An Introduction To The Theory Of Numbers", Hugh L.Montgomery, Ivan Niven, wiley publishers
2. 2.Tom M Apostol "Introduction to Analytic number theory", Springer
3. 3.VK Krishnan "Elementary number theory", Universities press

Online Resources/ Web References:

https://www.coursera.org/learn/number-theory-cryptography
https://nptel.ac.in/courses/111/103/111103020/

NARAYANA ENGINEERING COLLEGE:GUDUR								
20PH1004	**SEMICONDUCTOR PHYSICS**							**R20**
I-B.Tech	**Hours / Week**			**Total hrs**	**Credit**	**Max Marks**		
	L	**T**	**P**		**C**	**CIE**	**SEE**	**TOTAL**
II-Semester	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.
4. To introduce p-n junction diode and its applications
5. To impart knowledge on optical properties of materials.
6. To impart knowledge in basic concepts of LASERs and Optical fibres.

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	Understand carrier transport mechanism in semiconductors.
CO 4	Understand the characteristics, operation and applications of of p-n junction diode.
CO 5	Recognize the importance of photonic devices relevant to engineering domains.
CO 6	Realize importance of LASERs and Optical fibres 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	2	3										
CO2	3	1	3	3										
CO3	3	2	2	2										
CO4	3	2	2	2		1	2							
CO5	3	1	1	3		1	2							
CO6	3	2			2									
1: Low, 2-Medium, 3- High														

COURSE CONTENT		
MODULE – 1	**INTRODUCTION TO QUANTUM MECHANICS**	**8H**
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, free particle energy, wave function, momentum; operators and expectation values, Eigen values and Eigen functions of a particle confined to one dimensional infinite square well (potential well).		
At the end of the Module 1, students will be able to: 1. Understand the concept of matter waves. (BL-2) 2. Recognize the difference between phase velocity and group velocity. (BL-2) 3. Understand Physical significance of wave function. (BL-2) 4. Identify the importance of Schrodinger's wave equation in describing the motion of elementary particles. (BL-3)		
MODULE -2	**FREE ELECTRON THEORY OF METALS**	**8H**
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, Matthiessen rule, causes of electrical resistance in metals, Bloch's theorem (Qualitative). Kronig Penny Model (Qualitative), effective mass and Brillouin zones, 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. (BL-2) 2. apply these theories to explain electrical conductivity in metals. (BL-2) 3. explain formation of energy bands in solids. (BL-2) 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. (BL-2)		
MODULE-3	**INTRODUCTION TO SEMICONDUCTORS**	**8H**
Origin of energy bands, Intrinsic semiconductors - density of charge carriers(derivation), Fermi energy, Electrical conductivity; extrinsic semiconductors - P-type & N-type, Density of charge carriers, Dependence of Fermi energy on carrier concentration and temperature; Direct and Indirect band gap semiconductors, Hall effect- Hall coefficient (derivation), Applications of Hall effect; Drift and Diffusion currents, Einstein coefficients, Continuity equation(derivation), Applications of Semiconductors.		
At the end of the Module 3, students will be able to: 1. outlinethe properties of n-type and p-type semiconductors. (BL-2) 2. interpretthe direct and indirect band gap semiconductors. (BL-2) 3. identifythe type of semiconductor using Hall effect. (BL-3) 4. identify applications of semiconductors in electronic devices. (BL-3)		
MODULE-4	**SEMICONDUCTOR DIODE**	**8H**
Open circuited PN junction, Current components in a PN diode, Diode Equation, Volt-Ampere Characteristics, Energy band diagram of PN Diode, Temperature dependence of Volt-Ampere Characteristics, Diode resistance (Static and Dynamic resistance), Diode as a switch, Rectifier-Half wave and Full wave rectifier-working, Ripple factor, efficiency and form factor.		
At the end of the Module 4, students will be able to: 1. Study the characteristics and operation of p-n junction diode. (BL-2)		

2. Derive the expression Diode Equation. (BL-2)
3. Explain the energy band diagram & effect of temperature on the characteristics of diode. (BL-2)
4. Explain how diode acts as a switch and rectifier. (BL-2)

MODULE-5	OPTICAL PROPERTIES OF MATERIALS	9H

Classification of optical materials, carrier generation and recombination processes, Absorption, emission and scattering of light in metals, insulators and semiconductors (Concepts only), photodiode-working, quantum efficiency, response speed; solar cell working, derivation of expressions for V_m&I_m, conversion efficiency; LED-principle theory, construction, working, applications; Optical data storage techniques.

At the end of the Module 5, students will be able to:
1. understand carrier generation and recombination processes. (BL-2)
2. Gain knowledge over interaction of light with metals, insulators and semiconductors. (BL-2)
3. Understand the construction and working of various photonic devices. (BL-2)
4. Explain Optical data storage techniques. (BL-2)

MODULE-6	LASERS & OPTICAL FIBERS	7H

Lasers: Spontaneous & stimulated emission of radiation, Population inversion, Pumping methods, Properties of lasers- monochromaticity, coherence, directionality, brightness
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 fibers based on Refractive index profile-advantages of optical fibres.

At the end of the Module 6, students will be able to:
1. Describe Spontaneous & stimulated emission of radiation. (BL-2)
2. Understandthe basic concepts of LASER light Sources. (BL-2)
3. Describe the construction and working of different types of Lasers. (BL-2)
4. Identify the applications of lasers in various fields. (BL-3)

Total Hours	48 Hours

Content beyond syllabus:
1. Quantum dots and quantum wells

Self-Study:
Contents to promote self-Learning

SNO	Topic	Reference
1	Quantum Mechanics	https://youtu.be/w7Wf3Wr0guA?list=PL1955A15B7F 282A7F https://youtu.be/NfkJKIoExYo?list=PL1955A15B7 F282A7F
2	Free Electron Theory of Metals	https://youtu.be/L-eOdZFt9BY https://youtu.be/G2zgAs50718
3	Semiconductors	https://youtu.be/BQijtvYxgIM https://youtu.be/rzxCRJcFalw
4	Semiconductor Diode	https://youtu.be/L28F1Oenyds https://youtu.be/Dfdzz64gux8?list=PL350612601E2D BFDE
5	Optical Properties of Materials	https://youtu.be/dZhgOuG4C0A https://youtu.be/WWjldCmRteg
6	Lasers	https://youtu.be/eoOM0Gx6GJc https://youtu.be/RyY4PEpV2RQ

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 Principlesl, Wiley 2012.
4. Kasap. S.O., Principles of Electronic Materials and Devicesl, 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 Studentsl. 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:

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

NARAYANA ENGINEERING COLLEGE:GUDUR								
20ES1003	**BASIC ELECTRICAL AND ELECTRONICS ENGINEERING**							**R20**
I-B.Tech	**Hours / Week**			**Total hrs**	**Credit**	**Max Marks**		
	L	**T**	**P**		**C**	**CIE**	**SEE**	**TOTAL**
II-Semester	3	0	0	48	3	40	60	100

Pre-requisite: Fundamental concepts of Electrical Circuits Analysis and Electro Magnetic Fields.

Course Objectives:

1. Able to understand the performance of Electrical circuit elements.
2. To understand the Principle of Operation of electrical machines.
3. Able to Explain Typical AC Power Supply scheme.
4. To impart knowledge on characteristics of the p-n junction diode
5. To provide comprehensive idea about working principle, operation and applications of BJT, FET, MOSFET.
6. Understand the operation and working of Oscillators and operational amplifiers.

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

CO 1	Summarize the basic concepts of R,L,C ,voltage ,current and power of a circuit.
CO 2	Describe the principle, working and construction of DC Generators &Motor.
CO 3	Describe the construction, operation, types and equivalent circuit of a single phase transformer.
CO 4	Analyze the Semiconductor Diodes.
CO 5	Analyze the behavior of BJT.
CO 6	Describe the working of MOSFET.

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													
CO3	2													
CO4	3													
CO5	3													
CO6	3													
1: Low, 2-Medium, 3- High														

COURSE CONTENT		
MODULE – 1	**DC & AC CIRCUITS**	**8H**
Electrical circuit elements (R - L and C) - Kirchhoff laws - Series and parallel connection of resistances with DC excitation. Superposition Theorem - Representation of sinusoidal waveforms - peak and rms values - phasor representation - real power - reactive power – apparent power.		
At the end of the Module 1, students will be able to: 1. Understand the Basic Electrical circuit elements. (BL-2) 2. Able to understand the parallel connection of resistances. (BL-2) 3. Demonstrate on real power, reactive power and apparent power. (BL-2)		
MODULE -2	**DC & AC MACHINES**	**8H**
Principle and operation of DC Generator - EMF equations - principle and operation of DC Motor - Performance Characteristics of DC Motor Speed control of DC Motor Principle and operation of Single Phase Transformer - OC and SC test on transformer - principle and operation of Induction Motor.		
At the end of the Module 2, students will be able to: 1. Explain principle and operation of DC Generator & Motor. (BL-2) 2. Understand the principle and operation of DC Motor. (BL-2) 3. Explain operation of transformer and induction motor. (BL-2)		
MODULE-3	**BASICS OF POWER SYSTEMS**	**9H**
Layout & operation of Hydro, Thermal, Nuclear Stations - Solar & wind generating stations Typical AC Power Supply scheme Elements of Transmission line Types of Distribution systems: Primary & Secondary distribution systems.		
At the end of the Module 3, students will be able to: 1. Understand the working of Electrical power generating stations. (BL-2) 2. List the varies Elements of Transmission line. (BL-1) 3. Explain Types of Distribution systems. (BL-2)		
MODULE-4	**SEMICONDUCTOR DEVICES**	**7H**
Intrinsic semiconductors-Electron-Hole Pair Generation, Conduction in Intrinsic Semiconductors, Extrinsic Semiconductors-N-Type and P-Type Semiconductors, Comparison of N-Type and P-Type Semiconductors. The p-n Junction - Drift and Diffusion Currents, The p-n Junction Diode-Forward Bias, Reverse Bias, Volt-Ampere Characteristics, Applications of Diode, Zener Diode- Volt-Ampere Characteristics, Zener Diode as Voltage Regulator.		
At the end of the Module 4, students will be able to: 1. List the types of semiconductors. (BL-1) 2. Understand the operation of PN junction diode. (BL-2) 3. Explain the characteristics of diode. (BL-2) 4. Compare various rectifiers parameters with and without filters. (BL-02) 5. Study the breakdown mechanism in semiconductors. (BL-02)		
MODULE-5	**BIPOLAR JUNCTION TRANSISTOR**	**8H**
Bipolar Junction Transistor (BJT) Types of Transistors, Operation of NPN and PNP Transistors, Input-Output Characteristics of BJT-CB, CE and CC Configurations, Relation between Ic, In and le. Transistor Biasing Fixed Bias, Voltage Divider Bias, Transistor Applications- Transistor as an Amplifier, Transistor as a Switch.		
At the end of the Module 5, students will be able to: 1. Describe operation and characteristics of transistors.(BL-2) 2. Study various configurations of Transistor. (BL-2)		

3. Understand the working principle of JFET.(BL-2)
4. Explain the Operation of MOSFET. (BL-2)
5. Compare BJT, FET & MOSFET Parameters. (BL-02)

MODULE-6	**OSCILLATORS AND OP-AMPS**	8H

Oscillators: Sinusoidal Oscillators, Barkhausen Criteria for Oscillator Operation, Components of an Oscillator- Classification of Oscillators, LC Tuned, RC Phase Shift Oscillator circuits. Operational Amplifiers(Op-Amps)-Symbol of an Op-Amp, single Input and Dual Input Op-Amps(Differential Amplifier), Characteristics of an Ideal Op-Amp, Basic Forms of Op-Amps-Inverting & Non-Inverting Amplifiers

At the end of the Module 6, students will be able to:
1. Explain the importance of Barkhausan criteria. (BL-2)
2. Understand the concept of Feedback. (BL-2)
3. Describe operation and working of various LC tuned oscillators. (BL-2)
4. Compare the characteristics of ideal op amp to practical.(BL-2)
5. Explain various applications of Operational amplifiers.(BL-2)

Total Hours	**48 Hours**

Content beyond syllabus:
1. OCC characteristics of DC generator
2. BJT & FET Biasing.

Self-Study:
Contents to promote self-Learning

SNO	Topic	Reference
1	DC & AC Circuits	https://nptel.ac.in/courses/117/106/117106108/
2	DC & AC Machines	https://nptel.ac.in/content/storage2/courses/105105110 /pdf/m5101.pdf
3	Basics of Power Systems	https://nptel.ac.in/content/storage2/courses/105105110 /pdf/m5101.pdf
4	Semiconductor Devices	https://nptel.ac.in/content/storage2/courses/105105110 /pdf/m5101.pdf https://onlinecourses.nptel.ac.in/noc18 ee15/unit?unit=5&lesson-9
5	BJT and FETS	https://www.youtube.com/watch?v=zbwqk69VcQM
6	Oscillators and Op-Amps	https://www.youtube.com/watch?v=0RSI-QJ5-4A&t=22s https://www.youtube.com/watch?v=cITAOpONnMs&t=2193s

Text Book(s):

1. D. P. Kothari and I. J. Nagrath - "Basic Electrical Engineering" - Tata McGraw Hill - 2010.
2. V.K. Mehta & Rohit Mehta, "Principles of Power System" - S.Chand - 2018.
3. Basic Electrical and Electronics Engineering, M.S.Sukhija, T.K.Nagsarkar, Oxford University
4. Basic Electrical and Electronics Engineering, S.K Bhattacharya, Pearson Education, 2012

Reference Book(s):

1. L. S. Bobrow - "Fundamentals of Electrical Engineering" - Oxford University Press -2011.
2. E. Hughes - "Electrical and Electronics Technology" - Pearson - 2010.
3. J. Millman, C. Halkias, "Electronic Devices and Circuits", Tata Mc-Graw Hill, 4th Edition, 2010.
4. David A.Bell, "Electronic Devices and Circuits", Fifth Edition, Oxford University Press, 2009
5. Salivahanan, Kumar, Vallavaraj, "Electronic Devices and Circuits", Tata Mc-Graw Hill, Second Edition

Online Resources/ Web References:

1. https://nptel.ac.in/courses/108/105/108105159/
2. https://nptel.ac.in/courses/108/105/108105066/
3. https://nptel.ac.in/courses/108/105/108105066/
4. https://youtu.be/L28F1Oenyds
5. https://www.youtube.com/watch?v=0C4uxtS-tlQ
6. https://www.youtube.com/watch?v=0RSI-QJ5-4A
7. http://www.mathtutordvd.com/products/Engineering-Circuit-Analysis-Volume-1.cfm
8. https://www.researchgate.net/publication/329252017 Analysis Study In Principles Of Operation Of Dc Machine
9. https://www.engineering.com/
10. https://www.electrical4u.com/p-n-junction-diode/
11. https://nptel.ac.in/content/storage2/courses/117101106/downloads/L23.PDF

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

Pre-requisite: Knowledge of Mathematics and Basic Programming Language

Course Objectives:

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

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

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

CO-PO Mapping

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

1: Low, 2-Medium, 3- High

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

OOP in Python: Object Oriented Features, Classes, self variable, Methods, Constructors, Destructors, Inheritance, Overriding Methods, Data hiding, Polymorphism, Operator Oveloading, Abstract Classes.

Error and Exceptions: Difference between an error and Exception, Handling Exception, try except block, Raising Exceptions, User Defined Exceptions.

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

1. Apply object orientation concepts.(BL -3)
2. Apply the exception handling concepts. (BL -3)
3. Implement OOPs using Python for solving real-world problems. (BL -3)

MODULE-6	Regular Expressions and Turtle Graphics	8H

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

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

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

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

Total hours:	48 HOURS

Content Beyond Syllabus:

1. Testing
2. GUI Programming
3. Matplotlib
4. Databases

Text Book(s):

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

Reference Books :

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

NARAYANA ENGINEERING COLLEGE:GUDUR								
20PH1504	**SEMICONDUCTOR PHYSICS LAB**							**R20**
I-B.Tech	**Hours / Week**			**Total hrs**	**Credit**	**Max Marks**		
	L	**T**	**P**		**C**	**CIE**	**SEE**	**TOTAL**
II-Semester	0	0	3	39	1.5	40	60	100

Pre-requisite: Nil

Course Objectives:

1. To provide student to learn about some important experimental techniques in physics with knowledge in theoretical aspects so that they can excel in that field.
2. To prepare students for performing requirement analysis and design of variety of applications.
3. To enable the students to understand characteristics and applications of semiconductor diode.
4. To educate students to recognize the applications of laser in finding the particle size, and its role in diffraction studies.
5. To make the students to understand the important parameters of optical fibres and metals

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

CO 1	Recall basic semiconductor concepts, materials, instruments, and laboratory safety procedures. (BL-1)
CO 2	Perform semiconductor experiments and analyze observations, graphs, errors, and calculated parameters. (BL-3)
CO 3	Demonstrate safe laboratory practice, accurate record writing, result interpretation, and scientific reporting. (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	2	3		3			3	3				
CO2	3	3	3	2		3			3	3				
CO3	3	3	3	3		2			3	3				
1: Low, 2-Medium, 3- High														

COURSE CONTENT		
TASK – 1		**CO1**
Determination of Hall voltage and Hall coefficient of a given semiconductor using Hall effect.		
The objective: To determine a) sign of the charge carriers, b) charge carrier concentration, c) mobility of the charge carriers of a given semiconductor		
TASK -2		**CO1**
To determine the resistivity of semiconductor by Four probe method		
Objective: To determine the resistivity of semiconductor by Four probe method		
TASK -3		**CO2**
Determine the energy gap of a given semiconductor diode		
Objective: To plot characteristics between reverse saturation current and 103 /T and find out the approximate value of Energy Band Gap in PN junction diode		
TASK -4		**CO2**
Forward and reverse bias characteristics of a P-N junction diode		
Objective: To study and verify the functionality of PN junction diode in forward bias and to: 1. Plot Volt-ampere characteristics of P-N diode. 2. Find cut off voltage for P-N junction diode.		
TASK -5		**CO2**
To study voltage regulation and ripple factor for a half-wave and a full wave rectifier without and with different filters.		
Objective: To study the operation of Half- Wave Rectifier with and without filter and to find its: Percentage Regulation Ripple Factor Efficiency		
TASK -6		**CO2**
To Study the V-I Characteristics of Solar Cell.		
Objective: To study i) illumination characteristics, ii) current-voltage characteristics and iii) power-load characteristics of a solar cell.		
TASK -7		**CO2**
Plot the V-I characteristics and determine the threshold voltage of Light Emitting Diode.		
Objective: A study of characteristics of light emitting diode (LED) which used in optical fiber communication as a light source.		
TASK -8		**CO3**
Determination of wavelength of LASER light using diffraction grating		
Objectives: To determine the concept of diffraction 2. To determine the wavelength of the given Laser source.		
TASK -9		**CO3**
Laser: Diffraction at a single slit		
Objective: Determination of width of a given single slit using laser diffraction method Laser beam has high monochromaticity, coherence and directionality. Hence it forms clear diffraction		

pattern and we can measure width of a single slit accurately.		
TASK -10		**CO3**
Laser: Diffraction at a double slit		
Objective: Determination of width of a given double slit using laser diffraction method. With this experiment we can demonstrate diffraction nature of lasers and can measure width of double slit accurately.		
Additional Experiments:		
TASK -11		**CO4**
To determine the numerical aperture and acceptance angle of a given optical fibre		
Objective: To determine the numerical aperture and acceptance angle of a given optical fiber. In optical fibres light travel by multiple total internal reflections. Numerical aperture represents light gathering powerof optical fibre. Acceptance angle represents maximum limiting angle at one end of optical fibre for the light ray to travel by multiple total internal reflections through the core region of the fibre. 1. Optical fibers may be used for accurate sensing of physical parameters and fields like pressure, temperature and liquid level. 2 For military applications like fiber optic hydrophones for submarine and underwater sea application and gyroscopes for applications in ships, missiles and aircrafts		
TASK -12		**CO4**
Determination of Fermi energy of a metal		
Objective. To determine Fermi energy of a metal. Fermi energy represents highest energy level occupied by the electron at 0 K in a metal		
	Tota Hours	**39 Hours**

Virtual lab

1. I four probe method resistivity of a semiconductor https: lab.amrita.edu/?sub=1&brch=282&sim=1512&cnt=1
2. 2 Newtons rings https://vlab.amrita.edu/?sub=1&brch=189&sim=335&cnt=1
3. Zener diode https://vlab.amrita.edu/?sub=1&brch=282&sim=1522&cnt=1

Self-Study:

Contents to promote self-Learning

SNO	Topic	Reference
1	Solar cell	https://youtu.be/uBVRxlHkN5w
2	Hall effect	https://youtu.be/lUugrqMOY7E
3	Half wave and full wave rectifiers	https://youtu.be/QGawHsg4NpQ

Text Book(s):

1. C. L. Arora, "Practical Physics", S. Chand & Co., New Delhi, 3rd Edition, 2012.
2. Vijay Kumar, Dr. T. Radhakrishna, "Practical Physics for Engineering Students", S M Enterprises, 2nd Edition, 2014.

Reference Book(s):

1. C.F. Coombs, "Basic Electronic Instrument Handbook", McGraw-Hill Book Co., 1972.
2. C.H. Bernard and C.D. Epp, John Wiley and Sons, "Laboratory Experiments in College Physics" Inc., New York, 1995.
3. S. Balasubramanian, M.N. Srinivasan "A Text book of Practical Physics"- S Chand Publishers, 2017.
4. Dr. Ruby Das, C.S.Robinson, Rajesh Kumar and Prasanth Kumar "A text book of Engineering Physics Practical", 1st edition, Sahu University Science Press, 2010.
5. Jayaraman, "Engineering Physics Laboratory Manual", Ist edition, Pearson Education, 2014.

Web Resources:

1. https://www.scribd.com/doc/143091652/ENGINEERING-PHYSICS-LAB.
2. https://www3.nd.edu/-wzech/LabManual 0907c.pdf.
3. https://www.morebooks.de/store/gb/book/engineering-physics-lab-manual/isbn/978-3-330-34402.

NARAYANA ENGINEERING COLLEGE:GUDUR								
20ES1508	**BASIC ELECTRICAL AND ELECTRONICS ENGINEERING LAB**							**R20**
I-B.Tech	**Hours / Week**			**Total hrs**	**Credit**	**Max Marks**		
	L	**T**	**P**		**C**	**CIE**	**SEE**	**TOTAL**
II-Semester	0	0	2	30	1	40	60	100
Pre-requisite: Basic knowledge of de machines and transformers								
Course Objectives: 1. To Verification of KCL, KVL and Superposition theorem. 2. To conduct testing on DC and AC Machines.								
Course Outcomes: After successful completion of the course, the student will be able to:								
CO 1	Recall basic electrical quantities, circuit elements, electronic components, instruments, and safety rules. (BL-1)							
CO 2	Construct, test, and analyze DC/AC electrical and basic electronic circuits using suitable laws and measurement techniques. (BL-3)							
CO 3	Demonstrate safe wiring, systematic experimentation, teamwork, troubleshooting, and technical documentation. (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					
CO2	3								3					
CO3	3								3					
1: Low, 2-Medium, 3- High														

COURSE CONTENT		
PART-A		
TASK – 1		**CO1**
Verification of Kirchhoff laws.		
Objectives: 1. To Verify the KCL 2. To Verify the KVL		
TASK -2		**CO1**
Verification of Superposition Theorem.		
Objectives: 1. To Verify the Superposition Theorem for DC Circuit.		
TASK -3		**CO2**
Brake test on DC shunt motor. Determination of performance curves.		
Objectives: Plot the following characteristics 1. Efficiency Vs Output 2. Line current Vs Output 3. Speed Vs Output 4. Torque Vs Output 5. line current Vs Forque		
TASK -4		**CO2**
Speed Control of DC shunt motor		
Objectives: Plot the following characteristics 1. To Control the speed of DC Motor by Armature Control Method. 2. ii) To Control the speed of DC Motor by Field Control Method.		
TASK -5		**CO2**
O.C. & S.C. Tests on Single phase Transformer.		
Objectives: Predetermination of the following 1. Efficiency at different load conditions and different power factors 2. Regulation at different load conditions and different power factors 3. Output vs. Efficiency curves		
TASK -6		**CO2**
Brake Test on Three Phase Induction Motor.		
Objectives: To determine the performance characteristics, 1. Output power in watts vs load current, 2. output power in watts vs speed, 3. output power in watts vs efficiency, 4. output power in watts vs pf, 5. output power in watts vs slip.		
PART-B		
TASK -1		**CO2**
characteristics of Semi-conductor diode and Zener Diode		
Objectives: Draw and study the characteristics of Semi-conductor diode and Zener Dode		
TASK -2		**CO3**
Characteristics of Transistor in Common Emitter configuration		
Objectives: Draw and study the input and output characteristics of Transistor in Common Emitter configuration		

TASK -3		**CO3**
Characteristics of Transistor in Common Collector configuration		
Objectives: Draw and study the input and output characteristics of Transistor in Common collector configuration		
TASK -4		**CO3**
Characteristics of FET in Common Source Configuration		
Draw and study the static and transfer characteristics of FET in Common Source Configuration		
Additional Experiments:		
TASK -5		**CO4**
Study of Rectifiers		
Objectives: Construct half wave and full wave rectifier circuits. Find ripple factor and plot their output waveforms with and without filters.		
TASK -6		**CO4**
Study the application of amplifier		
Objectives: Study the application of Op-amp as an Inverting amplifier, Non-inverting amplifier, Voltage follower, Summer and Subtractor.		
	Tota Hours	**30 Hours**

Virtual Labs:

1. Speed Control of DC Motor By Varying The Armature And Field Resistances.
2. Conduct OC and SC Test on Single Phase Transformer.
3. Conduct Brake test on 3-phase induction motor.

Self-Study:

Contents to promote self-Learning

SNO	Topic	Reference
1	Kirchoff's Laws & Superposition theorem	https://www.youtube.com/watch?v=S-bbn0ZQ7is
2	The performance characteristics of DC and AC motors	https://www.youtube.com/watch?v=k https://www.youtube.com/
3	Zener Diode Characteristics	https://www.youtube.com/watch?v=zjrSAuhTFPE
4	Operational amplifiers	https://www.youtube.com/watch?v=cITA0PONnMs

Text Book(s):

1. Electrical Machinery, P.S. Bimbhra, Khanna Publishers, 7th Edition, 2011.
2. Electrical Machines, SK Bhattacharya, Mc Graw Hill Education (India) Pvt. Ltd., 4th Edition, 2014, 3rd Reprint 2015.
3. Basic Electrical and Electronics Engineering, M.S.Sukhija, T.K.Nagsarkar, Oxford University
4. Basic Electrical and Electronics Engineering, S.K Bhattacharya, Pearson Education, 2012

Reference Book(s):

1.A. E. Fitzgerald and C. Kingsley, "Electric Machinery", New York, McGraw Hill Education, 2013.
2. Sudhakar, Shyammohan S Palli, "Circuits & Networks", Tata McGraw-Hill, 4th Edition, 2010.
3.DavidA.Bell, "Electronic Devices and Circuits", Fifth Edition, Oxford University Press, 2009.
4..Salivahanan, Kumar, Vallavaraj, "Electronic Devices and Circuits", Tata Mc-Graw Hill, Second Edition

Web Resources:

1. https://nptel.ac.in/content/storage2/courses/108105053/pdf/L-41(TB)(ET)%20((EE)NPTEL).pdf
2. https://nptel.ac.in/courses/108/102/108102146/
3. https://www.electronicsforu.com/tag/on-semiconductor
4. https://www.electrical4u.com/difference-amplifier/

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

Pre-requisite: Basic Mathematics

Course Objectives:

1. To know basic workshop processes and adopt safety practices while working with various tools and equipments
2. To identify, select and use various marking, measuring, holding, striking and cutting tools & equipments.
3. Toknowabouttheinternalpartsofacomputer,assemblingacomputerfromtheparts,preparing a computer for use by installing the operating system
4. To gain knowledge about the usage of tools like Word processors, Spreadsheets, Presentations
5. To learn about Networking of computers and use Internet facility for Browsing and Searching

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

CO1	Identify workshop tools, engineering materials, computer hardware, software, and safety practices. (BL-1)
CO2	Apply workshop techniques and IT procedures to perform fitting, wiring, fabrication, hardware, and software tasks. (BL-3)
CO3	Demonstrate practical workmanship, problem-solving, teamwork, safety, and professional reporting. (BL-3)

CO-PO Mapping

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

COURSE CONTENT	CO
Trade -1 Carpentry (6 H)	
Familiarity with different types of woods and tools used in wood working and make following joints from out of 300x40x25mm soft wood stock. 1. Half–Lapjoint. 2. Mortiseand Tenon joint	CO 1
Trade-2 Fitting (6 H)	
i.]Familiarity with different types of tools used in fitting and do the fitting exercises out of 80 x 50 x 5 mm M.S. stock 1) V-fit 2) Dovetail fit	CO 1
Trade - 3 Sheet Metal Work (6 H)	CO 1
Familiarity with different types of tools used in sheet metal working, Developments of following sheet metal job from out of 22 or 20 guage G.I. sheet 1) Tapered tray 2) Conical funnel	
Trade - 4 Electrical House Wiring (6 H)	CO 2
Familiarities with different types of basic electrical circuits and make thefollowing Electrical connections a) Two lamps in series b) Two way switch c) Tube light Two lamps in parallel with 3 pin plug and switches	
Trade 5 - Welding	CO 2
Familiarity with different types of tools used in welding and do the following welding exercises 1. Single V butt joint 2. Lap joint	

Text Book(s):

1. Hajra Choudhury S.K., Hajra Choudhury A.K., Nirjar Roy S.K. "Elements of WorkshopTechnology"Vol-I2008&Vol-II2010MediaPromoters&Publishers Pvt.Limited,Mumbai.
2. KalpakjianS.andStevenS.Schmid,"ManufacturingEngineeringand Technology" 4th Edition, Pearson Education IndiaEdition,2002.
1. P. Kannaiah&K. L. Narayana "Workshop manual" 2nd Ed., ScitechpublicationsPvt.Ltd.,Hyderabad,2008.

Reference Book(s):

1. Gowri P., Hariharan and Suresh Babu A., "Manufacturing Technology-I", Pearson Education2008.

WebResources:

1. https://www.muet.edu.pk/sites/default/files/images/users/41/Workshop%20Intro.pdf
1. http://ecoursesonline.iasri.res.in/mod/page/view.php?id=98826

NARAYANA ENGINEERING COLLEGE:GUDUR								
20ES1505	ENGINEERING & ITWORK SHOP							R20
PART-B IT WORKSHOP LAB								
I-B.Tech	Hours / Week			Total hrs	Credits	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
II Semester	0	0	4	64	2	40	60	100

Course Objectives:

1. To provide Technical training on Productivity tools like Word processors, Spreadsheets, Presentations.
2. To make the students know about the internal parts of a computer, assembling, installing the operating system.
3. To teach connecting two or more computers.

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

CO 1	Identify workshop tools, engineering materials, computer hardware, software, and safety practices. (BL-1)
CO 2	Apply workshop techniques and IT procedures to perform fitting, wiring, fabrication, hardware, and software tasks. (BL-3)
CO 3	Demonstrate practical workmanship, problem-solving, teamwork, safety, and professional reporting. (BL-3)

CO-PO Mapping

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

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

Select a LAN cable, Identify the wires in the cable, Define the purpose of each wire, Study the RJ45 connecter, Use crimping tool to fix the cable to the connecter, Test the cable using LAN tester, Connect two or more computers using cross and straight cables, Configure the computers, share the data between the computers.	
Additional Experiments:	
TASK -1 IoT	CO 3
Raspberry Pi Study the architecture of Raspberry pi, configure software, Install SD card, Connect the cables, Install Raspbian (or any other) operating system, Configure Wi-Fi, remotely connect to your Raspberry Pi.	
TASK -2 OUTLOOK, MACROS	CO 3
Practice the following tasks and submit report A. Configure outlook and access mails. B. Create Macros in word and spreadsheet tools	

Text Book(s):

2. B. Govindarajulu, "IBM PC and Clones Hardware Trouble shooting and Maintenance",2nd edition, Tata McGraw-Hill, 2002

3. "MOS study guide for word, Excel, Power point & Outlook Exams", Joan Lambert, Joyce Cox, PHI.

4. "Introduction to Information Technology", ITL Education Solutions limited, Pearson Education.

Reference Book(s):

4. Rusen, "Networking your computers and devices", PHI

5. Bigelows, "Trouble shooting, Maintaining & Repairing PCs", TMH.

NARAYANA ENGINEERING COLLEGE:GUDUR								
20ES1512	**PYTHON PROGRAMMING LAB**							R20
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
II	0	0	2	30	1	40	60	100

Pre-requisite: Programming Knowledge

Course Objectives:

1. To gain knowledge on python programs basics
2. To prepare students for solving the programs on functions, data structures, Files
3. To prepare students for solving the programs on Classes, Exception Handling, Regular Expressions and Multi-threading

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

CO1	Recall Python syntax, data types, operators, built-in functions, and basic data-science terminology. (BL-1)
CO2	Develop, execute, and analyze Python programs for numerical, logical, data-processing, and visualization problems. (BL-3)
CO3	Demonstrate modular coding, debugging, documentation, data handling, and responsible use of data. (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			2				2	2			2	2
CO2	3	3	3		3				3	3			2	3
CO3	3	3	3		3				3	3			3	3

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 theuser (Pythagorean Theorem) 4. Write a program to convert a Binary number to Decimal number and verify if it isa Perfect number.	CO 1
Task-2 - Conditional Statements (2 H)	
1. Write a program to determine if a given string is a Palindrome or not 2. Write a program for Fibonacci sequence is generated by adding the previous two terms by starting with 1 and 2, the first 10 terms will be: 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, ...	CO 1
Task-3 - Functions (2 H)	
1. Write a function ball_collide that takes two balls as parameters and computes if they are colliding. Your function should return a Boolean representing whether or notthe balls are colliding. Hint: Represent a ball on a plane as a tuple of (x, y, r), r being the radius. If (distance	CO 2
between two balls centers) <= (sum of their radii) then (they are colliding)	
TASK-4 - Functions Continued (2 H)	
1. Write a function that draws a Pyramid with # symbols  2. Choose any five built-in string functions of C language. Implement them on yourown in Python. You should not use string related Python built-in functions.	CO 2
TASK-5 - Strings (4 H)	
1. Write a program to use split and join methods in the string and trace a birthdaywith Diction b array data structure. 2. Write a program using map, filter and reduce functions	CO 2
TASK-6 - Lists (4 H)	

1. Write program which performs the following operations on list's. Don't use built-in functions a) Updating elements of a list b) Concatenation of list's c) Check for member in the list d) Insert into the list e) Sum the elements of the list f) Push and pop element of list g) Sorting of list h) Finding biggest and smallest elements in the list i) Finding common elements in the list	CO 2
TASK-7 - Files (2 H)	
1. Write a program to print each line of a file and count the number of characters,words and lines in a file. 2. Write a program that allows you to replace words, insert words and delete wordsfrom the file.	CO 3
TASK-8 - Modules and Packages (2 H)	
1. Write a program for creating a module and import a module 2. Write a program to perform any two operations using Numpy and pandas	CO 3
TASK-9 - Class and Objects (4 H)	
1. Write a program for Class variables and instance variable and illustration of theself variable i) Robot ii) ATM Machine	CO 4
TASK-10 - Exception Handling (2 H)	
1. Write a program of exception handling to open a file while do not have write permissions	CO 4
2. Write a Program to handle multiple errors with one except statement.	
TASK-11 - Regular Expressions (2 H)	
1. Write a Python program to remove the parenthesis area in a string. Sample data : ["example (.com)", "w3resource", "github (.com)", "stackoverflow(.com)"] 2. Write a program to match the name phone , emails, passwords and phone numbers using pattern matching	CO 3
TASK-12 - Turtle (2 H)	
1. Write a turtle program to construct a clock dial 2. Write a turtle program to produce a flower in different colours	CO 3
Total Hours	**30 Hours**

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

Virtual Labs:

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

List of Experiments

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

Text Book(s):

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

Reference Book(s):

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

NARAYANA ENGINEERING COLLEGE:GUDUR								
20EN1502	**ORAL COMMUNICATION SKILLS LAB**							R20
I-B.Tech	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
II-Semester	0	0	2	30	1	40	60	100

Pre-requisite: Nil

Course Objectives:

1. Understand the role of communication in personal & professional success and develop awareness of appropriate communication strategies.
2. Understand and learn to distinguish informal speech from formal speech through role plays and can handle a concern or complaint, with empathy and understanding.
3. Improves speaking ability in English both in terms of fluency and comprehensibility.
4. Understand the essential points in preparing an oral presentation
5. To improve the mass communication and provide an opportunity to exercise their rights to express them effectively
6. To equip students with knowledge and techniques to effectively tackle the interview process

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

CO 1	Identify basic grammar, vocabulary, pronunciation, listening, speaking, reading, and writing conventions. (BL-1)
CO 2	Apply communication skills in conversations, group discussions, presentations, interviews, and workplace situations. (BL-3)
CO 3	Demonstrate confidence, fluency, accuracy, teamwork, professional etiquette, and effective interpersonal communication. (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				
CO2									3	3				
CO3									3	3				

1: Low, 2-Medium, 3- High

COURSE CONTENT	CO
Module - 1	
Ice - Breaking Activity – Introducing Oneself and Others – Greetings – Taking Leave - Introduction to Communication Skills – Verbal & Non Verbal Communication - Barriers to effective communication - Kinesics - Proxemics – Chronemics - Haptics- Paralanguage.	**CO1**
Module - 2	
Situational Dialogues and Role play – Expressions in various Situations - Greetings – Apologies – Requests – Giving directions -Social and Professional etiquettes – Telephone Etiquettes	**CO2**
Module - 3	
Just a Minute (JAM) - Asking for Information and Giving Directions–Description (Oral): Pictures, Photographs, Products, and Process	**CO3**
Module – 4	
Presentation Skills – Oral presentations (individual and group) through Seminars / PPTs - Fluency & accuracy in speech – Improving self- expression– Tonal variations – Listener oriented speaking - Developing persuasive speaking skills.	**CO4**
Module - 5	
Debate : concepts, types, do's and don'ts - intensive practice- Group Discussion and Group Discussion : Dynamics of group discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency and organization of ideas and rubrics for evaluation.	**CO5**
Module - 6	
Interview Skills: Concept and process, pre-interview planning, opening strategies, answering strategies, interview through Tele - Conference & video - conference and Mock Interviews.	**CO6**
Total Hours	**30 Hours**

Reference Book(s):

- *Rizvi,Ashraf.M.,EffectiveTechnicalCommunication,McGrawHill,NewDelhi.2005*
- *Raman, Meenakshi &Sangeetha Sharma. Technical Communication: Principles and Practice, Oxford University Press, New Delhi.2011.*
- *Chase, Becky Tarver. Pathways: Listening, Speaking and Critical Thinking. Heinley ELT; 2ndEdition,2018.*
- *English for Technical Communication for Engineering Students, Aysha Vishwamohan, TataMcGraw-Hill2009*
- *CommunicationSkillsbyLeenaSen,PHILearningPvtLtd.,NewDelhi,2009*

Web Resources:

- *Grammar/Listening/Writing1-language.com*
- *http://www.5minuteenglish.com/*
- *https://www.englishpractice.com/Grammar/Vocabulary*
- *English Language LearningOnline*
- *http://www.bbc.co.uk/learningenglish/*
- *http://www.better-english.com/*

- *http://www.nonstopenglish.com/*
- *https://www.vocabulary.com/*
- *BBC Vocabulary Games*
- *Free Rice Vocabulary GameReading*
- *https://www.usingenglish.com/comprehension/*
- *https://www.englishclub.com/reading/short-stories.htm*
- *https://www.english-online.at/ Listening*
- *https://learningenglish.voanews.com/z/3613*
- *http://www.englishmedialab.com/listening.htmlSpeaking*
- *https://www.talkenglish.com/*
- *BBC Learning English – Pronunciationtips*
- *Merriam-Webster – Perfect pronunciation Exercises AllSkills*
- *https://www.englishclub.com/*
- *http://www.world-english.org/*
- *http://learnenglish.britishcouncil.org*

/Online Dictionaries

- *Cambridge dictionary online :https://dictionary.cambridge.org/*
- *MacMillan dictionary :https://www.macmillandictionary.com/*

Oxford learner's dictionaries :https://www.oxfordlearnersdictionaries.com/

SEMESTER - III

NARAYANA ENGINEERING COLLEGE::GUDUR								
20ES1012	**DATA STRUCTURES AND ALGORITHMS**							**R20**
II-B.Tech	**Hours / Week**			**Total hrs**	**Credit**	**Max Marks**		
	L	**T**	**P**		**C**	**CIE**	**SEE**	**TOTAL**
I-Semester	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	Define basic data structures, algorithm specifications, asymptotic notations, time-space trade-offs, arrays, and searching techniques.(BL-1)
CO 2	Explain the operations and applications of stacks and queues and their role in solving computational problems. (BL-2)
CO 3	Apply linked-list based structures and fundamental sorting techniques to solve computational problems. (BL-3)
CO 4	Analyze binary trees, binary search trees, height-balanced trees, and B-trees for appropriate data organization and indexing. (BL-4)
CO 5	Apply graph traversal, shortest-path, minimum-spanning-tree, and hashing techniques to solve computational problems. (BL-3)

CO-PO Mapping

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

1: Low, 2-Medium, 3- High

COURSE CONTENT		
MODULE – 1	**Introduction to Data Structures**	**9H**
Introduction: Overview of Data Structures, Implementation of Data Structures, Algorithm Specifications, Analysis of an Algorithm, Asymptotic Notations, Time-Space trade off, Arrays. **Searching:** Introduction, Basic Terminology, Linear Search and Binary Search Techniques and their complexities.		
At the end of the Module 1, students will be able to: 1. Understand the linear and non-linear data structures. (BL - 2) 2. Understand the time and space complexities of an algorithm. (BL - 2) 3. Illustrate representation of data using Arrays. (BL - 2) 4. Explain searching techniques. (BL - 2)		
MODULE -2	**Stacks and Queues**	**9H**
Stacks: Introduction, Representation of a Stack, Stack Operations, Applications of Stacks. **Queues:** Introduction, Representation of a Queue, Queue Operations, Various Queue Structures: Circular Queue, Double Ended Queue, Priority Queue, Applications of Queues.		
At the end of the Module 2, students will be able to: 1. Explain stack ADT and its operations. (BL - 2) 2. Understand the expression evaluation using stacks. (BL - 2) 3. Implement various queue structures. (BL - 3)		
MODULE-3	**Linked Lists and Sorting**	**10H**
Introduction, Singly linked lists, Doubly Linked Lists, Circular Linked Lists, Linked Stacks and Queues, Applications of Linked Lists. **Sorting:** Introduction, Bubble Sort, Selection Sort, Insertion Sort, Merge Sort, Quick Sort		
At the end of the Module 3, students will be able to: **1.** Understand basics concepts of linked lists. **(BL - 2)** **2.** Illustrate various structures of linked lists. **(BL - 2)** **3.** Understand the concept of sorting. **(BL - 2)**		
MODULE-4	**Trees**	**10H**
Introduction, Basic Terminologies, Definition and concepts, Representation of Binary Tree, operations on a BinaryTree, Binary Search Tree, Height balanced BinaryTree, B Trees.		
At the end of the Module 4, students will be able to: **1.** Understand the concept of trees. **(BL - 2)** **2.** Compare different tree structures. **(BL - 2)** **3.** Apply trees for indexing. **(BL - 3)**		
MODULE-5	**Graphs& Hashing**	**10H**
Graphs: Introduction, Graph Terminologies, Representation of Graphs, Graph Operations, Shortest Paths, Topological Sorting, Minimum Spanning Trees – Kruskal's and Prim's algorithms. **Hashing:** Introduction to Hash Table, Static Hashing, Dynamic Hashing.		

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

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

Total hours:	**48 hours**

Content beyond syllabus:

- Activation Record Management
- Optimum Sorting Algorithms

Reference Book(s):

1. Data Structures A Pseudo code Approach with C, Second Edition by Richard F. Gilberg, Behrouz A. Forouzan, Cengage Learning.
2. Data Structures and Algorithms Using C++ by Ananda Rao Akepogu, Radhika Raju Palagiri, Pearson, 2010.
3. Data Structures and Algorithms Made Easy by Narasimha Karumanchi, Careermonk Publications, 2016
4. Peter Bras, "Advanced Data Structures", Cambridge University Press, 2014
5. Data Structures, RS Salaria, Khanna Publishing House, 3rd Edition, 2017
6. Data Structures through C, Yashwant Kanetkar, BPB Publications, 3rd Edition, 2019
7. Expert Data Structures with C, RB Patel, Khanna Publications, 2019

NARAYANA ENGINEERING COLLEGE:: GUDUR								
20CS2001	**COMPUTER ORGANIZATION & ARCHITECTURE**							**R20**
II-B.Tech	**Hours / Week**			**Total hrs**	**Credit**	**Max Marks**		
	L	**T**	**P**		**C**	**CIE**	**SEE**	**TOTAL**
I-Semester	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 functional architecture, basic operations, interconnection structures and machine-level concepts of a computer system. (BL-2)
CO2	Interpret fixed-point and floating-point number representations and apply computer arithmetic algorithms. (BL-3)
CO3	Illustrate instruction-set concepts, addressing modes and control-unit organization for executing computer instructions. (BL-3)
CO4	Analyze memory organization, cache and virtual memory, parallel-processing structures and their impact on computer performance. (BL-4)
CO5	Demonstrate the organization of I/O devices, buses, interrupts, DMA and standard interface mechanisms. (BL-3)

CO-PO Mapping

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

1: Low, 2-Medium, 3- High

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

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

1. Recognize the various types of memories. (BL 1).
2. Understand the concept of memory organization. (BL 2).
3. Explain the concept of Multiple Bus Organization. (BL 2).
4. Compare the performance of cache memory and virtual memory. (BL 2).
5. Understand the Interconnection Networks structure and hazards of the system (BL2).

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

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

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

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

Total Hours	**48H**

Content beyond syllabus:

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

Text Book(s):

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

Reference Book(s):

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

NARAYANA ENGINEERING COLLEGE:: GUDUR								
20CS2002	**DATABASE MANAGEMENT SYSTEMS**							**R20**
II-B.Tech	**Hours / Week**			**Total hrs**	**Credit**	**Max Marks**		
	L	**T**	**P**		**C**	**CIE**	**SEE**	**TOTAL**
I-Semester	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	Design conceptual database models using database concepts, system architecture and Entity-Relationship modeling. (BL-3)
CO 2	Explain the relational model, integrity constraints, logical database design and relational algebra operations. (BL-2)
CO 3	Construct SQL and PL/SQL queries, procedures, functions, packages, triggers and cursors for RDBMS applications. (BL-3)
CO 4	Apply functional dependencies, normalization and transaction concepts to improve relational database design and reliability. (BL-3)
CO 5	Apply concurrency-control, recovery and indexing techniques to support reliable and efficient database systems. (BL-3)

CO-PO Mapping

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

1: Low, 2-Medium, 3- High

COURSE CONTENT		
MODULE – 1	**Introduction to Database concepts and Modeling**	**8H**
Introduction to Data bases, Purpose of Database Systems, View of Data, Data Models, Database Languages, Database Users, Database Systems architecture. Overview of Database Design, Beyond ER Design, Entities, Attributes and Entity sets, Relationships and Relationship sets, Conceptual Design with the ER Model.		
At the end of the Module 1, students will be able to: 1. Understand the Purpose of Database Systems, Data Models, and View of Data.(BL-2) 2. Summarize the concept of Database Languages, Users and Architecture. (BL-2) 3. Design ER diagrams for given database. (BL-2) 4. Explain conceptual design for enterprise systems (BL-2)		
MODULE – 2	**Relational Model, Relational Algebra**	**8H**
Introduction to the Relational Model – Integrity Constraints over Relations, Enforcing Integrity constraints, querying relational data, Logical data base Design, Views. Introduction to Relational algebra, selection and projection, set operations, renaming, joins, division.		
At the end of the Module 2, students will be able to: 1. Understand Basics of Relational Model. (BL-2) 2. Describe phases of Logical Database Design.(BL-2) 3. Explain the relational algebra operations on relations. (BL-2)		
MODULE – 3	**SQL**	**8H**
SQL: Basic form of SQL Query, DDL, DML, Views in SQL, Joins, Nested & Correlated queries, Operators, Aggregate Functions, integrity and security, Functions & Procedures, Packages, Triggers, Cursors, PL/SQL principles and examples.		
At the end of the Module 3, students will be able to: 1. Construct SQL queries in RDBMS. (BL-3) 2. Understand integrity and security Constraints in SQL (BL-2) 3. Construct PL/SQL programs in RDBMS. (BL-3)		
MODULE – 4	**Normalization &Transaction Management**	**12H**
Introduction, Functional Dependencies (FDs), Normalization for relational databases: 1NF, 2NF,3NF and BCNF, Basic definitions of Multi Valued Dependencies, 4NF and 5NF.Transaction processing, Transaction Concept, Transaction State, Implementation of Atomicity and Durability, Concurrent Executions.		
At the end of the Module 4, students will be able to: 1. Analyze functional dependencies. (BL-3) 2. Apply normal forms on functional dependencies. (BL-3) 3. Understand Atomicity and Durability, Concurrent Executions. (BL-2)		
MODULE – 5	**Concurrency Control &Recovery and Indexing**	**12H**

Lock-Based Protocols, Timestamp- Based Protocols, Validation-Based Protocols, Multiple Granularity. Failure Classification, Recovery and Atomicity, Log-Based Recovery. Introduction to Index data structures, Hash-Based, Tree Based Indexing.
At the end of the Module 5, students will be able to: 1. Discuss the Concurrency Control and various Protocols. (BL-2) 2. Understand reasons for system failures. (BL-2) 3. Understand Ordered Indices, B+ Tree Index Files. (BL-2)

Total hours:	**48 Hours**

Content beyond syllabus:

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

Text Book(s):

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, Database System Concepts, 6th Edition, Tata McGraw-Hill Publishing Company,2017.

2. Raghu Ramakrishnan, Database Management System, 3rd Edition, Tata McGraw-Hill Publishing Company, 2014.

Reference Book(s):

1. Peter Rob, A.Ananda Rao, Corlos Coronel, Database Management Systems (for JNTU), Cengage Learning, 2011.

2. Hector Garcia Molina, Jeffrey D. Ullman, Jennifer Widom, Database System Implementation, 1st Edition, Pearson Education, United States, 2000.

3. E. Ramez and Navathe, Fundamental of Database Systems, 7th Edition, Pearson Education

4. R.P. Mahapatra & Govind Verma, Database Management Systems, Khanna Publishing House, 2016.

5. Carlos Coronel and Steven Morris, Database Systems: Design, Implementation, and Management, 12th edition, Cengage Learning,2016.

6. John V. ,Absolute beginner's guide to databases, Petersen, QUE

NARAYANA ENGINEERING COLLEGE:: GUDUR								
20CS2003	**MATHEMATICAL FOUNDATION FOR COMPUTER SCIENCE**							**R20**
II-B.Tech	**Hours / Week**			**Total hrs**	**Credit**	**Max Marks**		
	L	**T**	**P**		**C**	**CIE**	**SEE**	**TOTAL**
I-Semester	3	0	0	48	3	40	60	100

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

Course Objectives:

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

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

CO 1	Apply mathematical logic, predicate calculus, truth tables, normal forms and rules of inference to formulate and analyze logical statements. (BL-3)
CO 2	Analyze relations, functions and algebraic structures and construct lattice and Hasse diagrams. (BL-3)
CO 3	Apply permutations, combinations, binomial and multinomial concepts, inclusion-exclusion and the pigeon-hole principle to solve counting problems. (BL-3)
CO 4	Solve recurrence relations using substitution, generating functions and characteristic-root methods. (BL-3)
CO 5	Apply graph and tree concepts, graph traversal and spanning-tree principles to represent and solve computing problems. (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
CO2	3	3	2										2	2
CO3	3	3	2										2	2
CO4	3	3	3										2	2
CO5	3	3	3										3	2
1: Low, 2-Medium, 3- High														

COURSE CONTENT		
MODULE – I	**STATEMENTS AND PREDICATE CALCULUS**	**10 Hrs**
Statements and notations, connectives, well-formed formulas, truth tables, tautology, Equivalence implication; Normal forms: Disjunctive normal forms, Conjunctive normal forms, Principle Disjunctive normal forms, Principle Conjunctive normal forms .Predicative logic, Free & Bound variables, Rules of inference, Consistency, proof of contradiction, Automatic Theorem Proving.		
At the end of this Module students will be able: 1. To understand the concepts associated with Mathematical Logic and Predicate calculus.		
MODULE- II	**SET THEORY**	**10Hrs**
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:	**48 Hours**

Content beyond syllabus:

Finding Minimal cost Spanning Tree using Prim's Algorithm.

Text Book(s):

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

Reference Book(s):

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

NARAYANA ENGINEERING COLLEGE:: GUDUR								
20CS2004	**OBJECT ORIENTED PROGRAMMING USING JAVA**							R20
II-B.Tech	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
I-Semester	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	Explain the fundamental concepts, syntax, data types, variables, operators, and control statements of Java.(BL-2)
CO2	Apply arrays, strings, wrapper classes, and related Java features to develop programs.(BL-3)
CO3	Apply object-oriented programming concepts such as classes, objects, inheritance, polymorphism, and interfaces.(BL-3)
CO4	Develop Java programs using packages and exception handling mechanisms.(BL-6)
CO5	Apply multithreading and file I/O concepts to develop Java 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	2			2							3	2	3
CO2	3	2	2		3							3	3	3
CO3	3	2	3		3							3	3	3
CO4	3	2	1		3							3	3	3
CO5	3	2	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**
Declaration, Initialization and accessing values, One-Dimensional Arrays, Multi-dimensional arrays, Alternative Array Declaration Syntax, var-arg methods, Wrapper Classes. String, StringBuffer and StringBuilder classes.		
At the end of the Module 2, students will be able to: 1. Understand Arrays and accessing array values.(BL-2) 2. Demonstrate 1-D and Multi-dimensional arrays.(BL-2) 3. Explain the String, StringBuffer, StringBuilder Classes.(BL-2)		
MODULE-3	**OOPs Concepts**	**10H**
Class fundamentals. Declaration objects, Assigning object reference variables, Introducing Methods, Constructors, this keyword, Garbage collection, Inheritance basics, Types of inheritance, Benefits, Member access rules, Constructor and calling sequence, Abstract Classes, Super and final keywords**.** Method overloading and overriding, Defining an interface, Implementing interface, Accessing interface properties.		
At the end of the Module 3, students will be able to: 1. Understand the basic syntax for class fundamentals.(BL-2) 2. Explain Access modifiers in Inheritance.(BL-2) 3. Compare and Contrast Method overloading and Method overriding.(BL-3) 4. Explain interface and its implementation.(BL-2)		
MODULE-4	**Packages , Exception Handling and Applets**	**10H**
Packages: Defining Package, finding packages and class path, accessing Protection. Exception Handling: Exception handling Fundamentals, exception types, Built-inExceptions, Using try-catch-finally throw- throws keywords, creating your own Exceptions. Applets: Introduction to Applets, Applet Life Cycle methods.		
At the end of the Module 4, students will be able to: 1. Develop user defined packages.(BL-3) 2. Implement Exception Handling.(BL-3) 3. Write our own Exceptions (BL-1) 4. Implement Applet Life Cycle Methods. (BL-3)		

MODULE-5	Multi-Threaded Programming and Files	10H
Multi-Threaded Programming: The java thread model, Thread Life Cycle, The main() thread, creating a Thread, Creating Multiple Threads, Using isalive() and join(), Thread Priorities, Synchronization. I/O Files: Byte Oriented and Character oriented classes, RandomAccess Files.		
At the end of the Module 5, students will be able to: 1. Explain the concept of multi threaded concept.(BL-2) 2. Discuss thread states and its priorities.(BL-3) 3. Understand the concept of Synchronization.(BL-2) 4. Demonstrate input/output Files.(BL-3)		
	Total hours:	**48 Hours**

Content beyond syllabus:

1. Event Handling Mechanism
2. GUI Programming in JAVA

Text Book(s):

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

Reference Book(s):

1. R A. Johson-Thomson,An introduction to java programming and object oriented application development,
2. Y Daniel liang, Introduction to java programming 6th Edition, PearsonEducation.
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 McGrawHill.

NARAYANA ENGINEERING COLLEGE::GUDUR								
20ES1515	**Data Structures and Algorithms Lab**							**R20**
II-B.Tech	**Hours / Week**			**Total hrs**	**Credit**	**Max Marks**		
	L	**T**	**P**		**C**	**CIE**	**SEE**	**TOTAL**
I-Semester	0	0	3	39	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	Implement searching techniques and linear data structures such as stacks and queues using arrays.(BL-3)							
CO 2	Implement linked-list-based data structures and perform their fundamental operations.(BL-3)							
CO 3	Apply sorting, tree, and graph algorithms to solve computational problems efficiently.(BL-3)							

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

COURSE CONTENT	CO
TASK-1	
1. Write a Program to Implement the following Searching Algorithms: a) Linear Search b) Binary Search	CO1
TASK-2	
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	
1. Write a Program to Implement Queue Operations using Arrays 2. Write a Program to Implement Circular Queue Operations using Arrays	CO2
TASK-4	
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	
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	
1. Write a Program to Sort the set of elements: a) Insertion Sortb) Quick Sort	C04
TASK-7	
Write a Program to Sort the set of elements: a) Merge Sort b) Heap Sort	C04
TASK-8	
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	
1. Write a Program to implement the following Graph Traversal Algorithms: a) Depth first traversal b) Breadth first traversal	CO4
TASK-10	
1. Write a Program to implement the following Minimum Spanning Tree Algorithms: a) Kruskal's Algorithm b) Prim's Algorithm	CO4

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

1. Write a Program to Implement Tree traversal Techniques 2. Write a Program to Implement Radix Sort	CO4
Total Hours	**39 Hours**

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, 2nd Edition, 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
Expert Data Structures with C, RB Patel, Khanna Publications, 2019

NARAYANA ENGINEERING COLLEGE:: GUDUR								
20CS2501	**DATABASE MANAGEMENT SYSTEMS LAB**							R20
II-B.Tech	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
I-Semester	0	0	3	39	1.5	40	60	100

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

Course Objectives:

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

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

CO 1	Apply SQL and PL/SQL programming concepts to create, manipulate, query, and manage relational databases using DDL, DML, procedures, and basic programming constructs.(BL-3)
CO 2	Analyze and implement database queries using aggregate functions, constraints, cursors, triggers, and other database programming techniques to retrieve and maintain data efficiently.(BL-4)
CO 3	Design and develop normalized relational database systems using ER models, tables, keys, views, procedures, functions, and triggers for real-world applications.(BL-6)

CO-PO Mapping

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

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

e. Delete the rows of customer table whose Cust_city is 'hyd'.
f. Create a table called branch table.

Name	**Type**
Branch name	Varchar2(20)
Branch city	Varchar2(20)
asserts	Number

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.
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 theresult. c. Add primary key constraint and not null constraint to the employee table. d. Insert null values to the employee table and verify the result. 2. a. Create a user and grant all permissions to the user. b. Insert values in the department table and use commit. . Add constraints like unique and not null to the department table. . Insert repeated values and null values into the table. 3. a. Create a user and grant all permissions to the user. b. Insert values into the table and use commit. c. Delete any three records in the department table and use rollback. . Add constraint primary key and foreign key to the table. 4. a. Create a user and grant all permissions to the user. b. Insert records in the sailor table and use commit. c. Add save point after insertion of records and verify save point. d. Add constraints not null and primary key to the sailor table. 5. a. Create a user and grant all permissions to the user. b. Use revoke command to remove user permissions. c. Change password of the user created. d. Add constraint foreign key and notnull. 6. a. Create a user and grant all permissions to the user. b. Update the table reserves and use save point and rollback. c. Add constraint primary key, foreign key and not null to the reserves table **.** Delete constraint not null to the table column	CO 1
Task -3 QUERIES USING AGGREGATE FUNCTIONS(3H)	
1. a. By using the group by clause, display the names who belongs to dept no 10along with average salary.	CO2

b. Display lowest paid employee details under each department.
c. Display number of employees working in each department and theirdepartment 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 greaterthan or equal to 5000.

2. a. Calculate the average salary for each different job.
b. Show the average salary of each job excluding manager.
c. Show the average salary for all departments employing more than three people.
d. Display employees who earn more than thelowest salary in department 30
e. Show that value returned by sign (n)function.
f. How many days between day of birth to current date

3. a. Show that two substring as single string.
b. List all employee names, salary and 15% rise in salary.
c. Display lowest paid emp details under each manager
d. Display the average monthly salary bill for each deptno.
e. Show the average salary for all departments employing more than two people.
f. By using the group by clause, display the id 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.
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 atleast 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 least3characters.
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

fromorderdate. 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 anddisplaythegrade. b. Write a PL/SQL program to find the sum of digits in a given umber. 3. a. Write a PL/SQL program to display the number in reverse order. b. Writea PL/SQLprogram to check whether the given number is prime or not. 4. a. Write a PL/SQL program to find the factorial of a given number. b. Write a PL/SQL code block to calculate the area of a circle for a value of radiusvarying from 3 to 7. Store the radius and the corresponding values of calculated area inan empty table named areas, consisting of two columns radius and area. 5. a. Write a PL/SQL program to accept a string and remove the vowels from thestring.(When 'hello' passed to the program it should display 'Hll' removing e and o from theworldHello). b. Write a PL/SQL program to accept a number and a divisor. Make sure the divisor is lessthan or equal to 10. Else display an error message. Otherwise Display the remainder inwords.	CO 3
TASK-5 PROCEDURES AND FUNCTIONS(3H)	
1. Write a function to accept employee number as parameter and return Basic +HRA together as single column. 2. Accept year as parameter and write a Function to return the total net salaryspent for a given year. 3. Create a function to find the factorial of a given number and hence find NCR. 4. Write a PL/SQL block to print prime Fibonacci series using local functions. 5. Create a procedure to find the lucky number of a given birth date. 6. Create function to the reverse of given number	CO 3
TASK-6 TRIGGERS(3H)	
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:	CO 3

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 isinserted 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 oneor more publications. A publication covers essentially one of the specialist subjects and is normally written by a single author. When writing a particular book, each author works with on editor, but may submit another work for publication to be supervised by other editors. To improve their competitiveness, the company tries to employ a variety of authors, more than one author being a specialist in a particular subject for the above case study, do the following: 1. Analyze the data required. 2. Normalize the attributes. 3. Create the logical data model using E-R diagrams	CO 3
TASK-8 GENERAL HOSPITAL(6H)	
A General Hospital consists of a number of specialized wards (such as Maternity, Pediatric, Oncology, etc.). Each ward hosts a number of patients, who were admitted on the recommendation of their own GP and confirmed by a consultant employed by the Hospital. On admission, the personal details of every patient are recorded. A separate register is to be held to store the information of the tests undertaken and the results of a prescribed treatment. A number of tests may be conducted for each patient. Each patient is assigned to one leading consultant but may be examined by another doctor, if required. Doctors are specialists in some branch of medicine and may be leading consultants for a number of patients, not necessarily from the same ward. For the above case study, do the following. 1. Analyze the data required. 2. Normalize the attributes. Create the logical data model using E-R diagrams	CO 3
TASK -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.	CO 4

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

4. Comprehend the data given in the case study by creating respective tableswithprimary keys and foreign keys where ever required. 5. Insert values into the tables created (Be vigilant about Master- Slavetables). 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 (withDepartment 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 Moduletables. (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 - 1PROCEDURES	
1. Create the procedure for palindrome of given number. 2. Create the procedure for GCD: Program should load two registers with two Numbers andthen apply the logic for GCD of two numbers. GCD of two numbers is performed bydividing the greater number by the smaller number till the remainder is zero. If it is zero,the divisor is the GCD if not the remainder and the divisors of the previous division arethe new set of two numbers. The process is repeated by dividing greater of the twonumbers by the smaller number till the remainder is zero and GCD isfound. 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 naturalnumber. 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 isperfect or not	CO 1
TASK -2 CURSORS	

1. Write a PL/SQL block that will display the name, dept no, salary of fist highestpaidemployees**.** **2.** Update the balance stock in the item master table each time a transaction takes place in the item transaction table. The change in item master table depends on the item id is already present in the item master then update operation is performed to decrease the balance stock by the quantity specified in the item transaction in case the item id is not present in the item master table then the record is inserted in the item master table. **3.** Write a PL/SQL block that will display the employee details along with salary usingcursors. **4.** To write a Cursor to display the list of employees who are working as a Managers orAnalyst. **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 ofall the employees in the 'employee' table are updated. If none of the employee's salary are updated, we geta message 'None of the salaries were updated'. Else we get a message like for example, 'Salaries for 1000 employees are updated' if there are 1000 rows in 'employee' table	CO 3

Virtual Labs:

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

List of Experiments with Description:

1. Data Definition Language(DDL) Statements: (Create table, Alter table, Drop table)Aim: To Understand and Implement Data Defining Language (DDL) Statements.
   Objective: To understand the various aspects of Data definition language commands like:Creating a table, with or without constraints.
   Understanding Data types.
   Altering the structure of the table like adding attributes at later stage, modifying size ofattributes 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 ManipulationCommands like:
   Inserting Data into the table, (inserting all attributes in a table or inserting selectedattributes in a table).
   Updating Data into the table (updating all tuples in a table or updating selected tuples in atable).

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

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

   Aim: To understand various aspects of Data Query Language

   Commands likeDisplaying 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 madepermanent 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 structureof 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.

Total Hours	**39 Hours**

Text Book(s):

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

Reference Book(s):

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

NARAYANA ENGINEERING COLLEGE:GUDUR								
20CS2502	**OBJECT ORIENTED PROGRAMMING USING JAVA LAB**							R20
II-B.Tech	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
I-Semester	0	0	3	39	1.5	40	60	100

Pre-requisite: Programming knowledge

Course Objectives:

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

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

CO 1	Apply fundamental Java programming concepts, including data types, control structures, arrays, strings, and basic input/output, to develop Java programs.(BL-3)
CO 2	Implement object-oriented programming concepts such as classes, objects, constructors, methods, inheritance, abstraction, and interfaces using Java.(BL-3)
CO 3	Develop Java applications using exception handling, runtime polymorphism, multithreading, synchronization, and packages.(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	3	2	2	3				2	2			3	3
CO2	3	3	3	3	3				2	2			3	3
CO3	3	3	3	2	3				2	2			3	3
1: Low, 2-Medium, 3- High														

COURSE CONTENT	CO
Task 1 - Basics (6H)	
a). Write a JAVA program to display default value of all primitive data type of JAVA? b). Write a java program that display the roots of a quadratic equation ax2+bx=0. Calculate the discriminate D and basing on value of D, describe the nature of root. ? c). Five Bikers Compete in a race such that they drive at a constant speed which may or may not be the same as the other. To qualify the race, the speed of a racer must be more than the average speed of all 5 racers. Take as input the speed of each racer and print back the speed of qualifying racers. ? d) Write a case study on public static void main(250 words) ?	CO 1
Task -2 Operations, Expressions, Control-flow, Strings (4H)	
a). Write a JAVA program to search for an element in a given list of elements using binary search mechanism. ? b). Write a JAVA program to sort for an element in a given list of elements using bubble sort? (c). Write a JAVA program to sort for an element in a given list of elements using merge sort. ? (d) Write a JAVA program using String Buffer to delete, remove character. ? (e) Write a program to perform the following operations on strings through interactive input. 1) Sort given strings in alphabetical 2) Convert the strings to uppercase. ?	CO 1
Task -3 Class, Objects (4H)	
a). Write a JAVA program to implement class mechanism. – Create a class, methods and invoke them inside main method. ? b). Write a JAVA program to implement constructor. ?	CO 2
TASK-4 Methods (4H)	
a). Write a JAVA program to implement constructor overloading. ? b). Write a JAVA program implement method overloading. ?	CO 2
TASK-5 Inheritance (6H)	
a). Write a JAVA program to implement Single Inheritance? b). Write a JAVA program to implement multi level Inheritance? c). Write a java program for abstract class to find areas of different shapes?	CO 3
TASK-6 Interfaces (6H)	

a). Write a JAVA program give example for "super" keyword. ? b). Write a JAVA program to implement Interface. What kind of Inheritance can be achieved? c). Write a JAVA program to implement multiple inheritance access in java? d). Write a JAVA program by using extends and implements keywords?	CO 3
TASK-7 Exceptions (4H)	
a).Write a JAVA program that describes exception handling mechanism. ? b).Write a JAVA program Illustrating Multiple catch clauses?	CO 3
TASK-8 Runtime Polymorphism (4H)	
a). Write a JAVA program that implements Runtime polymorphism? b). Write a Case study on run time polymorphism, inheritance that implements in above problem?	CO 4
TASK-9 User defined Exception (6H)	
a). Write a JAVA program for creation of Illustrating throw? b). Write a JAVA program for creation of Illustrating finally? c). Write a JAVA program for creation of Java Built-in Exceptions? d).Write a JAVA program for creation of User Defined Exception?	CO 4
TASK -10 Threads (4H)	
a). Write a JAVA program that creates threads by extending Thread class .First thread display "Good Morning "every 1 sec, the second thread displays "Hello "every 2 seconds and the third display "Welcome" every 3 seconds ,(Repeat the same by implementing Runnable) ? b). Write a program illustrating is Alive and join ()? c). Create two threads such that one of the thread print even no's and another prints odd no's up to a given range. ?	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 that import and use the defined your package in the previous Problem? d). Write a Java Program to Create a package called "Arithmetic" that contains methods to deal with all arithmetic operations. Also, write a program to use the package.?	CO 4

Additional Experiments:	
TASK-1 Applet	
a).Write a JAVA program to paint like paint brush in applet. ? b) Write a JAVA program to display analog clock using Applet. ? c). Write a JAVA program to create different shapes and fill colors using Applet. ? d). Write an applet illustrating sequence of events in an applet. ?	
TASK -2 Event Handling	
a).Write a JAVA program that display the x and y position of the cursor movement using Mouse. ? b).Write a JAVA program that identifies key-up key-down event user entering text in a Applet. ?	
Total Hours	**39 Hours**

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 McGrawHill.

NARAYANA ENGINEERING COLLEGE:GUDUR								
20CD6001	**CAREER COMPETENCY DEVELOPMENT I (CSE,ECE,EEE)**							**R20**
II-B.Tech	**Hours / Week**			**Total hrs**	**Credit**	**Max Marks**		
	L	**T**	**P**		**C**	**CIE**	**SEE**	**TOTAL**
I-Semester	0	0	2	36	1	40	60	100

Course Objectives:

To enhance employability skills and to develop career competency

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

CO 1	Apply quantitative techniques to solve aptitude problems.
CO 2	Analyze logical patterns and relationships to solve reasoning problems.
CO 3	Apply vocabulary and grammatical skills to construct and interpret sentences.
CO 4	Apply algorithms and programming logic to solve problems using C/Python.
CO 5	Apply recursion, backtracking and hashing techniques to solve computational problems.

CO-PO Mapping

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

COURSE CONTENT		
MODULE – 1	**APTITUDE-1**	**7H**
Number System, Clocks, Advanced Algebra, LCM & HCF, BODMAS, Order of Arithmetic Operations, Ratio & Proportion		
MODULE -2	**REASONING-1**	**6H**
Deductive Logic, Blood Relations, Puzzles, Coding & Decoding, Number Series		
MODULE-3	Verbal-1	**7H**
Word formation: Prefix, suffix, synonyms, antonyms, odd words, homophones, spelling test andcontextual vocabulary. Parts of speech: Nouns, adjectives, prepositions, gerunds. Sentence structures: Identifying the sentences, sentence pattern, sentence completion, sentence arrangement, joining sentences.		
MODULE-4	**TECHNICAL SKILLS-1**	**8H**
Problems and Logic Building: Study of Various problems and Logic Building: Algorithms and Pseudocodes; various problems using Number Series, Arrays and Strings. Students must do the following Tasks using any online platforms of **C / Python**(Writeproper Pseudo codes and Algorithms also for the given problems): **Number Series: Task1**: Prime series (**Hint**: Find Prime Series up to n) **Task2**: Fibonacci Series (**Hint**: Find Fibonacci sequence up to n) **Arrays-** **Task3**: Find duplicates in an array (**Hint**: Same elements which are duplicated must identify) **Task4**: Findthe K^{th} largest and K^{th} smallest number in an array (**Hint**: Finding largest andsmallest number of kth position) **Strings-** **Task5:** Find the Nth character (**Hint**: Finding the given character position) **Task6**: Rotation of String (**Hint**: Rotating the characters either left or right side rotation)		
MODULE-5	**TECHNICAL SKILLS-2**	**8H**
Recursion and Hashing: Recursion and Backtracking. Hashing Techniques. Students must do the following Tasks using any online platforms of **C / Python**:(Write suitable pseudo codes and algorithms for the given tasks) **Recursion and BacktrackingTask1**: Largest Element in an array **Task2**: Convert Decimal to Binary Number **Task3**: subset sum (**Hint**: Find Subsets for the given array and calculate the sum). **Task4**: Word Break Problem (**Hint:** The given sentence must be broken into number wordsbasedvarious delimiters). **Hashing - Task5**: Pair with given sum in an Array (**Hint**: Array elements must pair with given constraintand findthe sum) **Task6**: Count Distinct absolute values in a sorted array (**Hint**: Convert into absolute values andfind distinctcount in a sorted array)		
	Total Hours	**36 Hours**

EVALUATION:

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

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

Text / Reference Books:

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

SEMESTER –IV

NARAYANA ENGINEERING COLLEGE::GUDUR								
20MA1007	STATISTICAL ANALYSIS AND TECHNIQUES USING R							R20
II BETCH	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
SEMESTER - II	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	Understand the basics and working environment of R programming and its fundamental programming elements. (BL-2)
CO 2	Apply R programming to construct data objects and solve probability problems. (BL-3)
CO 3	Apply R commands to summarize, visualize, and analyze data using descriptive statistical methods. (BL-3)
CO 4	Apply statistical hypothesis testing and graphical analysis techniques using R.(BL-3)
CO 5	Apply statistical models and regression techniques to analyze and interpret data using R. (BL-3)

CO-PO Mapping

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

1: Low, 2-Medium, 3- High

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

MODULE – 5	Complex Statistical analysis and Regression	9H
Examples of Using Formula Syntax for Basic tests, Formula Notation in Graphics, Analysis of Variance (ANOVA).Simple Linear Regression, Multiple Regression, Curvilinear Regression, Plotting Linear Models and Curve Fitting, Summarizing Regression Models.		
At the end of the Module 5, students will be able to: 1. Create a range of graphs to summarize your data and results. (BL-2) 2. Illustrate box-whisker plots, scatter plots, including multiple correlation plots. (BL-3) 3. Move graphs from R to other programs and save graphs as files on disk. (BL-2) 4. Explain formula notation for simple hypothesis tests, graphics. (BL-2)		
	Total Hours	**48 Hours**

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

Text Book(s):

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

Reference Book(s):

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

NARAYANA ENGINEERING COLLEGE::GUDUR								
20CS2005	**COMPUTER NETWORKS**							R20
II BETCH	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
SEMESTER- II	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	Explain the fundamentals of data communication, network models, signals, transmission media, and physical-layer performance.(BL-2)
CO 2	Apply data-link layer techniques for error detection, error correction, flow control, and MAC protocols. (BL-3)
CO 3	Apply routing algorithms, addressing schemes, congestion control, and internetworking protocols for network-layer communication. (BL-3)
CO 4	Analyze transport-layer protocols and congestion-control mechanisms for reliable and efficient data transmission.(BL-4)
CO 5	Apply client-server communication concepts and application-layer protocols for network-based 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	1											2	2
CO2	3	2	1	2									2	3
CO3	3	3	3	2									3	3
CO4	3	3	2	3									3	2
CO5	3	2	3	2									3	2

1: Low, 2-Medium, 3- High

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

MODULE –5	Application Layer	(10H)
Introduction, Client Server Programming-Iterative communication using UDP, Iterative communication using TCP. Standard Client Server Protocols: WWW, HTTP, Domain Name System, FTP, e-mail, TELNET, Secure Shell.		
At the end of the Module 5, students will be able to: 1. Implement client server communication. (BL-3)		
2. Explain the working of world wide web with HTTP, DNS. (BL-2) 3. Describe the protocols for mail, remote system login. (BL-2) 4. Discuss file transfer, network management protocols. (BL-2)		
	Total hours:	**48 hours**
Content beyond syllabus: 1. Wired LANs (Ethernet Family), Wireless LANs (802.11 Family) 2. Connecting Devices and VPN 3. Peer-to-Peer paradigm		
Text Book(s): 1. Behrouz A. Forouzan, Data communications and networking, 5th edition, Mc Graw Hill Education, 2012. 2. Andrew S. Tanenbaum, Wetherall, Computer Networks, 5th edition, Pearson, 2013.		
Reference Book(s): 1. Douglas E. Comer, Internetworking with TCP/IP – Principles, protocolsand architecture-Volume 15th edition, PHI. 2. Kurose James, Ross Keith, Computer Networking: A Top-Down Approach, 6th Edition, Pearson Education 3. Fall, Richard, TCP/IP Illustrated: The Protocols, 2ND edition, Pearson Education 4. Behrouz A. Forouzan, TCP/IP Protocol Suite, 4th edition, Tata McGraw Hill 5. Bhushan Trivedi, Data Communication and Networks, Oxford,2016. 6. Davie, Elsevier,Computer Networks, 5th Edition, Peterson. 7. M. Dave, Computer Networks, Cengage Learning,2012.		

NARAYANA ENGINEERING COLLEGE::GUDUR								
20CS2006	**OPERATING SYSTEMS**							R20
II BETCH	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
SEMESTER - II	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	Explain the fundamental concepts, structures, operations, services, and types of operating systems. (BL-2)
CO 2	Apply process scheduling, synchronization, and deadlock-handling techniques to manage processes efficiently.(BL-3)
CO 3	Analyze memory management and virtual memory techniques, including paging, page replacement, frame allocation, and thrashing.(BL-4)
CO 4	Apply file system concepts, directory structures, file allocation, and free-space management techniques for efficient file organization.(BL-3)
CO 5	Apply disk scheduling, mass-storage management, RAID, and protection mechanisms for efficient and secure operating system resource management.(BL-3)

CO-PO Mapping

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

1: Low, 2-Medium, 3- High

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

The concept of a file, access methods, directory structure, file system mounting, file sharing, protection, file system structure. File system structure, File system implementation, directory implementation, allocation methods, free space management**.**

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

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								
20CS2007	**SOFTWARE ENGINEERING**							R20
II BETCH	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
SEMESTER-II	3	0	0	48	3	40	60	100

Pre-requisite: Programming Skills

Course Objectives:

1. To understand the software life cycle models.
2. To understand the software requirements and SRS document.
3. To understand the important of modeling and modeling languages
4. To design and develop correct and robust software products
5. To understand the maintenance of the software.

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

CO 1	Explain software engineering principles, software processes, process models, and agile development practices. (BL-2)
CO 2	Apply requirements engineering techniques and UML modeling concepts to represent software requirements and system behavior.(BL-3)
CO 3	Apply software design principles, architectural styles, and component-based design techniques to develop software solutions.(BL-3)
CO 4	Apply user interface design, coding, code review, and software testing techniques to develop and validate software.(BL-3)
CO 5	Analyze software quality practices and product metrics development and maintenance activities.(BL-4)

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

COURSE CONTENT		
MODULE – 1	**The Software Process**	**10H**
The Nature of Software, The Unique Nature of Web Apps, Software Engineering, The Software Process, Software Engineering Practice, Software Myths**.** A Generic Process Model, Process Assessment and Improvement, Prescriptive Process Models, Specialized Process Models, The Unified Process, Personal and Team Process Models, Process Technology, Product and Process. Agility and the Cost of Change, Agile Process, Extreme Programming, Other Agile Process Models**.**		
At the end of the Module 1, students will be able to: 1.Demonstrate the different phases involved in the software development. (BL-3) 2.Classify the various process models. (BL-2) 3. Identify suitable lifecycle model to be used. (BL-3) 4. Identify the need of agility and examine Agile process models (BL-3)		
MODULE -2	**Modeling Concepts**	**10H**
Class Diagrams, Deployment Diagrams, Use-Case Diagrams, Sequence Diagrams, Communication Diagrams, Activity Diagrams, State Diagrams. Requirements Engineering, Eliciting Requirements, Developing Use Cases, and Building the requirements model, Negotiating Requirements, Validating Requirements. Requirements Analysis, Scenario-Based Modeling, UML Models that Supplement the Use Case, Data Modeling Concepts, Class-Based Modeling**.**		
At the end of the Module 2, students will be able to: 1. Understand the requirements. (BL-2) 2. Solve the problem by defining the computing requirements of the problem. (BL-3) 3. Organize the scenario-based modeling and class based modeling in the design phase (BL-3) 4. Construct SRS for Problems. (BL-3)		
MODULE-3	**Design concepts**	**10H**
Design with Context of Software Engineering, The Design Process, Design Concepts, The Design Model. Software Architecture, Architecture Genres, Architecture Styles, Architectural Design, Assessing Alternative Architectural Designs, Architectural Mapping Using Data Flow. Component, Designing Class-Based Components, Conducting Component-level Design, Designing Traditional Components, Component-Based Development**.**		
At the end of the Module 3, students will be able to: 1. Identify the basic issues in software design. (BL-3) 2. Illustrate the importance of software architecture. (BL-2) 3. Apply the standard design principles based on suitable Architecture. (BL-3)		

MODULE-4	User Interface Design, Coding and Testing	9H
Characteristics of a Good User Interface, Basic Concepts, Types of User Interfaces, Fundamentals of Component-based GUI Development, A User Interface Design Methodology. Coding, Code Review, Software Documentation, Testing, Unit Testing, Black-box Testing, White-Box Testing		
At the end of the Module 4, students will be able to: 1. Analyze the architecture styles and build the system from the components. (BL-3) 2. Describe the golden rules in designing and analyzing UI. (BL-2) 3. Explain the user interface design process. (BL-2) 4. Explain the MVC (model-view-controller) design pattern and its importance to sound user interface software design and implementation. (BL-2)		
MODULE-5	**Software Quality & Product Metrics**	**9H**
Software Quality, Software Quality Management System, ISO 9000, SEI Capability Maturity **Model Product metrics :**Metrics for Requirements Model, Metrics for Design Model, Metrics for source code, Metrics for testing, Metrics for maintenance.		
At the end of the Module 5, students will be able to: 1. Illustrate the strategic approach to software testing (BL-2) 2. Describe the art of debugging (BL-2) 3. Explain the various testing strategies (BL-2) 4. Describe the Product metrics inSoftware Quality(BL-2)		
	Total hours:	**48 hours**

Content beyond syllabus:

Open source software Testing Automation Tools

Text Book(s):

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

Reference Book(s):

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

NARAYANA ENGINEERING COLLEGE::GUDUR								
20EC3011	DIGITAL LOGIC DESIGN							R20
II BETCH	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
SEMESTER-II	3	0	0	48	3	40	60	100

Pre-requisite: Basic knowledge on number system and algebra

Course Objectives:

1. To study the basic concepts of number systems and binary codes. To minimize Boolean expressions using map and Q-M method.
2. To design combinational and sequential circuits.
3. To familiarize Registers &counters using Flip-Flops. To understand the concept of memory organization

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

CO 1	Recall number systems, binary codes, Boolean algebra concepts, and logic gates used in digital logic design. (BL-1)
CO 2	Apply Boolean algebra, Karnaugh maps, and Quine–McCluskey method to simplify Boolean functions and implement them using logic gates. (BL-3)
CO 3	Design and implement combinational circuits such as adders, subtractors, multiplexers, decoders, encoders, comparators, and code converters. (BL-3)
CO 4	Analyze synchronous sequential circuits using flip-flops, state tables, state diagrams, registers, and counters. (BL-4)
CO 5	Explain the organization and characteristics of RAM, ROM, Flash memory, and programmable logic devices such as PROM, PAL, and PLA. (BL-2)

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

COURSE CONTENT		
MODULE – 1	**NUMBER SYSTEMS & BOOLEAN ALGEBRA**	**10H**

Number Systems: Introduction, Number Systems, Number base conversions, 1‘s and 2‘s Complements, BCD code, Excess -3 codes, Gray code, ASCII code, Error Detection and Correction Codes.

Boolean Algebra: Basic definition, Basic theorems and properties, Boolean Functions, Canonical & Standard forms, Logic gates, implementation of Boolean functions using logic gates

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

1. List number systems. (BL-1)
2. Illustrate different code conversions. (BL-2)
3. List Theorem‘s and properties of Boolean algebra (BL-1)
4. Explain the functionality of logic gates(BL-2)

MODULE -2	**SIMPLIFICATION OF BOOLEAN FUNCTIONS**	**10H**

Introduction, Karnaugh map simplification, Don't care conditions, Prime Implicants, Quine-McCluskey method Simplification, NAND & NOR Implementations, Two Level Implementations.

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

1. Apply basic laws and De Morgan‘s theorems to simplify Boolean expressions(BL-3)
2. Explain map and Q-M method to minimize Boolean expressions. (BL-2)
3. Implement Boolean expression using universal gates. (BL-3)
4. Implement Boolean expression using two level methods. (BL-3)

MODULE-3	**COMBINATIONAL CIRCUITS**	**9H**

Introduction, Design Procedure, Adders, Sub tractor, Binary Adder-Sub tractor, BCD Adder, Binary Multiplier, Magnitude Comparator, Multiplexers, De-multiplexers, Decoders, Encoders and Code Converters.

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

1. Design combinational logic circuits. (BL-3)
2. Implement Boolean expression using multiplexer. (BL-3)
3. Implement higher order MUX using lower order MUX.(BL-3)
4. Design code converters using gates. (BL-3)

MODULE-4	**SEQUENTIAL CIRCUITS**	**10H**

Introduction, Latches, Flip-flops, Master-slave flip flops, Edge-triggered flip-flops, Flip-Flop conversions, Design of Synchronous Sequential Circuits: State Equations, State Table, State reduction, State assignment, State diagram , Mealy and Moore machine models, Registers, Shift Registers, Counters: Synchronous counters, Asynchronous counters & other counters.

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

1. Describe behavior of latches & flip flops. (BL-2)

2. Analyze the flip-flop conversions(BL-3)
3. Analyze synchronous sequential circuits. (BL-3)
4. Explain the design procedure of sequential circuits(BL-2)
5. Design synchronous sequential circuits using state reduction & assignment process. (BL-3)

MODULE-5	**MEMORY & PROGRAMMABLE LOGIC DEVICES**	**9H**

Introduction, Random Access Memory, Types of RAM, Memory decoding, Read Only Memory, Types of ROM, Flash memory, Programmable Logic Devices (PLDs): Basic concepts, Programmable Read Only Memory (PROM), Programmable Array Logic (PAL) and Programmable Logic Array(PLA).

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

1. Explain PROM, PAL and PLA. (BL-2)
2. Compare digital logic families. (BL-2)
3. Illustrate the characteristics of digital IC's . (BL-2)

Total Hours	**48 Hours**

Text Book(s):

1. M. Morris Mano, M.D. Ciletti, ―Digital Design‖, 5th edition, Pearson, 2018.
2. R. P. Jain, "Modern Digital Electronics", 4th edition, McGraw Hill Education (India Private Limited), 2012.
3. Anil K. Maini, ―Digital Electronics: Principles, Devices and Applications‖, Willey, 2007

Reference Book(s):

1. Anand Kumar, Switching Theory and Logic Design, PHI,2008
2. Charles H. Roth, Fundamentals of Logic Design, Thomson Publications, 5thEdition, 2004.
3. John. M Yarbrough, ―Digital Logic Applications and Design‖, Thomson Learning, 2006.

NARAYANA ENGINEERING COLLEGE::GUDUR								
20MA1501	**STATISTICAL ANALYSIS AND TECHNIQUES USING R LAB**							R20
II BETCH	Hours / Week			Total	Credit	Max Marks		
	L	T	P	hrs	C	CIE	SEE	TOTAL
SEMESTER-II	0	0	3	39	1.5	40	60	100

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

Course Objectives:

1. To setup R tools and get familiarize with commands
2. To Execute commands related to Probability
3. To implement statistical analysis functions.
4. To draw graphs for the results in R Programming

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

CO 1	Demonstrate the fundamental knowledge of R-Programming concepts and apply data objects for solving engineering applications. (BL-2)
CO 2	Apply descriptive statistics, probability commands and data distribution techniques for statistical analysis and data manipulation. (BL-3)
CO 3	Analyze hypothesis testing, graphical analysis and regression models on different data-sets for testable hypothesis and visualization. (BL-4)

CO-PO Mapping

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

1: Low, 2-Medium, 3- High

COURSE CONTENT	CO
TASK -1Installing Packages	
Installing R tools and Exploring packages in R. Managing user workspace	CO 1
TASK -2 Basic Programs	
Programs on data types in R. Programs on Creating and manipulating a vector in R.	CO 1
TASK -3 Operations	
Programs on Creating matrix operations in R Programs on manipulating matrix in R. Programs on Creating and operations on Factors in R.	CO 1
TASK -4 Data Frames and Operators	
Programs on Data Frames in R. Programs on Operators in R. Programs on Data Sets.	CO 2
TASK -5 Working with Graphs	
Programs on Customizing and Saving to Graphs in R. Programs on PLOT Function in R to customize graphs Programs for Generating Box plots, and Scatter plots	CO 2
Task - 6 Data distribution	
Programs on Random Number Generation and Control Programs on Random Numbers and Sampling Programs on Creating Random Data Partitions	CO 3
Task -7 Hypothesis Testing	
Programs on Simple Hypothesis Testing Programs on Correlation and Covariance.	CO 3
Task -8 ANOVA	
Simple Programs on Analysis of Variance (ANOVA) Programs on One-Way ANOVA Programs on Two-Way ANOVA	CO3
Task -9 ANOVA	
Programs for Performing simple Linear Regression. A. Give Me a Number - Regression B. Computing the Root-Mean-Square Error Performing Variable Selection in Linear Regression.	CO 3
Task -10 Data Summary	
Programs on Extracting Means Programs on Creating Standard Data Summaries Programs on Summary Statistics	CO 4

Additional Experiments: **TASK-1Complex Analysis**	
Programs on Manipulating Data and Extracting Components Programs on Creating Data for Complex Analysis, Summarizing Data.	CO 4
TASK -2Multiple Regression	
Programs on Multiple Regression Building Regression Trees	CO 4
Total Hours	**39 Hours**

Virtual Labs

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

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

List of Experiments:

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

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

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

List of Experiments:

What's in There - Exploratory Data Analysis
2.2Creating Standard Data Summaries
2.3Extracting a Subset of a Dataset
Splitting a Dataset
Creating Random Data Partitions
Generating Standard Plots, such as Histograms, Boxplots, and Scatterplots
2.7Generating Multiple Plots on a Grid
2.8Creating Plots with the `lattice` Package

2.9Creating Charts that Facilitate Comparisons
2.10Creating Charts That Help to Visualize Possible Causality

3. https://app.cybrary.it/browse/next-tech-course/transfer-regression-analysis-in-r?queryID=655394865504019e0f9b3fb59c3cb66e&objectID=46430
In this virtual lab, you will utilize foundational knowledge of R in order to approach machine learning model driven regression analysis solutions to validate and measure the performance of said models. More specifically, we will cover linear regression, neural networks, regression trees, variable selection, and more.

List of Experiments:

Give Me a Number - Regression
3.2Computing the Root-Mean-Square Error
3.3Building KNN Models for Regression
3.4Performing Linear Regression
3.5Performing Variable Selection in Linear Regression
3.6Building Regression Trees
3.7Building Random Forest Models for Regression3.8Using Neural Networks for Regression
3.9Performing K-Fold Cross-Validation
3.10Performing Leave-One-Out Cross-Validation to Limit Overfitting

Text Book(s):

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

Reference Book(s):

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

NARAYANA ENGINEERING COLLEGE:: GUDUR								
20CS2503	**OPERATING SYSTEMS AND COMPUTER NETWORKS LAB**							R20
II BETCH	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
SEMESTER-II	0	0	3	39	1.5	40	60	100

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

Course Objectives:

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

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

CO 1	Analyze and simulate CPU Scheduling Algorithms like FCFS, Round Robin, SJF, Priority and implement Deadlock detection and avoidance algorithms. (BL-3)
CO 2	Implement memory management schemes, page replacement schemes and File Organization techniques in an operating system environment. (BL-3)
CO 3	Analyze data link layer and network layer concepts to differentiate Error detection, Correction codes and various routing protocols for a computer network. (BL-4)

CO-PO Mapping

CO	PO												PSO	
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	2	2	3	3				2	2		3	3	3
CO2	2	2	2	2	3				2	2		2	3	3
CO3	3	3	3	3	3				2	2		2	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. (a) Sequential (b) Indexed (c) Linked	CO 2
TASK -2	
Write a C program to simulate the following file organization techniques (a) Single level directory (b)Two level directory	CO 2
TASK -3	

Write a C program to simulate the following file organization techniques (a) Hierarchical (b) DAG	CO 2

Virtual Labs:

http://vlabs.iitkgp.ernet.in/ant/ The Advanced Network Technologies Virtual Lab has been developed by keeping in mind thefollowing objectives:

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

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

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

1. Round Robin Process Scheduling Algorithm

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

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

TASK -1 TCP Client server Programming	
Implement TCP Client server communication	CO 3
TASK -2 UDP Client server Programming	CO 3
Implement UDP Client server communication	

Text Book(s):

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

Reference Book(s):

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

NARAYANA ENGINEERING COLLEGE::GUDUR								
20CS2504	**SOFTWARE ENGINEERING LAB**							R20
II BETCH	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
SEMESTER-II	0	0	3	39	1.5	40	60	100

Pre-requisite: Problem solving skills

Course Objectives:

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

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

CO 1	Understand fundamental concepts of software engineering and analyze process models required to develop a software system. (BL-2)
CO 2	Analyze software requirements and model requirements for developing the application. (BL-4)
CO 3	Apply software design and development techniques by understanding software architecture. (BL-3)

CO-PO Mapping

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

1: Low, 2-Medium, 3- High

COURSE CONTENT	CO
Task 1 - Role of Software (6H)	
Objective: To identify the role of software in today's world across various domains. Software is also a predominant are for trade and export especially for the countries like India. Domains like health care, Airlines , financial Services, Insurance , retails, Education, and many more have exploited software and still there a lot of the scope for software to create impact and add values in multiple dimensions. Problem Description: In the context of this background, identify the areas (or application or systems) how software has been leveraged extensively in the following domains Health Care 2. Airlines 3. Banking Insurance 4. Retail 5. Education Summary	CO 1
Task -2 SOFTWARE DEVELOPMENT LIFE CYCLE MODELS (6H)	
Objective: To identify the suitable process model. Justify the best suitable SDLC for the following: a. College automation system b. online shopping	CO 1
Task -3 SOFTWARE REQUIREMENTS SPECIFICATION (6H)	
Describe the individual phases/modules of the project, Identify deliverables. a) Prepare SRS for Online Railway reservation system. b) Prepare SRS for Hotel Management system.	CO 2
TASK-4 DATA MODELLING (6H)	
Draw use case diagram for Online Movie ticket reservation. Prepare use case diagram for Online airline reservation system	CO 2
TASK-5 CLASS MODELLING (6H)	
Draw class diagram for Health care center. Draw class diagram for inventory system.	CO 2
TASK-6 DATA MODELLING (6H)	
Draw the class and use case diagram for Hospital management system?	CO 2
TASK-7 SOFTWARE TESTING (3H)	
Write the test cases for Banking application	CO 4
TASK-8 SOFTWARE TESTING (3H)	
Create a test plan documentation for Library management system.	CO 4
TASK-9 SOFTWARE TESTING	
UML Diagrams for develop the AUTOMATED TELLER MACHINE (ATM) application	CO 4
TASK -10 SOFTWARE TESTING	
UML Diagrams for develop the LIBRARY INFORMATION SYSTEM application.	CO 4

Additional Experiments:	
TASK-13 SOFTWARE METRICS	CO 4
ke ATM system study its system specification and report various bugs	
TASK -14 SOFTWARE DESIGN	CO 3
A program written in c language for Matrix multiplication fails. Introspect the causes for failure and write down the possible reasons for failure	
Total Hours	**39 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 shownbelow:

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

Text Book(s):

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

Reference Book(s):

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

NARAYANA ENGINEERING COLLEGE:GUDUR								
20CD6002	**CAREER COMPETENCY DEVELOPMENT II (CSE,ECE,EEE)**							**R20**
II BETCH	**Hours / Week**			**Total hrs**	**Credit**	**Max Marks**		
	L	**T**	**P**		**C**	**CIE**	**SEE**	**TOTAL**
SEMESTER-II	0	0	2	36	1	40	60	100

Course Objectives:

To enhance employability skills and to develop career competency

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

CO 1	Demonstrate effective communication, interpersonal skills and aptitude reasoning required for professional and campus recruitment success. (BL-2)
CO 2	Apply quantitative, logical and analytical problem-solving skills to perform well in competitive and placement examinations. (BL-3)
CO 3	Analyze problems using logical reasoning and critical-thinking techniques to develop effective solutions. (BL-4)
CO 4	Apply algorithms and programming logic to solve problems using c/python
CO 5	Apply recursion, backtracking ang hashing techniques to solve computational problems.

CO-PO Mapping

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

<table>
<tr><th colspan="3">COURSE CONTENT</th></tr>
<tr><td>MODULE – 1</td><td>APTITUDE-II</td><td>7H</td></tr>
<tr><td colspan="3">Ages, Alligations & Mixtures, Averages, Partnership, Calendars, Time & Work, Chain Rule, Pipes and Cisterns,</td></tr>
<tr><td>MODULE -2</td><td>REASONING-II</td><td>6H</td></tr>
<tr><td colspan="3">Odd Man Out/ Objective Reasoning, Missing Number, Logical word Sequence, Directions,Seating Arrangement, Logical Statement Assumption, Data Arrangements</td></tr>
<tr><td>MODULE-3</td><td>VERBAL-II</td><td>7H</td></tr>
<tr><td colspan="3">Articles, Tenses. Voice (Active & Passive), speech (direct and indirect), one word substitution, Idioms and phrases. Tag questions, subject verb arrangement, Paragraph writing (passage completion, Para completion, fill in the blanks)</td></tr>
<tr><td>MODULE-4</td><td>TECHNICAL SKILLS-III</td><td>8H</td></tr>
<tr><td colspan="3">Linked Lists: single and Double Linked List Problems.
Solve the given Tasks in CodeTantra Platform using C/Python/Java.
Single and Double Linked List -
Task1: Find sum of even positions in a given Linked List (Hint: Construct linked list and find the evenpositions in the list and calculate the sum value).
Task2: Check whether 2 Lists are same. (Hint: Lists must be equal number of elements).
Task3: Reverse the values in a List and display. (Hint: Read from last element to first element)
Task4: Double Linked List Insertion and Deletion of element. (Hint: Construct Double linked list and insert anddelete the element in a given position).
Students may solve at least any other 5 problems under “Easy/Medium” category in HackerRank other than the given Tasks.</td></tr>
<tr><td>MODULE-5</td><td>TECHNICAL SKILLS-IV</td><td>8H</td></tr>
<tr><td colspan="3">Searching & Sorting: Searching & Sorting Algorithms and related Applications.Solve the given Tasks in CodeTantra Platform using C/Python/Java.
Searching and Sorting
Task1: Searching an Element in a linked list using liner search technique. (Hint: Construct aLinked List and find the element in given location).
Task2: Search an Element in a linked list in using Binary Search Technique (Construct a linkedlist and sort the elements and find the given element).
Task3: Quick Sort Application (Hint: Solve the problem using Divide and Conquer technique)
Task4: Merge sort Application (Hint: Solve using Recursive technique).
Students may solve at least any other 5 problems under “Easy/Medium” category in Hacker Rank other than the given Tasks.</td></tr>
<tr><td colspan="2">Total Hours</td><td>36 Hours</td></tr>
</table>

EVALUATION:

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

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

Text / Reference Books:

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

SEMESTER - V

NARAYANA ENGINEERING COLLEGE::GUDUR							
20CS2008	**ARTIFICIAL INTELLIGENCE**						R20
III BETCH	Hours / Week			Total hrs	Credit	Max Marks	
	L	T	P		C	CIE	SEE	TOTAL
SEMESTER-I	3	0	0	48	3	40	60	100

Course Outcomes: After successful completion of the course, student will be able to:	
CO 1	Explain the foundations of Artificial Intelligence, its history, intelligent agents, rationality, environments, agent structures, and problem formulation. (BL-2)
CO 2	Apply problem-solving and uninformed search strategies such as Breadth-First Search, Depth-First Search, and Depth-Limited Search to solve AI problems. (BL-3)
CO 3	Analyze and apply informed, local, and adversarial search techniques including GBFS, A* search, hill-climbing, minimax decision making, and alpha-beta pruning. (BL-4)
CO 4	Apply knowledge representation and reasoning techniques using knowledge-based agents, Wumpus World, propositional logic, resolution, forward/backward chaining, and first-order logic. (BL-3)
CO 5	Apply learning techniques including inductive learning, decision trees, ensemble learning, explanation-based learning, relevance-based learning, and expert-system concepts to AI 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	2	3	2			1				2	3	3
CO2	3	3	3	2	3							2	3	3
CO3	3	3	3	3	3							2	3	3
CO4	3	3	2	3	3	1		2				2	3	3
CO5	3	3	3	3	3	1	1	2				3	3	3
1: Low, 2-Medium, 3- High														

COURSE CONTENT		
MODULE – 1		**8H**
Overview on A.I The state of the Art, Intelligent Agents - Agents and Environments, Good behavior, The nature of Environments, the Structure of Agents.		
At the end of this Module students will be able: 1. Recognize the importance of Artificial Intelligence (L1) 2. Identify how intelligent agent is related to its environment (L2)		
MODULE – 2		**9H**
Problem Solving: Problem solving agents, toy problems, Real-world problems, searching for solutions. **Uninformed Search strategies**: BFS, DFS, Depth-limited search.		
At the end of this Module students will be able: 1. Examine how an agent can formulate an appropriate view of the problem it faces(L5). 2. Solve the problems by systematically generating new states (L3) 3. Derive new representations about the world using process of inference (L3)		
MODULE – 3		**11H**
Informed Search strategies: GBFS, A* search, Local search algorithms: Hill-climbing. Adversarial Search: Games, optimal decision in games, Alpha-Beta pruning, Imperfect, Real-Time Decisions.		
At the end of this Module students will be able: 1. Apply searching techniques for solving a problem (L3) 2. Evaluate alpha-beta pruning algorithm(L5) 3. Evaluate real time decisions(L5)		
MODULE – 4		**9H**
Knowledge and reasoning: Logical Agents: Knowledge -based Agents, The WUMPUS world, Logic, Propositional Logic, Reasoning Patterns in Propositional logic, Resolution, Forward and Backward chaining. First-order Logic: Syntax and Semantics of First-Order Logic.		
At the end of this Module students will be able: 1. Build an Intelligent agent (L3) 2. Understand syntax and semantics of first order logic		
MODULE – 5		**11H**
Learning: Learning from Observations- Forms of Learning, Inductive Learning, Learning Decision Trees, and Ensemble Learning**.** **Knowledge in Learning**: A Logical formulation of learning, knowledge in learning, Explanation-Based Learning, Learning using Relevance Information		

At the end of this Module students will be able: Understand forms of learning techniques(L2) Illustrate learning techniques using relevance information(L4)	
Total hours:	**48 hours**

Text Books:

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

Reference Books:

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

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

Course Outcomes: After successful completion of the course, student will be able to:	
CO 1	Analyze algorithm specifications and performance, and apply divide-and-conquer techniques such as binary search, merge sort, quick sort, selection, and Strassen's matrix multiplication. (BL-4)
CO 2	Apply greedy and dynamic programming methods to solve optimization problems including knapsack, job scheduling, minimum-cost spanning trees, shortest paths, multistage graphs, optimal binary search trees, and travelling salesperson problems. (BL-3)
CO 3	Apply traversal and search techniques for trees and graphs, and develop backtracking solutions for problems such as 8-queens, sum of subsets, graph coloring, Hamiltonian cycles, and knapsack. (BL-3)
CO 4	Analyze and apply branch-and-bound techniques and lower-bound theory to solve optimization problems and evaluate algorithmic efficiency using reductions and comparison trees. (BL-4)
CO 5	Analyze NP-Hard and NP-Complete problems, explain NP-Hardness and NP-Completeness, and apply polynomial-time reductions, including concepts related to Cook's Theorem and known source problems. (BL-4)

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

COURSE CONTENT		
MODULE – 1		**10H**
Introduction: Algorithm, Algorithm specification, Performance analysis. Divide and Conquer: General method, Binary Search, Finding the maximum and minimum, Mergesort, Quicksort, Selection, Strassen's matrix multiplication.		
At the end of this Module students will be able 1. Derive the recurrence equation for running time of a given algorithm and solve. 2. Understand the general principle of Divide and Conquer and identify suitable problems to apply Divide and Conquer paradigm 3. Analyze the time complexities of Binary Search, Finding the maximum and minimum, and Strassen's matrix multiplication algorithms. 4. Compare complexities of Merge sort, Quick sort and Selection sort techniques		
MODULE – 2		**9H**
Greedy Method: General method, Knapsack problem, Job Scheduling with Deadlines, Minimum cost Spanning Trees, Optimal storage on tapes, Single-source shortest paths. **Dynamic programming**: General Method, Multistage graphs, All-pairs shortest paths, Optimal binary search trees, 0/1 knapsack, the traveling salesperson problem.		
At the end of this Module students will be able: 1. Understand optimization problems and the general principles of Greedy and Dynamic Programming paradigms to solve them 2. Define Principle of optimality with examples. 3. Differentiate Greedy and Dynamic programming paradigms. 4. Apply dynamic programming strategy for Optimal binary search trees, Multistage graphs, All-pairs shortest paths, 0/1 knapsack, the traveling salesperson problem.		
MODULE – 3		**10H**
Basic Traversal and Search Techniques: Techniques for binary trees, Techniques for Graphs, Network Flow, Connected components and Spanning trees, Articulation point and Bi-connected components and DFS **Back tracking**: General Method, 8 – queens problem, Sum of subsets problem, Graph coloring and Hamiltonian cycles, Knapsack Problem.		
At the end of this Module students will be able: 1. Illustrate graph search strategies : BFS, DFS and D-Search . 2. Determine articulation points and bi-connected components in a given graph using Depth First Spanning Trees 3. Demonstrate the recursive and iterative backtracking algorithms. 4. Apply backtracking strategy to solve N – queens problem, Sum of subsets problem andKnapsack problem		
MODULE – 4		**10H**

Branch and Bound: The method, Travelling salesperson, 0/1 Knapsack problem, Efficiency considerations.

Lower Bound Theory: Comparison trees, Lower bounds through reductions – Multiplying triangular matrices, inverting a lower triangular matrix, computing the transitive closure.

At the end of this Module students will be able:

1. Illustrate the state space search techniques; FIFO, LIFO and LC.
3. Analyze the advantage of bounding functions in Branch and Bound technique to solve the Travelling Salesperson problem.
4. Compare the LC and FIFO branch and bound solutions for 0/1 knapsack problem.
2. Understand lower bound theory concept in solving algebraic problems.

MODULE – 5	**9H**

NP – Hard and NP – Complete Problems: NP Hardness, NP Completeness, Consequences of being in P, Cook‘s Theorem, Reduction Source Problems, Reductions: Reductions for some known problems

LEARNING OUTCOMES:

At the end of this Module students will be able:

1. Differentiate deterministic and Non-deterministic algorithms. 105 Page
2. Define P, NP, NP –hard and NP-complete classes of problems.
3. Understand the satisfiability problem.
4. State Cook’s Theorem.
5. Understand the reduction techniques.

Total hours:	**48 hours**

Text Books:

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

Reference Books:

1. Anany Levitin, “Introduction to the Design and Analysis of Algorithms”, Third Edition, Pearson Education,2012.
2. Thomas H.Cormen, Charles E.Leiserson, RonaldL. Rivestand Clifford Stein,“Introduction to Algorithms”, Third Edition, PHI Learning Private Limited, 2012.
3. Alfred V.Aho, John E.Hopcroft and Jeffrey D. Ullman,“Data Structures and Algorithms”, Pearson Education,Reprint2006.
4. Donald E. Knuth,“The Art of Computer Programming”, Volumes 1&3 Pearson Education, 2009. Steven S. Skiena, “The Algorithm Design Manual”,Second Edition, Springer,2008.

NARAYANA ENGINEERING COLLEGE:: GUDUR							
20CS2010	THEORY OF COMPUTATION						R20
III BETCH	Hours / Week			Total hrs	Credit	Max Marks	
	L	T	P		C	CIE	SEE	TOTAL
SEMESTER-I	3	0	0	48	3	40	60	100

Course Outcomes: On successful completion of the course, student will be able to:	
CO 1	Explain alphabets, strings, languages and finite automata, and apply DFA, NFA, ε-NFA, output automata, conversion and minimization techniques. (BL-2)
CO 2	Apply regular expressions, regular sets, identity and equivalence rules, inter-conversion between finite automata and regular expressions, pumping lemma, closure properties and regular grammars. (BL-3)
CO 3	Construct and analyze context-free grammars using derivations, parse trees, ambiguity, simplification techniques, normal forms, closure properties and applications. (BL-3)
CO 4	Design and analyze pushdown automata, instantaneous descriptions and acceptance mechanisms, and establish conversions between pushdown automata and context-free grammars. (BL-4)
CO 5	Explain and analyze Turing machines, their representations and variants, linear bounded automata, context-sensitive languages, unrestricted grammars, and recursive and recursively enumerable languages. (BL-4)

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

COURSE CONTENT		
MODULE – 1		**10H**
Introduction : Basics of set theory, Relations on sets, Deductive proofs, Reduction to definitions, Other heorem forms, Proving equivalences about sets, The Contra positive, Proof by contradiction, Counter xamples, Inductive proofs, Alphabets, Strings, Languages, Problems, Grammar formalism, Chomsky Hierarchy.		
At the end of Module 1, student will be able to: 1. Describe equivalence, partial order and compatible relations (L1). 2. Demonstrate the concepts of language to perform finite automata(L1)		
MODULE – 2		**10H**
Finite Automata: An Informal picture of Finite Automata, Deterministic Finite Automata (DFA),Non Deterministic Finite Automata (NFA), Applying FA for Text search, Finite Automata with Epsilon transitions (ϵ-NFA or NFA- ϵ), Finite Automata with output, Conversion of one machine to another, Minimization of Finite Automata, Myhill-Nerode Theorem.		
At the end of Module 2, student will be able to: 1. Distinguish DFA and NFA. (L4) 2. Construct DFA for an input string. (L6) 3. Perform minimization of Automata.(L5)		
MODULE – 3		**10H**
Regular Expressions: Regular Expressions, Regular Sets, Identity Rules, Equivalence of two Regular Expressions, Manipulations of Regular Expressions, Finite Automata, and Regular Expressions, Inter Conversion, Equivalence between Finite Automata and Regular Expressions, Pumping Lemma, Closure Properties, Applications of Regular Expressions, Finite Automata and Regular Grammars, Regular Expressions and Regular Grammars.		
At the end of Module 3, student will be able to: 1. Compare Moore and Mealy Machines.(L2) 2. Construct regular expression for the given Finite Automata.(L6) 3. Construct finite automata for the given regular expression.(L6) 4. Apply closure properties on regular expressions.(L3)		
MODULE – 4		**9H**
Context Free Grammars: Formal Languages, Grammars, Classification of Grammars, Chomsky Hierarchy Theorem, Context Free Grammar, Leftmost and Rightmost Derivations, Parse Trees, Ambiguous Grammars, Simplification of Context Free Grammars-Elimination of Useless Symbols, E Productions and Unit Productions, Normal Forms for Context Free Grammars-Chomsky Normal Form and Greibach Normal Form, Pumping Lemma, Closure Properties, Applications of Context Free Grammars.		
At the end of Module 4, student will be able to: 1. Define Context Free Grammar. (L1)		

2. Distinguish Chomsky Normal Form and Greibach Normal form.(L4) 3. Apply Pumping Lemma theorem on Context Free Grammar.(L3)		
MODULE – 5		**9H**
Push Down Automata: Pushdown Automata, Definition, Model, Graphical Notation, Instantaneous Description Language Acceptance of pushdown Automata, Design of Pushdown Automata, Deterministic and Non – Deterministic Pushdown Automata, Equivalence of Pushdown Automata and Context Free Grammars Conversion, Two Stack Pushdown Automata, Application of Pushdown Automata.		
At the end of Module 5, student will be able to: 1. List the applications of Pushdown Automata. (L1) 2. Construct Pushdown Automata for context free grammar.(L6)		
	Total hours:	**48 hours**

Text Books:

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

Reference Books:

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

NARAYANA ENGINEERING COLLEGE::GUDUR								
20EC3007	MICROPROCESSORS AND MICROCONTROLLERS							R20
III BETCH	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
SEMESTER-I	3	0	0	48	3	40	60	100

Pre-requisite: Knowledge on switching theory and logic design, basics of computer organisation, architecture and basic programming techniques

Course Objectives:

1. To study the internal architecture, interrupts & memory organization of 8086 microprocessor.
2. To understand the programming concepts using 8086.
3. To impart the basics of the MSP 430 and its variants.
4. To understand programming techniques using interrupts, instruction set & addressing modes
5. To provide the knowledge on low power modes of MSP 430.

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

CO 1	Recall the architecture, register organization, flags, addressing modes, and interrupt concepts of the 8086 microprocessor. (BL-1)
CO 2	Explain the 8086 instruction set, assembler directives, programming concepts, and the architecture and instruction features of the 8051 microcontroller. (BL-2)
CO 3	Apply assembly language programming techniques to solve arithmetic, logical, branching, string, and data-processing problems using 8086 and 8051. (BL-3)
CO 4	Analyze memory, I/O, interrupt, timer, serial, and peripheral interfacing techniques used with 8086 and 8051. (BL-4)
CO 5	Develop microprocessor and microcontroller based applications using appropriate programming and interfacing techniques. (BL-3)

CO-PO Mapping

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

COURSE CONTENT		
MODULE – 1	**8086 MICROPROCESSOR**	**10H**
Introduction, Microprocessor Evolution, Intel 8086 Microprocessor: Features block diagram, Register Organization, Memory organization, Interrupts and Interrupt Vector Table.		
At the end of the Module 1, students will be able to: 1. List the features of 8086 microprocessor.(BL-1) 2. Explain the architecture of 8086 microprocessor.(BL-2) 3. Describe the memory organization of 8086 microprocessor.(BL-1) Explain the concept of interrupt handling of 8086.(BL-2)		
MODULE -2	**PROGRAMMING WITH 8086**	**10H**
Instruction Formats -Addressing Modes-Instruction Set of 8086, Assembler Directives, Macros and Procedures. Simple ALP's.		
At the end of the Module 2, students will be able to: 1. Explain the different addressing modes in 8086. (BL-2) 2. Explain different instruction set of 8086 (BL-2)		
MODULE-3	**LOW POWER RISC MSP430**	**10H**
Low power RISC MSP430 block diagram, features and architecture, Variants of the MSP430 family viz. MSP430x2x, MSP430x4x, MSP430x5x and their targeted applications, Register set.		
At the end of the Module 3, students will be able to: 1. List the features of MSP 430 microcontroller.(BL-1) 2. Explain the architecture of MSP 430 microcontroller.(BL-2) 3. Compare variants of MSP 430. (BL-2)		
MODULE-4	**ADDRESSING MODES & INTERRUPTS OF MSP430**	**8H**
Addressing modes, Instruction set, Memory address space; I/O ports pull up/down resistors concepts, Interrupts and interrupt programming		
At the end of the Module 4, students will be able to: 1. Apply data in MSP 430 programming using addressing modes. (BL-3) 2. Explain the instruction set of MSP 430. (BL-2) 3. Do programming using interrupts.(BL-3) 4. Lists interrupt types supported by MSP430. (BL-2)		
MODULE-5	**ON-CHIP PERIPHERALS OF MSP 430**	**10H**
On-chip peripherals (Analog & Digital), ADC, Comparator and data transfer using DMA controller, Watchdog timer, System clocks, Timers &Real Time Clock (RTC), Low power modes. Serial Communication Protocols: UART, USB, I2C & SPI and implementation using MSP430.		

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

1. List the on chip peripherals of MSP 430 microcontroller.(BL-1)
2. Discuss MSP430 clock system. (BL-2)
3. Explain the operation of watchdog timer.(BL-2)
4. Explain the concept of Real Time Clock (RTC). (BL-2)
5. List the features of UART, USB, SPI, and I2C. (BL-1)
6. Explain the UART, I2C, SPI interface using MSP430. (BL-2)

Total Hours	**48 Hours**

Text Book(s):

1. Microprocessor and Microcontrollers‖, N. Senthil Kumar, M. Saravanan, S. Jeevanathan, Oxford Publishers. Second Edition, 2016
2. MSP430 microcontroller basics. John H. Davies, Newnes Publication, I st Edition, 2008
3. ―The X86 Microprocessors , Architecture, Programming and Inerfacing‖ , Lyla B.Das ,Pearson Publications,2010

Reference Book(s):

1. Advanced microprocessors & microcontrollers‖, K M Burchandi& A K Ray, 3 rd edition, 2013
2. ―Microprocessor and Interfacing: Programming and Hardware‖, Douglas V.Hall, McGrawHill
3. ―8086 microprocessor: Programming and Interfacing the PC‖, Kenneth Ayala Cengage Learning.

NARAYANA ENGINEERING COLLEGE::GUDUR								
	SOFTWARE PROJECT MANAGEMENT							R20
Course Code	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
20CS4026	3	0	0	48	3	40	60	100

Course Objectives:

- Understanding the specific roles within a software organization as related to project and process management
- Describe the principles, techniques, methods & tools for model-based management of software projects, assurance of product quality and process adherence (quality assurance), as well as experience-based creation & improvement of models (process management).
- Understanding the basic infrastructure competences (e.g., process modeling and measurement)
- Understanding the basic steps of project planning, project management, quality assurance, and process management and their relationships

Course Outcomes: After successful completion of the course, the student will be able to:	
CO 1	Explain conventional software management, the waterfall model, software management performance, software economics, and pragmatic software cost estimation. (BL-2)
CO 2	Apply modern software economics practices to reduce product size, improve software processes and team effectiveness, increase automation, achieve required quality, conduct peer inspections, and transition to iterative processes. (BL-3)
CO 3	Analyze software lifecycle phases, including inception, elaboration, construction and transition, and classify management, engineering and programmatic artifacts from management and technical perspectives. (BL-4)
CO 4	Apply software process workflows, milestones, status assessments, iterative process planning, work breakdown structures, cost and schedule estimation, project organization, responsibilities and process automation. (BL-3)
CO 5	Analyze software project control and process instrumentation using metrics, management and quality indicators, lifecycle expectations, metrics automation, process tailoring, and future software project management practices. (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	3	3	3	3	2
CO2	3	3	2						3	3	3	3	3	3
CO3	3	3	3						3	3	3	3	3	3
CO4	3	3	3						3	2	3	3	3	3
CO5	3	3	3						2	2	3	3	3	3
1: Low, 2-Medium, 3- High														

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

Textbook:

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

Reference

1. Robert K. Wysocki "Effective Software Project Management" Publication, 2011. Wiley
2. Walker Royce: "Software Project Management"- Addison-Wesley, 1998. Gopalaswamy Ramesh, "Managing Global Software Projects" - McGraw HillEducation (India), Fourteenth Reprint 2013.

NARAYANA ENGINEERING COLLEGE:: GUDUR								
20CS2505	**ARTIFICIAL INTELLIGENCE LAB**							R20
III BETCH	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
SEMESTER-I	0	0	2	36	1	40	60	100
Course Outcomes: After successful completion of the course, student will be able to:								
CO 1	AI problem-solving, search techniques, and intelligent agents(BL-1)							
CO 2	Explain search, knowledge representation, and AI problem-solving techniques(BL-2)							
CO 3	Implement DFS, BFS, TSP, 8-puzzle, A*, hill-climbing, simulated annealing, and knowledge representation techniques(BL-3)							

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

List of Experiments	
TASK – 1	
Implementation of DFS and BFS	
TASK – 2	
Implementation of travelling salesman Problem	
TASK – 3	
Implementation of simple Chabot.	
TASK – 4	
Implementation of wampus world problem.	
TASK – 5	
Implementation of 8 puzzle problem	
TASK – 6	
Implementation of Towers of Hanoi problem	
TASK – 7	
Implementation of A* Algorithm	
TASK – 8	
Implementation of Hill Climbing Algorithm	
TASK – 9	
Implementation of Simulated Annealing Algorithm.	
TASK – 10	
Implementation of Knowledge representation schemes.	
TASK – 11	
Demonstrate knowledge representation for the following using open source tools: a. Ram likes mango. b. Seema is a girl. c. Bill likes Cindy. d. Rose is red. e. John owns gold	
TASK – 12	
Implementation of any case study using AI techniques	
Total hours:	**36 hours**

Text Book(s):

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

Reference Book(s):

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

NARAYANA ENGINEERING COLLEGE::NELLORE								
20CS2506	**CODING LAB-I**							**R20**
III BETCH	**Hours / Week**			**Total hrs**	**Credit**	**Max Marks**		
	L	**T**	**P**		**C**	**CIE**	**SEE**	**TOTAL**
SEMESTER-I	0	0	2	36	1	40	60	100

Course Outcomes: After successful completion of the course, the student will be able to:	
CO 1	Analyze fundamental programming constructs and problem-solving concepts used in coding problems(BL-1)
CO 2	Explain computational approaches for arrays, strings, searching, sorting, and mathematical problems(BL-2)
CO 3	Apply suitable programming techniques to implement solutions for computational and real-world coding problems(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		3				2	2			3	2
CO2	2	2	2		2				2	1			2	2
CO3	3	3	3		3				2	2			3	3
1: Low, 2-Medium, 3- High														

List of Experiments	
TASK – 1	**3H**
Constellation	
TASK – 2	**3H**
Prime time again	
TASK – 3	**3H**
To develop code for minimum gifts problem	
TASK – 4	**3H**
To develop code for minimizing the sum problem	
TASK – 5	**3H**
To develop a code for critical planets problem	
TASK – 6	**3H**
.To develop code for Collecting candies problem	
TASK – 7	**3H**
To develop code for Total distance travelled by the Beetle problem	
TASK – 8	**3H**
To develop code for count crossing biker's problem	
TASK – 9	**3H**
To develop code for Finding the nth term of the given series	
TASK – 10	**3H**
To develop code for jar full of candies problem	
TASK – 11	**3H**
To develop code for fully automatic vending machine problem	
TASK – 12	**3H**
To develop code for Textual representation problem	
TASK – 13	**3H**
To prepare Logical Explanation for Rithik the day dreamer problem	
TASK – 14	**3H**
To Prepare Logic for parking space allotment problem	
TASK – 15	**3H**
To develop code for Forest and Fire problem	
Total hours:	**36 hours**

TEXT BOOKS

1. Reema Thareja, Python Programming Using Problem Solving Approach, Oxford University Press.
2. E. Balagurusamy, Programming in ANSI C, McGraw Hill Education.
3. Yashavant Kanetkar, Let Us C, BPB Publications.

REFERENCE BOOKS

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, 2nd Edition, Prentice Hall.
2. Byron S. Gottfried, Programming with C, Schaum's Outline Series, McGraw Hill.
3. R. G. Dromey, How to Solve It by Computer, Pearson Education.
4. Ellis Horowitz, Sartaj Sahni and Susan Anderson-Freed, Fundamentals of Data Structures in C, Universities Press.

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

Course Outcomes: After successful completion of the course, student will be able to:	
CO 1	Explain fundamental algorithm design paradigms and complexity measures(BL-1)
CO 2	Explain major algorithm design techniques and their applications(BL-2)
CO 3	Apply appropriate algorithmic techniques to implement solutions for computational problems(BL-3)

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

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

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

Total hours:	**36 hours**

Text Book(s):

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

Reference Book(s):

1. Thomas H.Cormen, Charles E.Leiserson, Ronald L.Rivest and Clifford Stein," Introduction to Algorithms", Third Edition, PHI Learning Private Limited,2012.
2. Alfred V.Aho, John E.Hopcroft and Jeffrey D.Ullman, "Data Structures and Algorithms", Pearson Education, Reprint2006..

NARAYANA ENGINEERING COLLEGE:GUDUR								
20CD6003	**CAREER COMPETENCY DEVELOPMENT III (CSE,ECE,EEE)**							**R20**
III BETCH	**Hours / Week**			**Total hrs**	**Credit**	**Max Marks**		
	L	**T**	**P**		**C**	**CIE**	**SEE**	**TOTAL**
SEMESTER-I	0	0	2	36	1	40	60	100

Course Objectives:

To enhance employability skills and to develop career competency

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

CO 1	fundamental concepts related to aptitude, reasoning, communication, and employability skills(BL-1)
CO 2	Explain common approaches for quantitative aptitude, logical reasoning, communication, and interview preparation(BL-2)
CO 3	Apply aptitude, reasoning, communication, and interview skills to placement-oriented tasks(BL-3)
CO 4	Understand and apply the basic concepts of Python programming, including variables, data types, operators, and control statements. (BL-4)
CO 5	Develop Python programs using functions, data structures, files, and modules to solve simple computational problems. (BL-5)

CO-PO Mapping

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

1: Low, 2-Medium, 3- High

COURSE CONTENT		
MODULE – 1	**APTITUDE-III**	**7H**
Percentages, Profit & Loss, Discounts, Simple Interest, Compound Interest, Data Interpretation,Permutations and Combinations, Menstruation-I (Measurement of Areas)		
MODULE -2	**REASONING-III**	**6H**
Ranking Test, Type Inequalities, Crypto Arithmetic, Critical Reasoning / Data Sufficiency		
MODULE-3	**VERBAL-III**	**6H**
Spotting Errors, Error Correction (Underlined Part & Phrase in Bold), Reading Comprehension 1, Sentence completion (Review and practice), Adjectives (Review and practice), Prepositions (Review and practice), Jumbled sentences (Review and practice).		
MODULE-4	**TECHNICAL SKILLS-V** **Structured Query Language & PL/SQL**	**8H**
SQL Constraints, SQL Operations, Nested queries (or) Sub queries and Examples, SQL Types ofJoins with Examples, Normal Forms, PL/SQL Programs .		
MODULE-5	**TECHNICAL SKILLS-VI** **Object Oriented Programming Principles through JAVA**	**9H**
JVM Compiler Vs JIT Compiler, Various OOPs Concepts and its Applications, Abstract Classes Vs Interfaces, Method overriding Vs Method Overloading, Access Specifiers, Exceptions and its Types, Exception Handling Mechanisms.		
	Total Hours	**30 Hours**

MODULE 1: Aptitude-3 (7H)

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

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

Text / Reference Books:

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

SEMESTER - VI

NARAYANA ENGINEERING COLLEGE::GUDUR								
20HS5001	**MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS (Common to All branches of Engineering)**							R20
III BETCH	**Hours / Week**			**Total hrs**	**Credit**	**Max Marks**		
	L	**T**	**P**		**C**	**CIE**	**SEE**	**TOTAL**
SEMESTER-II	2	0	0	32	2	40	60	100

1. To inculcate the basic knowledge of micro economics and financial accounting
2. To make the students learn how demand is estimated for different products, input-output relationshipfor optimizing production and cost
3. To Know the Various types of market structure and pricing methods and strategy
4. To give an overview on investment appraisal methods to promote the students to learn how to planlong-term investment decisions.
5. To provide fundamental skills on accounting and to explain the process of preparing financialstatements

Course Outcomes: After successful completion of the course, Student will be able to:	
CO 1	Explain the fundamental concepts, nature, significance, and functions of managerial economics, demand, elasticity, and demand forecasting.(BL-2)
CO 2	Apply production and cost concepts, production functions, economies of scale, and break-even analysis to managerial decision-making.(BL-3)
CO 3	Analyze different forms of business organizations, market structures, price-output determination, and pricing strategies.(BL-4)
CO 4	Evaluate working capital requirements and capital investment proposals using capital budgeting techniques such as Payback Period, ARR, NPV, and IRR(BL-5)
CO 5	Prepare and interpret basic financial accounting statements and analyze financial performance using liquidity, activity, capital structure, and profitability ratios(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			
CO2											3			
CO3											3			
CO4											2			
CO5											3			
1: Low, 2-Medium, 3- High														

COURSE CONTENT		
MODULE – 1	**MANAGERIAL ECONOMICS**	**6H**
Introduction – Nature, meaning, significance, functions, and advantages. Demand-Concept, Function, Law of Demand - Demand Elasticity- Types – Measurement. Demand Forecasting- Factors governing Forecasting, Methods. Managerial Economics and Financial Accounting and Management.		
MODULE – 2	**PRODUCTION AND COST ANALYSIS**	**6H**
Introduction – Nature, meaning, significance, functions and advantages. Production Function– Least-cost combination– Short run and Long run Production Function- Isoquants and Isocosts, MRTS - Cobb-Douglas Production Function - Laws of Returns - Internal and External Economies of scale. Cost & Break-Even Analysis - Cost concepts and Cost behavior- Break-Even Analysis (BEA) -Determination of Break-Even Point (Simple Problems)-Managerial significance and limitations of Break-Even Analysis.		
MODULE – 3	**BUSINESS ORGANIZATIONS AND MARKETS**	**7H**
Introduction – Nature, meaning, significance, functions and advantages. Forms of Business Organizations- Sole Proprietary - Partnership - Joint Stock Companies - Public Sector Enterprises. Types of Markets - Perfect and Imperfect Competition - Features of Perfect Competition Monopoly-Monopolistic Competition–Oligopoly- Price-Output Determination - Pricing Methods and Strategies		
MODULE – 4	**CAPITAL BUDGETING**	**7H**
Introduction – Nature, meaning, significance, functions and advantages. Types of Working Capital, Components, Sources of Short-term and Long-term Capital, Estimating Working capital requirements. Capital Budgeting– Features, Proposals, Methods and Evaluation. Projects – Pay Back Method, Accounting Rate of Return (ARR) Net Present Value (NPV) Internal Rate Return (IRR) Method (sample problems)		
MODULE – 5	**FINANCIAL ACCOUNTING AND ANALYSIS**	**6H**
Introduction – Nature, meaning, significance, functions and advantages. Concepts and Conventions- Double- Entry Book Keeping, Journal, Ledger, Trial Balance- Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet with simple adjustments). Financial Analysis - Analysis and Interpretation of Liquidity Ratios, Activity Ratios, and Capital structure Ratios and Profitability		
	Total hours:	**32 hours**

Text Books:

1. Varshney&Maheswari: Managerial Economics, Sultan Chand, 2013.
2. Aryasri: Business Economics and Financial Analysis, 4/e, MGH, 2019

Reference Books:

1. Ahuja Hl Managerial economics Schand,3/e,2013
2. S.A. Siddiqui and A.S. Siddiqui: Managerial Economics and Financial Analysis, New Age International, 2013.
3. Joseph G. Nellis and David Parker: Principles of Business Economics, Pearson, 2/e, New Delhi.
4. Domnick Salvatore: Managerial Economics in a Global Economy, Cengage, 2013

NARAYANA ENGINEERING COLLEGE::GUDUR								
20CS2012	MOBILE APPLICATION DEVELOPMENT							R20
III BETCH	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
SEMESTER-II	2	0	0	36	2	40	60	100

Course Outcomes: After successful completion of the course, Student will be able to:	
CO 1	Explain the Android software stack and development environment.(BL-2)
CO 2	Apply Android application components, widgets, layouts, controls, and event handling to develop user interfaces. (BL-3)
CO 3	Design Android applications using layouts, views, resources, multimedia components, and screen orientation features. (BL-6)
CO 4	Implement selection widgets, dialogs, and fragments to develop interactive Android applications. (BL-3)
CO 5	Develop Android applications using menus, Action Bars, and SQLite databases. (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	1	3	3								2	2
CO2	3	3	3	3	3								3	3
CO3	3	3	3	2	3								3	3
CO4	3	3	3	1	3								3	3
CO5	3	3	3	3	3								3	3
1: Low, 2-Medium, 3- High														

COURSE CONTENT		
MODULE – 1	**Introduction to Android**	**6H**
The Android 4.1 jelly Bean SDK, Understanding the Android Software Stack, installing the Android SDK, Creating Android Virtual Devices, Creating the First Android Project, Using the Text view Control, Using the Android Emulator, The Android Debug Bridge(ADB), Launching Android Applications on a Handset.		
At the end of the Module 1, students will be able to: 1. Understand the installation of Android Platform (BL-1) 2. Analyze the working of android applications (BL-2) 3. Apply debugging strategies in basic programming (BL-3)		
MODULE – 2	**Basic Widgets**	**7H**
The Role of Android Application Components, Utility of Android API, Overview of the Android Project Files, Understanding Activities, Role of the Android Manifest File, Creating the User Interface, Commonly Used Layouts and Controls, Event Handling, Displaying Messages Through Toast, Creating and Starting an Activity, Using the Edit Text Control, Choosing Options with Checkbox, Choosing Mutually Exclusive Items Using Radio Buttons.		
At the end of the Module 2, students will be able to: 1. Understand the concepts of Android API Components (BL-1) 2. Interpret the working examples using various android components (BL-2) 3. Solve basic level android applications using activities (BL-3)		
MODULE – 3	**Building Blocks for Android Application Design**	**7H**
Introduction to Layouts, Linear Layout, Relative Layout, Absolute Layout, Using Image View, Frame Layout, Table Layout, Grid Layout, Adapting to Screen orientation. Utilizing Resources and Media Resources, Creating Values Resources, Using Drawable Resources, Switching States with Toggle Buttons, Creating an Images Switcher Application, Scrolling Through Scroll View, playing Audio, Playing Video		
At the end of the Module 3, students will be able to: 1. Understand the various types of layouts (BL-1) 2. Analyze the various screen orientation strategies (BL-2) 3. Illustrate various components to implement audio and video applications (BL-4)		
MODULE – 4	**Selection widgets And Fetching Information Using Dialogs and Fragments**	**8H**
Using List View, Using the Spinner control, Using the GridView Control, Creating an ImageGallery Using the ViewPager Control. Dialogs, Selecting the Date and Time in One Application, Fragments, Creating SpecialFragments**.**		
At the end of the Module 4, students will be able to: 1. Understand the special controls like viewpager, GridView like controls (BL-1) 2. Apply various applications using dialogs (BL-3) 3. Remember the concepts of application development using Fragments (BL-1)		

MODULE – 5	Building Menus	8H
Creating Interface Menus and Action Bars, Menus and Their Types, Creating Menus ThroughXML, 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 aDrop-Down List Action Bar.		
At the end of the Module 5, students will be able to: 1. Understand the concepts of Menus (BL-2) 2. Analyze the working of various types of android menus (BL-2) 3. Understanding the special components like Tabbed Action Bar and Drop down list(BL-2)		
	Total hours:	**36 hours**

Text Books:

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

Reference Books:

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

NARAYANA ENGINEERING COLLEGE::GUDUR								
20CS2013	**WEB TECHNOLOGIES**							R20
III BETCH	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
SEMESTER-II	3	0	0	48	3	40	60	100

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-6)
CO 4	Develop web Applications using Scripting Languages.(BL-6)
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	2	2	3		3								3	3
CO2	3	3	3		3								3	3
CO3	3	3			3								3	3
CO4	3	3	3		3								3	3
CO5	2	2	2		3								2	2
1: Low, 2-Medium, 3- High														

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

At the end of the Module 5, students will be able to: 1. Understand the web applications using NODEJS (BL-1) 2. Implement various services using NODEJS (BL-2) 3. Compare Angular JS with React JS (BL-2)	
Total hours:	**48 hours**

Textbook:

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

Reference Book:

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

NARAYANA ENGINEERING COLLEGE::GUDUR								
20EC3006	**INTERNET OF THINGS (IOT)**							R20
III BETCH	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
SEMESTER-II	3	0	0	48	3	40	60	100
Pre-requisite: Basic Programming Language, Fundamentals of internet technology, computer networks								

Course Objectives:

1. To learn fundamentals of IoT
2. To Learn how to build hardware
3. To Learn software for IoT based systems
4. To design and implement IoT circuits and solutions

Course Outcomes: On successful completion of the course, the student will be able to:	
CO 1	Explain the architecture, communication protocols, and networking concepts of IoT.(BL-2)
CO 2	Develop simple IoT applications using Arduino by integrating sensors and actuators.(BL-3)
CO 3	Develop simple IoT applications using Raspberry Pi and explain SDN concepts for IoT.(BL-3)
CO 4	Apply data handling, storage, and analytics techniques using cloud and fog computing in IoT. (BL-3)
CO 5	Explain the applications of IoT in smart cities, smart homes, connected vehicles, smart grids, industries, agriculture, and healthcare.(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	2	1		2							3	3	2
CO2	2	2	3		3							3	3	3
CO3	2	2	3		2							2	3	3
CO4	3	2	2		3							3	3	2
CO5	2	1	2		2							3	2	2
1: Low, 2-Medium, 3- High														

COURSE CONTENT		
MODULE – 1	**INTRODUCTION TO INTERNET OF THINGS**	**10H**
The Internet of Things Today , Elements of an IoT ecosystem Time for Convergence , Characteristics of IoT, Physical design of IoT, Logical design of IoT, IoT enabling technologies, IoT levels and deployment		
At the end of the Module 1, students will be able to: 1. Explain usage of the term —The Internet of Things‖ in different contexts. (BL-2) 2. Describe the concepts of internet of things(BL-2) 3. Explain IOT Levels (BL-2)		
MODULE – 2	**NETWORKS AND COMMUNICATION**	**9H**
Networking Technology, Communication Technology, Processes Data Management, Prototyping embedded devices, Sensors and actuators, Embedded computing basics.		
At the end of the Module 2, students will be able to: 1. Explain concepts of networking & communication in IoT(BL-2) 2. Describe Basic elements in IoT (BL-2) 3. Explain embedded computing basics(BL-2) 4. What is importance of sensors and actuators in IOT(BL-2)		
MODULE – 3	**IOT ARCHITECTURES**	**9H**
Elements of IOT System, The IoT Reference Model, IoT Reference Architecture, The iCore Functional architecture, Privacy preserving Sharing of IoT Data		
At the end of the Module 3, students will be able to: 1. Describe the elements of IoT System (BL-2) 2. Select the IoT & iCore Reference model, Architectures for specific applications (BL-3) 3. Explain importance of privacy in preserving and sharing of data in IoT for various applications. (BL-2)		
MODULE – 4	**IOT PHYSICAL DEVICES AND ENDPOINTS**	**10H**
Introduction to Arduino, Arduino UNO, Installing the Software, Fundamentals of Arduino Programming Introduction to RaspberryPi, Operating Systems on RaspberryPi, Configuring RaspberryPi, Programming RaspberryPi with Python		
At the end of the Module 4, students will be able to: 1. Describe the function of Arduino (BL-2) 2. Explain fundamentals of Arduino programming(BL-2) 3. Describe configuration procedure of RaspberryPi(BL-2)		
MODULE – 5	**APPLICATIONS OF IOT**	**10H**

Home automation, Smart Cities, Smart Energy and the Smart Grid, Smart Transportation and Mobility, Industry applications- Value Creation and Challenges, Other IoT applications , Case studies in IoT system for Home automation , cities , Agriculture applications

At the end of the Module 5, students will be able to: 1. Explain importance of automation (BL-2) 2. Explain various applications of IOT (BL-2) 3. Describe impact of IoT in Industrial applications (BL-2) 4. Describe the Role of IoT in Smart cities (BL-2)	
Total hours:	**48 hours**

Textbook:

5. ArshdeepBahga, Vijay Madisetti, —Internet of Things: A Hands-on-Approach‖, VPT, 1st Edition, 2014.
6. Ovidiu Vermesan ,PeterFriess —Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems‖, 2013 River Publishers
7. Raj Kamal, Internet of Things, First edition, McGraw Hill

Reference Book:

5. Jeeva Jose, Internet of Things, Khanna Book Publishing Co., New Delhi
6. Adrian McEwen, Hakim Cassimally, —Designing the Internet of Things‖, John Wiley and Sons, 1st Edition, 2014.
7. Francis Da Costa, —Rethinking the Internet of Things: A Scalable Approach to Connecting Everything‖, Apress Publications, 1st Edition, 2013.
8. Matt Richardson, Shawn Wallace, —Getting Started with Raspberry Pi‖, O"Reilly (SPD), 3rd Edition, 2014.

NARAYANA ENGINEERING COLLEGE::GUDUR								
20CS4007	SOFTWARE ARCHITECTURE							R20
III BETCH	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
SEMESTER-II	3	0	0	49	3	40	60	100

Course Outcomes: After successful completion of the course, the student will be able to:	
CO 1	Demonstrate Software Architecture Reference Models and Architecture Business Cycle for making a good Software Architecture(BL-3)
CO 2	Choose different Software Architectural Life Cycles for designing a good Architecture(BL-5)
CO 3	Identify Quality Attributes, Functional attributes, and different types of tactics for creating architecture.(BL-1)
CO 4	Develop the document of software architecture and views for creating architecture.(BL-6)
CO 5	Develop real time projects by combining ATAM and CBAM frameworks with quality attributes. (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	2		2								2	2
CO2	3	3	3		3								2	2
CO3	3	3	3		3								3	2
CO4	3	2	3		3								3	1
CO5	3	3	3		3								3	1
1: Low, 2-Medium, 3- High														

COURSE CONTENT		
MODULE – 1	**SOFTWARE ARCHITECTURE**	**10H**
What is software Architecture-What is Software Architecture, Other Points of View, Architectural Patterns, Reference Models, and Reference Architectures, Importance of Software Architecture, Architectural Structures and views. **ENVISIONING ARCHITECTURE**: Architecture Business Cycle- Architectures influences, Software Processes and the Architecture Business Cycle, Making of ―Good‖ Architecture.		
MODULE – 2	**DESIGNING THE ARCHITECTURE WITH STYLES**	**10H**
Designing the Architecture: Architecture in the Life Cycle, Designing the Architecture, Formatting the Team Structure, Creating a Skeletal System. Architecture Styles: Architectural Styles, Pipes and Filters, Data Abstraction and Object Oriented Organization, Event-Based, Implicit Invocation, Layered Systems, Repositories, Interpreters.2013-2014		
MODULE – 3	**CREATING AN ARCHITECTURE-I**	**10H**
Creating an Architecture: Understanding Quality Attributes – Functionality and Architecture, Architecture and Quality Attributes, System Quality Attributes, Quality Attribute. Scenarios in Practice, Other System Quality Attributes, Business Qualities, Architecture Qualities. Achieving Qualities: Introducing Tactics, Availability Tactics, Modifiability Tactics, Performance Tactics, Security Tactics, Testability Tactics, Usability Tactics.		
MODULE – 4	**CREATING AN ARCHITECTURE-II**	**10H**
Documenting Software Architectures: Use of Architectural Documentation, Views, Choosing the Relevant Views, Documenting a view, Documentation across Views. Reconstructing Software Architecture: Introduction, Information Extraction, Database Construction, View Fusion, and Reconstruction.		
MODULE – 5	**ANALYZING ARCHITECTURES**	**9H**
The ATAM: Participants in the ATAM, Outputs of The ATAM, Phases Of the ATAM. The CBAM: Decision-Making Context, The Basis for the CBAM, Implementing the CBAM. The World Wide Web: A Case study in Interoperability- Relationship to the Architecture Business Cycle, Requirements and Qualities, Architecture Solution, Achieving Quality Goals.		
	Total hours:	**49 hours**

TEXTBOOK:

Software Architectures in Practice , Len Bass, Paul Clements, Rick Kazman, 2nd Edition, Pearson Publication.

Software Architecture, Mary Shaw and David Garlan, First Edition, PHI Publication, 1996.

REFERENCES:

Software Design: From Programming to Architecture, Eric Braude, Wiley, 2004.

N. Domains of Concern in Software Architectures and Architecture Description Languages. Medvidovic and D. S. Rosenblum. USENIX.

NARAYANA ENGINEERING COLLEGE::GUDUR								
20CS4014	CLOUD COMPUTING							R20
III BETCH	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
SEMESTER-II	3	0	0	48	3	40	60	100

Course Outcomes: After successful completion of the course, student will be able to:	
CO 1	Explain the fundamentals, characteristics, models, and service concepts of cloud computing. (BL-2)
CO 2	Design and develop cloud applications using appropriate cloud architecture, service models, and deployment models. (BL-6)
CO 3	Explain and classify virtualization technologies, virtual machines, and cloud virtualization platforms. (BL-2)
CO 4	Apply CloudSim and Aneka programming models to simulate and develop cloud applications. (BL-3)
CO 5	Deploy SaaS applications using cloud platforms such as Google App Engine, Microsoft Azure, and AWS. (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			2								2	2
CO2	3	3	3	2	3								3	3
CO3	2	2	2		3								3	2
CO4	3	3	3	2	3								3	3
CO5	3	2	3	2	3								3	3
1: Low, 2-Medium, 3- High														

COURSE CONTENT		
MODULE – 1		**9H**
Cloud Computing Insights- Distributed Computing, High Performance Computing, Utility and Enterprise Grid Computing, Cluster Computing**,** Cloud Computing fundamentals, Essential Characteristics, On Demand Self Service, Location independent resource pooling, Elastic Computing, Measured Service, Comparing cloud providers with traditional IT service providers, Vendor Lock-in, security level of third party- Security issues: Government policies.		
MODULE – 2		**10H**
Cloud computing architecture, Layers of Cloud computing- IaaS, PaaS and SaaS, Cloud deployment models- Private, Public, Hybrid and Community Clouds, Advantages of Cloud Computing.		
MODULE – 3		**10H**
Introduction, Characteristics of Virtualized Environments, Virtualization and Cloud Computing, Pros and Cons of Virtualization, Virtual machines and Virtualization of Clusters and Data Centres, Case studies – Xen Virtual Machine monitors – Xen API, VMware- VMware products-VMware features, Microsoft Virtual Server- Features of Microsoft Virtual Server, Open stack.		
MODULE – 4		**10H**
CloudsimOpen source framework, Simulate VMs, memory, network, disks; Aneka – Cloud computing Framework for Enterprise Cloud applications development, Aneka Architecture, Programming models: Thread, Task and MapReduce		
MODULE – 5		**9H**
Case studies – Salesforce.com for SaaS application development, GAE- Google App Engine, Microsoft Windows Azure – public resources for VMs and Services, AWS- Amazon Web Services – public cloud registration, Services, OpenStack – Open Source Development Platform for Clouds and tools.		
	Total hours:	**48 hours**

TEXTBOOK:

1. RajkumarBuyya, Christian Vecchiola, S. ThammaraiSelvi, "Mastering Cloud Computing – Foundations and applications", McGraw Hill Publications,
2. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing – A Practical Approach", Mc Graw Hill, Inc, New York, NY, USA.

REFERENCES:

1. Kai Hwang, Geoffrey C Fox, Jack J. Dongarra, "Distributed and Cloud Computing, Morgan Kaufmann.
2. Cloud Computing Principles and Paradigms, John Wiley & Sons publications

NARAYANA ENGINEERING COLLEGE::NELLORE								
20CS2508	**CODING LAB-II**							**R20**
III BETCH	**Hours / Week**			**Total hrs**	**Credit**	**Max Marks**		
	L	**T**	**P**		**C**	**CIE**	**SEE**	**TOTAL**
SEMESTER-I	0	0	2	36	1	40	60	100

Course Outcomes: After successful completion of the course, the student will be able to:	
CO 1	Understand and apply basic programming concepts to solve simple computational problems.
CO 2	Develop programs using conditional statements, loops, and functions to solve real-world problems.
CO 3	Apply logical thinking and problem-solving techniques to solve mathematical and numerical problems.
CO 4	Implement programs using strings, arrays, searching, and sorting techniques.
CO 5	Analyze problems, develop efficient algorithms, and test programs to obtain correct outputs.

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	3		3	3	2
CO2	3	3	3	3					3	3		3	3	2
CO3	3	3	3	3	2				3	3		3	3	3
CO4	2	3	3	3	3				3	3		3	2	3
CO5	1	3	3	3	1			1	3	3		3	2	2
1: Low, 2-Medium, 3- High														

List of Experiments	
TASK – 1	**3H**
Maximum number of guests	
TASK – 2	**3H**
Bunch of Balloons	
TASK – 3	**3H**
A City Bus	
TASK – 4	**3H**
Three Palindromic Substrings	
TASK – 5	**3H**
forest fire	
TASK – 6	**3H**
. Railway Station	
TASK – 7	**3H**
Bank Compare	
TASK – 8	**3H**
Counting Rock Samples	
TASK – 9	**3H**
Philaland Coins	
TASK – 10	**3H**
Football league	
TASK – 11	**3H**
Sorting Boxes	
TASK – 12	**3H**
Dining Table Seating Arrangement	
TASK – 13	**3H**
Television Set	
TASK – 14	**3H**
Chakravyuha Problem	
TASK – 15	**3H**
Bride Hunting	
Total hours:	**36 hours**

TEXT BOOKS

1. Reema Thareja, Python Programming Using Problem Solving Approach, Oxford University Press.
2. Allen B. Downey, Think Python: How to Think Like a Computer Scientist, O'Reilly Media.
3. E. Balagurusamy, Programming in ANSI C, McGraw Hill Education.

REFERENCE BOOKS

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall.
2. Yashavant Kanetkar, Let Us C, BPB Publications.
3. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, Introduction to Algorithms, MIT Press.
4. Ellis Horowitz, Sartaj Sahni and Susan Anderson-Freed, Fundamentals of Data Structures in C, Universities Press.
5. Byron Gottfried, Programming with C, McGraw Hill Education.

NARAYANA ENGINEERING COLLEGE::GUDUR								
20CS2509	MOBILE APPLICATION DEVELOPMENT LAB							R20
III BETCH	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
SEMESTER-II	0	0	2	30	1	40	60	100

Course Outcomes: On successful completion of the Laboratory, student will be able to:	
CO 1	Understanding Environment Setup & Configuration (BL-2)
CO 2	Applying UI Component Implementation (BL-3)
CO 3	Analyzing Layout Management & Design. (BL-4)

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

List of Experiments		
TASK – 1	**Android installations**	
Set up the Development environment to develop Android Applications		
TASK – 2	**Hello World Application.**	
Create "Hello World" Application.		
TASK – 3	**Using the Activity class**	
Create an application using the Activity class.		
TASK – 4	**Edit Text control.**	
Create an application using Edit Text control.		
TASK – 5	**Check Box control.**	
Creating an application that allows choosing options using Check Box control.		
TASK – 6	**Radio Button control**	
Creating an application that allows choosing options using Radio Button control		
TASK – 7	**Linear Layout**	
Create an application using Linear Layout		
	Relative Layout	
Create an application using Relative Layout		
TASK – 9	**Absolute Layout**	
Create an application using Absolute Layout		
TASK – 10	**play Audio and Video clips**	
Create an application to play Audio and Video clips		
TASK – 11	**Using Spinner.**	
Create an application that allows choosing options using Spinner.		
TASK – 12	**Menus**	
Create an application using Menus.		
Additional Experiments:		
TASK-13	**Radio Button control**	
Creating an application that allows choosing options using two sets of Radio Button controls.		
TASK -14	**Action Bar**	
1. Create an application using Action Bar. 2 . Create an application to display a Drop-Down List Action Bar.		
	Total hours:	**30hours**

Text Books:

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

References Books:

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

NARAYANA ENGINEERING COLLEGE::GUDUR							
20CS2510	**WEB TECHNOLOGIES LAB**						R20
III BETCH	Hours / Week			Total hrs	Credit	Max Marks	
	L	T	P		C	CIE	SEE	TOTAL
SEMESTER-II	0	0	2	36	1.5	40	60	100

Course Outcomes: On successful completion of the Laboratory, student will be able to:	
CO 1	Apply HTML elements, forms, tables, lists, images, frames, links, and multimedia features to develop basic web pages. (BL-3)
CO 2	Design interactive and responsive web pages using CSS and JavaScript for styling, form validation, event handling, and dynamic content generation. (BL-6)
CO 3	Develop database-driven web applications using PHP and MySQL with form processing, authentication, CRUD operations, and case-study-based solutions. (BL-6)

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

List of Experiments	
TASK – 1	
Create a web page to embed a map along with hot spot, frames & links.	
TASK – 2	
Create a web page using an embedded, external and inline CSS file.	
TASK – 3	
Create an online job registration page along with java script validations	
TASK – 4	
Develop web page for Library Management System using Servlet and JavaScript program that will validate the controls in the forms you have created for the application and access a data from database	
TASK – 5	
Develop web page for Banking Management System using Servlet and JavaScript program that will validate the controls in the forms you have created for the application and access a data from database.	
TASK – 6	
Create a program to implement the concepts of AJAX for web page login process.	
TASK – 7	
Develop a Simple game using JQuery.	
TASK – 8	
Write a PHP program for Employee Details, which includes Emp ID, Name, Designation, Salary, DOJ, etc., to connect with the database and execute queries to retrieve and update data. Also, prepare the report for single and group of employees based on the end user needs.	
TASK – 9	
Create an online application in any of the web application like PHP for Tourism management like the available trip details in season based. Type of mode, Concession details for passengers and Booking / Cancelling tickets.	
TASK – 10	
Design a web page application using Angular 9	
TASK – 11	
Design a registration page along with event handling using Angular 9	
TASK – 12	
Design user interface using React JS	
TASK – 13	
MINI-PROJECT (Suggested Domains):	
Total hours:	**36 hours**

Textbook:

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

References:

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

NARAYANA ENGINEERING COLLEGE:GUDUR								
20CD6004	**CAREER COMPETENCY DEVELOPMENT IV(CSE,ECE,EEE)**							**R20**
III BETCH	**Hours / Week**			**Total hrs**	**Credit**	**Max Marks**		
	L	**T**	**P**		**C**	**CIE**	**SEE**	**TOTAL**
SEMESTER-VI	0	0	2	36	1	40	60	100

Course Objectives:

To enhance employability skills and to develop career competency

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

CO 1	Apply mathematical and quantitative techniques to solve problems related to time, speed, probability, mensuration, geometry, and related aptitude concepts. (BL-3)
CO 2	Analyze relationships, classifications, causes, and effects to solve analytical and logical reasoning problems. (BL-4)
CO 3	Apply appropriate grammatical rules, vocabulary, sentence structures, and comprehension skills to improve verbal communication. (BL-3)
CO 4	Develop Java programs using string handling, collections, exception handling, multithreading, and applet concepts to solve practical programming problems. (BL-3)
CO 5	Apply hash tables, dynamic programming, greedy techniques, and graph algorithms to solve computational problems efficiently. (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		3		
CO2	2	3	3							2		3		
CO3	1	1	3						1	3		3		
CO4	3	3	3						1	2		3	2	3
CO5	3	3	3							1		3	2	3
1: Low, 2-Medium, 3- High														

COURSE CONTENT		
MODULE – 1	**APTITUDE-IV**	**7H**
Time, Speed and distance, Trains, Boats and streams, Heights and distances, Races and Games, Probability, Menstruation-II (Measurement of Volumes, surface areas), Geometry		
MODULE -2	**REASONING- IV**	**6H**
Analogy, Classification, Analytical Reasoning, Cause and affect Reasoning.		
MODULE-3	**VERBAL- IV**	**6H**
Sentence Improvement, Word Relation, Reading Comprehension 2, Tenses (Review and Practice), Voice (Review and Practice), Phrasal Verbs (Review and Practice).		
MODULE-4	**Oriented Programming Principles through Java**	**9H**
String handling, Collection framework, Multithreading, Exception Handling, and Applets. 1) Write a Java program to print all unique words present in the String. The task is to print all words occurring only once in the String. 2) Write a Java program to append the specified element to the end of a linked list. 3) Write a Java program to implement User defined exception. 4) Producer-Consumer problem to manage process synchronization 5) Chess Applet with a square Size of 2, 10, 20.		
MODULE-5	**Data Structures**	**8H**
Hash Tables, Dynamic Programming, Greedy Approach, Graphs 1) Find all Symmetric Pairs in an Array of Pairs using hash tables 2) Min Cost Path problem using dynamic approach 3) Largest lexicographic array with at-most K consecutive swaps Using greedy approach 4) Graph colouring problem		
	Total Hours	**36 Hours**

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

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

Text / Reference Books:

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

NARAYANA ENGINEERING COLLEGE:GUDUR								
20MC8011	**BUSINESS COMMUNICATION**							
III BETCH	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
SEMESTER-II	2	0	0	30	0	0	100	100

Course Objectives: The objective of this Course is to understand the communication concepts and to develop the students' competence in communication at an advanced level. Assuming that the students are fairly proficient in the basic communication skills of listening, speaking, reading and writing in English the course aims to train them in communicating efficiently in the workplace and professional contexts.

Course Outcomes: After successful completion of the course, the student will be able to:	
CO1	Define the concepts of HRP related to micro level manpower planning and job analysis
CO2	Understand the Systems Approach to Human Resource Planning
CO3	Understand the Recruitment and Selection Procedures
CO4	Define the manpower utilization techniques
CO5	Understand the emerging trends in the HR field

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

COURSE CONTENT		
MODULE – 1	**INTRODUCTION OF BUSINESS COMMUNICATION**	**6H**
Concept of Communication – Significance, Scope – Communication Process – Essentials of good communication – Channels of Communication – Formal, Informal Communication – Upward, Downward, Horizontal Communication.		
MODULE – 2	**TYPES OF COMMUNICATION**	**6H**
Types of communication: **Verbal – Oral Communication:** Advantages and Limitations of Oral Communication, Written Communication – Characteristics, Advantages & Limitations **Non verbal Communication:** Sign language – Body language – Kinesics – Proxemics – Time language and Hepatics: Touch language.		
MODULE – 3	**INTERPERSONAL COMMUNICATION**	**6H**
Communication Styles, Managing Motivation to Influence Interpersonal Communication – Role of emotion in Inter personal Communication.		
MODULE – 4	**BARRIERS OF COMMUNICATION**	**6H**
Types of barriers – Technological – Socio-Psychological barriers – Overcoming barriers, Types of listening.		
MODULE – 5	**REPORT WRITING**	**6H**
Formal reports – Writing effective letters – Different types of business letters - Interview techniques – Communication etiquettes		
	Total Hours	**30 Hours**

Text Books:

1. Business Communication, C.S.Rayudu, HPH.
2. Business Communication, Meenakshi Raman, Oxford University Press.

References:

1. Business communication, Shalini Varma, Vikas.
2. Business Communication, Raymond V.Lesikar, Neeraja Pandit et al.,TMH
3. English for Business Communication, Dr.T.M Farhatulla, Prism books Pvt. Ltd.
4. Business Communications, Hudson, Jaico Publications
5. Business communication for managers, Penrose, Raspbery, Myers, Cengage
6. The Skills of Communication, Bills Scot, Gower publishing company Limited, London.
7. Effective Communication, Harward Business School, Harward Business Review No.1214.
8. Essentials of Business Communication, Rajendra Pal, JS.Korlahhi, S.Chand

SEMESTER -VII

NARAYANA ENGINEERING COLLEGE::GUDUR								
20CS2013	CRYPTOGRAPHY AND NETWORK SECURITY							R20
IV BETCH	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
SEMESTER-I	3	0	0	48	3	40	60	100

Pre-requisite:

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

Course Objectives:

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

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

CO 1	Explain the fundamental concepts of computer and network security, including security attacks, services, mechanisms, cryptography, and steganography. (BL-2)
CO 2	Apply symmetric and asymmetric cryptographic algorithms for secure communication and key distribution. (BL-3)
CO 3	Analyze message authentication algorithms, hash functions, MACs, and digital signatures to ensure data integrity and authenticity. (BL-4)
CO 4	Analyze security mechanisms for e-mail and IP networks, including PGP, S/MIME, AH, ESP, security associations, and key management. (BL-4)
CO 5	Evaluate web security mechanisms, SSL/TLS, secure electronic transactions, intrusion detection, viruses, and firewall technologies for network protection. (BL-5)

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	2								2	2
CO 2	3	3	2	2	3								3	3
CO 3	3	3	2	3	3								3	3
CO 4	3	3	2	3	3								3	3
CO 5	3	3	3	3	3								3	3
1: Low, 2-Medium, 3- High														

COURSE CONTENT		
MODULE – 1		**8H**
Attacks on Computers and Computer Security: Introduction, The need for security, Principles of security, Types of Security attacks, Security services, Security Mechanisms, A model for Network Security Cryptography, plain text and cipher text, substitution techniques, transposition techniques, encryption and decryption, symmetric and asymmetric key cryptography, Steganography.		
LEARNING OUTCOMES: At the end of 1 Module students will be able: 1. Identify different types of Attacks (L3) 2. Interpret various cryptography techniques (L5) 3. Distinguish between cryptography and Steganography (L4)		
MODULE – 2		**9H**
Symmetric key Ciphers: Block Cipher principles &Algorithms (DES, AES, Blowfish), Block cipher modes of operation, Stream ciphers, Key distribution. **Asymmetric key Ciphers**: Principles of public key cryptosystems, Algorithms (RSA, Diffie Hellman, ECC), Key Distribution.		
LEARNING OUTCOMES: At the end of this Module students will be able: 1. Differentiate symmetric and asymmetric ciphers (L4) 2. Explain the principles of public key cryptography (L2) 3. Select the appropriate cryptographic algorithm based on the requirements and applications.(L5)		
MODULE – 3		**12H**
Message Authentication Algorithms and Hash Functions: Authentication requirements, Functions, Message authentication codes, Hash Functions, Secure hash algorithm, Whirlpool, HMAC, CMAC, Digital signatures, knapsack algorithm. LEARNING OUTCOMES: At the end of this Module students will be able: 1. Summarize authentication techniques (L2) 2. Apply Hash algorithm for generating Digital signatures (L3)		
MODULE – 4		**9H**
E-Mail Security: Pretty Good Privacy, S/MIME IP Security: IP Security overview, IP Security architecture, Authentication Header, encapsulating security payload, security associations, key-management.		

LEARNING OUTCOMES:

At the end of this Module students will be able:

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

MODULE – 5		**10H**

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

LEARNING OUTCOMES:

At the end of this Module students will be able:

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

	Total hours:	**48 hours**

Text Book(s):

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

Reference Book(s):

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

NARAYANA ENGINEERING COLLEGE::NELLORE								
20CS2014	DATA SCIENCE							R20
IV BETCH	Hours / Week			Total hrs	Credits	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
SEMESTER-I	3	0	0	48	3	40	60	100

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

Course Objectives:

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

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

CO1	Understand the different types of data sources
CO2	Explain preprocessing model and demonstrate the working on every datatype
CO3	Apply different Exploratory Data Analysis techniques.
CO4	Apply different similarity measures, distance measures to find similarity or distances between data.
CO5	Demonstrate the handling of very large data using Map Reduce.

CO-PO Mapping

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

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

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

Text Book(s):

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

Reference Book(s):

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

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

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

NARAYANA ENGINEERING COLLEGE::GUDUR								
20CS2015	MACHINE LEARNING							R20
IV BETCH	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
SEMESTER-I	2	0	0	48	2	40	60	100

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

Course Objectives :

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

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

CO 1	Analyze the fundamental concepts of machine learning, concept learning, hypothesis space, version spaces, and candidate elimination. (BL-4)
CO 2	Apply supervised classification techniques such as Decision Trees, KNN, Naïve Bayes, SVM, and ensemble methods to solve classification problems.(BL-3)
CO 3	Apply artificial neural networks and regression techniques to develop and evaluate machine learning models.(BL-3)
CO 4	Apply clustering algorithms such as K-Means, hierarchical, and density-based methods to analyze unlabeled data.(BL-3)
CO 5	Apply instance-based and reinforcement learning techniques, including KNN and Q-learning, to solve learning and decision-making problems.(BL-3)

CO-PO Mapping

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

1: Low, 2-Medium, 3- High

CONTENTS		
MODULE – 1		**8H**
Introduction: Learning – Types of Machine Learning – Supervised Learning, Relationship between ML and human learning, Example applications of ML-Designing a Learning system, Perspective and Issues in Machine Learning. Concept Learning Task – Concept Learning as Search – Finding a Maximally Specific Hypothesis – Version Spaces and the Candidate Elimination Algorithm.		
At the end of this Module students will be able: 1. Understand basic concepts of machine learning(L1) 2. Compare machine learning and human learning(L2) 3. Analyze machine learning techniques(L4)		
MODULE – 2		**9H**
Classification: Supervised Learning-The problem of classification-Training and testing classifier models-Decision Tree-Naive Bayes classification-Bayesian networks--Ensemble Learning-Support Vector Machines-Cross-validation-Model evaluation (precision, recall, F1-mesure, accuracy)-Applications of classifications.		
At the end of this Module students will be able: 1. Differentiate supervised and unsupervised learning methods (L4). 2. Solve classification problem using k-nearest neighbour classifier (L3). 3. Apply Naïve Bayes classifier to solve decision making problem (L3).		
MODULE – 3		**11H**
Artificial Neural Networks: Introduction, Neural Network representation, Appropriate problems, Perceptrons, Multilayer networks and Back propagation algorithm. **Unsupervised Learning** – K means Algorithm-Hierarchical and density based Clustering- Applications of Clustering.		
At the end of this Module students will be able: 1. Determine Clusters in data using k-means and Hierarchical Clustering methods (L5). 2. Remember applications of clustering techniques		
MODULE – 4		**9H**
Regression: Linear Regression-Multi-variable regression-Model evaluation-Least squares regression-Logistic regression -Gradient Descent Algorithm-Applications of regression.		
At the end of this Module students will be able: 1. Describe gradient descent approach, maximum likelihood estimation and method of least squares (L1). 2. Apply SVM to determine a hyper plane with maximum margin (L3). 3. Determine decision tree for given data (L5).		
MODULE – 5		**11H**
Instance Based Learning: Introduction, k-nearest neighbour learning, locally weighted regression, radial basis function, cased-based reasoning. **Reinforcement Learning:** Introduction, Learning Task, Q Learning, Non deterministic rewardsand actions, Temporal difference learning, Generalizing from examples, relationship to dynamicprogramming.		

At the end of this Module students will be able:
Understand instant based learning techniques(L2)
Understand reinforcement learning techniques(L2)

Total hours:	**48 hours**

Content beyond syllabus:

- Bayesian Learning:
- Computational learning theory

Text Book(s):

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

Reference Book(s):

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

NARAYANA ENGINEERING COLLEGE::NELLORE								
20EE3008	RENEWABLE ENERGY SOURCES							R20
IV BETCH	Hours / Week			Total hrs	Credits	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
SEMESTER-I	2	0	2	48	3	40	60	100

Course Objectives:

1. To create awareness about various Electric Energy Conversion Systems.
2. Learn the fundamental concepts about solar energy conversion systems and wind energy conversion systems.
3. To learn Thermal and Bio-energy conversion systems
4. To Understand the various technologies that are used in OECS
5. To Understand the Fuel cell technology

Course Outcomes: After successful completion of the course, the student will be able to:	
CO1	Understand various Electric Energy Conversion Systems(BTL-2)
CO2	Analyze the solar thermal conversion system(Also for high temperature applications) (BTL-4)
CO3	Analyze the Photo voltaic &Bio-Energy Conversion Systems (BTL-4)
CO4	Illustrate the existing Wind Energy Conversion System(BTL-2)
CO5	Extend the knowledge about working principle of various Fuel cell technology (BTL-2)

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

COURSE CONTENT		
MODULE – 1	**ENERGY CONSERVATION**	**10H**
Over view of conventional & renewable energy sources, need & development of renewable energy sources, types of renewable energy systems, Energy scenario — global and national; Renewable energy potential, Energy for sustainable development, Global climate change, concept of Hybrid systems.		
At the end of the Module 1, students will be able to: 1. Understand various renewable energy systems in present scenario. 2. Understand renewable energy potential and sustainable of renewable energy.		
MODULE – 2	**SOLAR & WIND ENERGY SOURCES**	**10H**
SOLAR ENERGY SOURCE: solar radiation, Measurements of Solar Radiation, Collectors, working principle of photo voltaic cell, Equivalent Circuit model, Performance Characteristics, Applications. **WIND ENERGY SOURCE:** Introduction, site selection considerations for installing wind mill, Construction details of the wind mill (Wind Turbine Gear System), Types of Wind Power Plants.		
At the end of the Module 2, students will be able to: 1. Describe the existing Solar Energy Conversion System 2. Understand characteristics of different solar concentrators 3. Describe the existing Wind Energy Conversion System 4. Understand characteristics of different types of wind power plants		
MODULE – 3	**THERMAL ENERGY & BIO-MASS**	**10H**
THERMAL ENERGY: Thermo-electric generator, Concepts and design considerations of MHD generators, Cycle analysis of MHD systems **BIO-MASS**: Biomass resources and their classification, Principles of Bio-Conversion, Anaerobic/aerobic digestion, types of Bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking.		
At the end of the Module 3, students will be able to: 1. Understand the various cycle operations in MHD systems 2. Understand the Bio-Energy Conversion Systems		
MODULE – 4	**GEOTHERMAL ENERGY & OCEAN ENERGY**	**9H**
GEOTHERMAL ENERGY: Principle of geothermal energy, Resources, types of wells, methods of harnessing the energy, Economic Aspects, scope in India. **OCEAN ENERGY**: Ocean Thermal Energy Conversion (OTEC), Principle of operation, development of OTEC plants, Tidal and wave energy.		
At the end of the Module 4, students will be able to: 1. Describe the existing Geothermal Energy Conversion System. 2. Understand the Ocean Energy Conversion System.		
MODULE – 5	**FUEL CELL ENERGY**	**9H**
Description, properties and operation of fuel cells, Major components & general characteristics of fuel cells, Indirect methanol fuel cell systems. Phosphoric acid fuel cell systems and molten		

carbonate fuel cell systems, applications	
At the end of the Module 5, students will be able to: 1. Understand the Fuel cell technology 2. Understand the Fuel cell modelling and system integration	
Total hours:	**48 hours**

Term work:

Report Submission on

1. Solar Energy Maximum Power Point Tracking (MPPT) based on VI characteristics.
2. Energy efficient based comparison between Vertical and Horizontal axis wind turbines.
3. Applications of Bio-mass plants in INDIA.
4. New technologies in heat extraction of Geo-Thermal energy system.
4. Explain the principle of operation of Ocean Thermal Energy Conversion.

Content beyond syllabus:

Advance energy conversion process

Self-Study:

Contents to promote self-Learning:

SNO	Topic	CO	Reference
1	Electric Energy Conversion Systems	CO1	https://www.britannica.com/technology/energy-conversio
2	solar energy conversion systems	CO2	https://www.appropedia.org/Solar_energy_conversion_systsem https://www.sciencedirect.com/topics/engineering/thermal-solar-energy-system-technology
3	Thermal and Bio-energy conversion systems	CO3	http://www.fao.org/3/T1804E/t1804e06.htm
4	Wind Energy Conversion Systems	CO4	https://www.appropedia.org/Wind_energy_conversion_system
5	Fuel cell technology	CO5	https://www.hydrogenics.com/technology-resources/hydrogen-technology/fuel-cells/

Text Book(s):

1. Non conventional Energy sources, G.D. Rai, Khanna Publishers.
2. Renewable energy resources: Tiwari and ghosal, Narosa publication.
3. Renewable energy sources and conversion technology, Bansal Keemann, Meliss, Tata Mc Graw Hill
4. D.P.Kothari,Rakesh Ranjan and K.C.Singal,Renewable Energy Resources & Emerging Tech prenticeHall of India Pvt.Ltd
5. Non conventional energy resources "Prentice Hall Inc,India by Sawhney G.S

Reference Book(s):

1. Renewable Energy Sources: Twidell & Weir, CRC Press.
2. Solar Energy/ S.P. Sukhatme, Tata McGraw-Hill.
3. Non Conventional Energy Systems: K M. Mittal, A H WheelerPublishing Co Ltd.
4. Renewable Energy Technologies: Ramesh & Kumar, Narosa publication. 5. Biomass Energy, Oxford& IBH Publication Co.

Online Resources:

1. https://archive.org/details/energyconversion00chan
2. https://www.trine.edu/books/documents/de_text1.0.0.pdf

Web Resources:

1. https://www.youtube.com/watch?v=mpHZWYpKDJg
2. https://www.youtube.com/watch?v=GExTwRNkQBg

NARAYANA ENGINEERING COLLEGE:GUDUR								
20CS4029	**ETHICAL HACKING**							
IV BETCH	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
SEMESTER-I	3	0	0	48	3	-	100	100

Pre-requisites: Computer Network, Basic Linux Command

Course Objectives: Ethical hacking is a subject that has become very important in present-day context, and can help individuals and organizations to adopt safe practices and usage of their IT infrastructure. Starting from the basic topics like networking, network security and cryptography, the course will cover various attacks and vulnerabilities and ways to secure them. There will be hands-on demonstrations that will be helpful to the participants. The participants are encouraged to try and replicate the demonstration experiments that will be discussed as part of the course.

Course Outcomes: After successful completion of the course, the student will be able to:	
CO1	Explain hacker frameworks, information security models, security architecture, risk analysis, and ethical hacking principles. (BL-2)
CO2	Analyze business objectives, security policies, attack planning, limitations, attack types, and engagement structures in security assessments. (BL-4)
CO3	Apply technical, social engineering, physical, and Internet reconnaissance techniques in security assessments. (BL-3)
CO4	Apply enumeration techniques to identify operating systems, networks, services, applications, and areas of concern. (BL-3)
CO5	Develop security assessment deliverables by integrating findings, documenting results, and preparing mitigation and defense plans. (BL-6)

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

COURSE CONTENT		
MODULE – 1		**9H**
Introduction to ethical hacking. Fundamentals of computer networking. TCP/IP protocol atacks. IP addressing and routing. TCP and UDP. IP subnets. Routing protocols. IP version 6.		
MODULE – 2		**10H**
Installation of attacker and victim system. Information gathering using advanced google search, archive.org, netcraft, whois, host, dig, dnsenum and NMAP tool. Vulnerability scanning using NMAP and Nessus. Creating a secure hacking environment. System Hacking: password cracking, privilege escalation, application execution. Malware and Virus. ARP spoofing and MAC attack.		
MODULE – 3		**10H**
Introduction to cryptography, private-key encryption, public-key encryption. Cryptographic hash functions, digital signature and certificate, applications. Steganography, biometric authentication, network-based attacks, DNS and Email security.		
MODULE – 4		**9H**
Packet sniffing using wireshark and burpsuite, password attack using burp suite. Social engineering attacks and Denial of service attacks. Elements of hardware security: side-channel attacks, physical inclinable functions, Hardware trojans.		
MODULE – 5		**10H**
Different types of attacks using Metasploit framework: password cracking, privilege escalation, remote code execution,etc.Attack on web servers: password attack, SQL injection, cross site scripting. Case studies: various attacks scenarios and their remedies.		
	Total Hours	**48 Hours**

Text Books:

1. Certified Ethical Hacker Michael Gregg, Pearson IT Certification .
2. Hacking the Hacker, Roger Grimes, Wiley.

NARAYANA ENGINEERING COLLEGE:GUDUR								
20CS4030	**CYBER SECURITY AND PRIVACY**							
IV BETCH	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
SEMESTER-I	3	0	0	48	3	40	60	100

Course Outcomes: After successful completion of the course, the student will be able to:	
CO1	Explain the fundamental concepts of cyber security, privacy and common security principles.(BL-2)
CO2	Analyze cyber threats, vulnerabilities, attacks and associated security risks.(BL-4)
CO3	Apply cryptographic techniques, authentication and access-control mechanisms to protect information.(BL-3)
CO4	Evaluate security controls, privacy requirements and incident-response approaches.(BL-5)
CO5	Design a secure solution incorporating appropriate security and privacy measures.(BL-6)

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

COURSE CONTENT		
MODULE – 1		**9H**
Introduction - Introduction to cyber security, Confidentiality, integrity, and availability. Foundations - Fundamental concepts, CIA, CIA triangle, data breach at target.		
MODULE – 2		**10H**
Security management, Governance, risk, and compliance (GRC)- GRC framework, security standards. Contingency planning - Incidence response, Disaster Recovery, BCP.		
MODULE – 3		**10H**
Cyber security policy - ESSP, ISSP, SYSSP. Risk Management - Cyber Risk Identification, Assessment, and Control. Cyber security: Industry perspective - Defense Technologies, Attack, Exploits.		
MODULE – 4		**9H**
Cyber security technologies - Access control, Encryption, Standards. Foundations of privacy - Information privacy, Measurement, Theories. Privacy regulation - Privacy, Anonymity, Regulation, Data Breach.		
MODULE – 5		**10H**
Privacy regulation in Europe, Privacy: The Indian Way - Data Protection, GDPR, DPDP, Aadhar. Information privacy: Economics and strategy, Economic value of privacy, privacy valuation, WTA and WTC, Business strategy and privacy, espionage, Privacy vs safety.		
	Total Hours	**48 Hours**

TEXT BOOKS

1. Charles P. Pfleeger, Shari Lawrence Pfleeger and Jonathan Margulies, Security in Computing, 5th Edition, Pearson Education.
2. William Stallings, Cryptography and Network Security: Principles and Practice, 7th Edition, Pearson Education.

REFERENCE BOOKS

1. Nina Godbole and Sunit Belapure, Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley India.
2. Atul Kahate, Cryptography and Network Security, 3rd Edition, McGraw Hill Education.
3. Bernard Marr, Data Strategy: How to Profit from a World of Big Data, Analytics and the Internet of Things, Kogan Page.

NARAYANA ENGINEERING COLLEGE::NELLORE								
20CS2511	**DATA SCIENCE LAB**							R20
IV BETCH	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
SEMESTER-I	0	0	3	36	1.5	40	60	100

Pre-requisite: Any Programming Language

Course Objectives:

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

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

CO 1	Apply Python/data science programming techniques to acquire, clean, preprocess and visualize datasets.(BL-3)
CO 2	Implement suitable data science and machine learning algorithms to solve practical problems.(BL-3)
CO 3	Evaluate data science models using appropriate performance measures and interpret the results.(BL-5)

CO-PO Mapping

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

1: Low, 2-Medium, 3- High

List of Tasks	
TASK – 1	
(a)Python installation for WINDOWS (b)Installation of Jupyter Notebook	
TASK – 2	
a) Write a Numpy program to add a border filled with 0's around the existing array. b) Write a Numpy program to get the unique elements of an array. c) Write a Numpy program to get the values and indices of the elements that are bigger than10 in a given array.	
TASK – 3	
(a) Write a pandas program to create and display a data Frame from a specified dictionary data which has the index labels. (b) Write a pandas program to select the rows where the score is missing, i.e. is NaN.	
TASK – 4	
(a)Write a Python program to draw a scatter plot with empty circles taking a random distribution in X and Y and plotted against each other. (b) Write a Python program to create a pie chart with a title of the popularity of programming languages.	
TASK – 5	
(a) Install Plotly (b) Create Line Chart, Bar Chart, Pie Charts using Plotly. (c) Create Box Plots, Violin Plots, Heatmaps using Plotly	
TASK - 6	
Develop the model Simple Linear regression with Python.	
TASK – 7	
Develop the model Multiple Linear regression with Python.	
TASK – 8	
Write a program to implement Logistic Regression.	
TASK – 9	
Write a program to implement the Decision Tree Regression model	
TASK – 10	
Write a program to implement the Random Forest Classification model.	
TASK – 11	
Write a program to implement the K-Nearest Neighbor algorithm to classify the given dataset.	
TASK – 12	
Write a program to implement the Support Vector Machine algorithm.	
Additional Tasks	

1. Write a program to implement the Naïve Bayesian classifier for a simple training data set stored as a .CSV file. 2. Write a program to implement the k-Means clustering algorithm to cluster the set of data stored in .CSV file.	
Total hours:	**36 hours**

Text Book(s):

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

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

Reference Book(s):

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

NARAYANA ENGINEERING COLLEGE::GUDUR								
20CS2512	MACHINE LEARNING LAB							R20
IV BETCH	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
SEMESTER-I	0	0	2	36	1	40	60	100

Pre-requisite: Basic knowledge in DBMS and preliminary fundamentals of data mining algorithms	
Course Objectives: To study various machine learning models for building applications.	
Course Outcomes: After successful completion of the course, the student will be able to:	
CO 1	Apply Python libraries and data preprocessing techniques for preparing and analyzing datasets for machine learning. (BL-3)
CO 2	Implement supervised and unsupervised machine learning algorithms such as FIND-S, Candidate-Elimination, Regression, K-Means, ID3, ANN, and Naïve Bayes. (BL-3)
CO 3	Develop and evaluate machine learning models for classification and medical diagnosis using appropriate performance measures and datasets. (BL-6)

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

List of Experiments	
TASK – 1	
Introduction to Python and Python Libraries- NumPy, Pandas, Matplotlib, Scikit.	
TASK – 2	
Perform Data exploration and pre-processing in Python.	
TASK – 3	
Perform Feature Engineering and Feature Selection Methods.	
TASK – 4	
Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.	
TASK – 5	
Implementation of Linear and Logistic Regression	
TASK – 6 **TASK-6 DATA MODELLING**	
Implementation of K means algorithm.	
TASK – 7	
For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.	
TASK – 8	
Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample	
TASK – 9	
Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.	
TASK – 10	
Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.	
TASK – 11	
Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.	
TASK – 12	
Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.	
Total hours:	**36 hours**

TEXTBOOK:

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

REFERENCES:

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

NARAYANA ENGINEERING COLLEGE:GUDUR								
20CD6005	**CAREER COMPETENCY DEVELOPMENT V (CSE,ECE,EEE)**							**R20**
II-B.Tech	**Hours / Week**			**Total hrs**	**Credit**	**Max Marks**		
	L	**T**	**P**		**C**	**CIE**	**SEE**	**TOTAL**
I-Semester	0	0	2	36	1	40	60	100

Course Objectives:

To enhance employability skills and to develop career competency

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

CO 1	Applying Advanced Quantitative Problem Solving. (BL-3)
CO 2	Analyzing Critical Verbal & Analytical Reasoning. (BL-4)
CO 3	Creating Resume Architecture & Personal Branding. (BL-6)
CO 4	Evaluating Professional Communication & Interview Dynamics. (BL-5)
CO 5	Applying Workplace Adaptation & Professionalism. (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		1	2	3
CO2	3	2	3						1			1		
CO3			3						2	2		2	1	
CO4	3		3						2			2		3
CO5	3		3			2			3	2	1	2	3	3

1: Low, 2-Medium, 3- High

COURSE CONTENT		
MODULE – 1	**APTITUDE-V**	**6H**
Logarithms, Quadratic equations, surds and power indices, game based aptitude, symbol based boxes		
MODULE -2	**REASONING-V**	**6H**
Logical games, logical problems, machine input, number puzzles, clock puzzles , water images , mirror images		
MODULE-3	**VERBAL-V**	**6H**
Types of sentences ,kinds of conjunctions ,Exemplify Voice in interrogative sentence, Degrees of Comparison (Adjective formation in sentence), Prepositions-with, over ,by ,infinitives, Auxiliary Verbs (Can/Cloud/May/Might/must)		
MODULE-4	**OBJECT ORIENTED PROGRAMMING USING PYTHON**	**9H**
Classes and Objects, **Constructors**, **Inheritance, Polymorphism**, **Abstraction, Exceptions** Task 1: __init__Constructor Task 2: multiple inheritance Task 3: Polymorphic Methods Task 4: Custom Exceptions		
MODULE-5	**DATA STRUCTURES**	**9H**
Trees, Heap and Hashing Task1: Check for Balanced Binary Tree Task 2: Shortest Path in an Unweighted Graph Task 3: Activity Selection Problem Task 4: Count Distinct Elements in Every Window		
	Total Hours	**36 Hours**

EVALUATION:

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

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

Text / Reference Books:

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

OPEN ELECTIVES (OE) R20 REGULATIONS

OPEN ELECTIVES(OE)

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

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

Course Objectives:

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

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

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

CO-PO Mapping

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

1: Low, 2-Medium, 3- High

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

Sorting: Introduction, Bubble Sort, Selection Sort, Quick Sort.Searching: Introduction, Basic Terminology, Linear Search and Binary Search Techniques. Hash Table:Hashing Techniques, Collision Resolution Techniques, Closed Hashing, Open Hashing.	
At the end of the Module 6, students will be able to: 1. Implement the sorting algorithms (BL - 3) 2. Select the appropriate sorting algorithm for a given application (BL - 3) 3. Understand the concept of Hash Table (BL - 2) 4. Explain searching techniques. (BL - 2)	
Total hours:	**48 hours**

Content beyond syllabus:

1. Heap Sort, Insertion Sort, Merge Sort
2. Optimum Sorting Algorithms

Text Book(s):

1. D. 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. NarasimhaKarumanchi, 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.
4. YashwantKanetkar, Data Structures through C,3rd Edition, BPB Publications, 2019.
5. RB Patel, Expert Data Structures with C, Khanna Publications, 2019.
6. Richard F. Gilberg, Behrouz A. Forouzan, Data Structures A Pseudo code Approach with C, Second Edition, Cengage Learning.
7. Ananda Rao Akepogu, Radhika Raju Palagiri,Data Structures and Alg. Using C++ ,

NARAYANA ENGINEERING COLLEGE:GUDUR								
20CS3002	**Introduction to Python**							R20
	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
	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: 4. Write programs for manipulating the strings. (BL - 1) 5. Understand the knowledge of data structures like Tuples, Lists, and Dictionaries.(BL - 2) 6. Select appropriate data structure of Python for solving a problem.(BL -3)		
MODULE-4	**Files, Modules and Packages**	**10 H**
Files- Persistent, Text Files, Reading and Writing Files, Format Operator, Filename and Paths, Command Line Arguments, File methods, Modules- Creating Modules, Import Statement, Form. Import Statement, name spacing, Packages- Introduction to PIP, Installing Packages via PIP(Numpy).		
At the end of the Module 4, students will be able to: 4. Understand the concepts of files. (BL - 2) 5. Implement the modules and packages. (BL - 3) 6. Organize data in the form of files. (BL - 3)		
MODULE-5	**Object Oriented Programming, Errors and Exceptions**	**9 H**

Object Oriented Features, Classes, self variable, Methods, Constructors, Destructors, Inheritance, Overriding Methods, Data hiding, Polymorphism. Difference between an error and Exception, Handling Exception, try except block, Raising Exceptions.
At the end of the Module 5, students will be able to: 4. Apply object orientation concepts.(BL -3) 5. Apply the exception handling concepts. (BL -3) 6. Implement OOPs using Python for solving real-world problems. (BL -3)
Total hours: 48 Hours

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

Text Book(s):

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

Reference Books :

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

NARAYANA ENGINEERING COLLEGE::GUDUR								
20CS3003	**JAVA PROGRAMMING**							R20
	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:

1. To acquire knowledge on preliminaries of Java.
2. To provide sufficient knowledge on developing real world projects.
3. To demonstrate the principles of packages, inheritance, and interfaces.
4. To understand exception handling, Event handling and Multithreading.
5. 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: 1. Describe the Purpose of Object oriented Programming Concepts.(BL-2) 2. Understand the importance of java. (BL-2) 3. Identify various basic components of java. (BL-2) 4. 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: 1. Understand Arrays and accessing array values. (BL-2) 2. Demonstrate1-D and Multi-dimensional arrays. (BL-2) 3. 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: 1. Understand the basic syntax for class fundamentals. (BL-2) 2. Demonstrate Access modifiers in Inheritance. (BL-2) 3. Compare "Method overloading and Method overriding". (BL-3)		
MODULE-4	**Packages and Exception Handling**	**10H**
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: 1. Demonstrate interface and its implementation. (BL-2) 2. Develop user defined packages. (BL-3) 3. Implement Exception Handling. (BL-3)		
MODULE-5	**Multi-Threaded**	**10H**

	Programming and I/O	
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 hours**

Content beyond syllabus:

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

Self-Study:

Contents to promote self-Learning:

Text Book(s):

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

Reference Book(s):

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

NARAYANA ENGINEERING COLLEGE:GUDUR								
20CS3004	ADVANCED JAVA PROGRAMMING							R20
	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 core concepts of java programming.

Course Objectives:

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

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

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

CO-PO Mapping

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

1: Low, 2-Medium, 3- High

COURSE CONTENT		
MODULE – 1	**Introduction to J2EE and Networking**	**10H**
Java Enterprise Edition: Java Platform, J2EE Architecture Types, Explore Java EE Containers, Types of Servers in J2EE Application, HTTP Protocols and API, Request Processing in Web Application, Web Application Structure, Web Containers and Web Architecture Models.		
Java Networking: Network Basics and Socket overview, TCP/IP client sockets, URL,TCP/IP server sockets, Datagrams, java.net package Socket, ServerSocket, InetAddress, URL, URLConnection**.**		
At the end of the Module 1, students will be able to: 8. Understand J2EE Architecture Types, containers and servers. (BL 2) 9. Gain knowledge on HTTP Protocols and APIs. (BL 2) 10. Discuss web applications and models. (BL 2) 11. Explain TCP/IP client server sockets programming. (BL 2)		
MODULE -2	**JDBC Programming**	**9H**
The JDBC Connectivity Model, Database Programming :Connecting to the Database, Creating a SQL Query, Getting the Results, Updating Database Data, Error Checking and the SQL Exception Class, The SQL Warning Class, The Statement Interface, PreparedStatement, CallableStatement The ResultSet Interface, Updatable Result Sets, JDBC Types, Executing SQL Queries, Result Set Meta Data, Executing SQL Updates, Transaction Management.		
At the end of the Module 2, students will be able to: 1. Prepare The JDBC Connectivity Model. (BL 3) 2. Practice on PreparedStatement, Callable Statement and ResultSet Interface. (BL 3) 3. Explain JDBC Types. (BL 2) 4. Implement SQL Queries &Transaction Management. (BL 2)		
MODULE-3	**Servlet API and Overview**	**10H**
Overview of Servlet, Servlet Life Cycle, HTTP Methods Structure and Deployment descriptor Servlet Context and Servlet Config interface, Attributes in Servelt Request Dispache rinterface, The Filter API: Filter, Filter Chain. Using the Generic Servlet Class**.** Understanding state and session, Understanding Session Timeout and Session Tracking, URL Rewriting.		
At the end of the Module 3, students will be able to: 1. Understand Servlet Life Cycle. (BL 2) 2. Differentiate ServletContext and ServletConfig interface. (BL 2) 3. Understand Config Cookies and Session Management. (BL 2) 4. Differentiate the GenericServlet and HTTP Servlet Class. (BL 2)		
MODULE-4	**Java Server Pages**	**9H**

The Problem with Servlets, Life Cycle of JSP Page, JSP Processing, JSP Application Design with MVC, Setting Up the JSP Environment JSP Directives, JSP Action, JSP Implicit Objects JSP Form Processing, JSP Session and Cookies Handling.JSP Session Tracking JSP Database Access, JSP Standard Tag Libraries, JSP Custom Tag, JSP Expression Language, JSP Exception Handling, JSP XML Processing.		
At the end of the Module 4, students will be able to: 1. Understand Life Cycle of JSP Page. (BL 2) 2. Explain MVC architecture and JSP Environment. (BL 2) 3. Construct JSP with DATABASES and exception handling. (BL 3)		
4. Understand the role of XML in JSP. (BL 2)		
MODULE-5	**Struts and Spring Frame Work**	**10H**
Basics & Architecture – Request Handling Life Cycle - Building a simple struts– Configuration, Actions, Interceptors, Results, Struts2 Tag Libraries, Struts2 XML Based Validations - Database Access. Overview of Spring, Spring Architecture, bean life cycle, XML Configuration on Spring, Aspect – oriented Spring, Managing Database, Managing Transaction.		
At the end of the Module 5, students will be able to: 13. Explain struts frame work. (BL 2) 14. Implement the Struts Framework. (BL 3) 15. Understand Spring Architecture(BL-2) 16. Implementation of spring to build web applications(BL-3).		
	Total hours:	**48 hours**

Content beyond syllabus: java mobile application development.

Text Book(s):

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

Reference Book(s):

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

NARAYANA ENGINEERING COLLEGE::GUDUR								
20CS3005	**PRINCIPLES OF DATABASES**							R20
	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:

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 indexing.

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

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

CO-PO Mapping

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

1: Low, 2-Medium, 3- High

COURSE CONTENT		
MODULE - 1	**Introduction to Database concepts and Modeling**	**10 H**
Introduction to Data bases, Purpose of Database Systems, View of Data, Data Models, Database Languages, Database Users, Database Systems architecture. Overview of Database Design, Beyond ER Design, Entities, Attributes and Entity sets, Relationships and Relationship sets, Conceptual Design with the ER Model.		
At the end of the Module 1, students will be able to: 12. Understand the Purpose of Database Systems, Data Models, View of Data. (BL-2)		
13. Summarize the concept of Database Languages, Users, Architecture. (BL-2) 14. Design ER diagrams for given database. (BL-2) 15. Explain conceptual design for enterprise systems (BL-2)		
MODULE - 2	**Relational Model, Relational Algebra**	**9 H**
Introduction to the Relational Model – Integrity Constraints over Relations, Enforcing Integrity constraints, querying relational data, Logical data base Design, Views. Introduction to Relational algebra, selection and projection, set operations, renaming, joins, division.		
At the end of the Module 2, students will be able to: 10. Understand Basics of Relational Model. (BL-2) 11. Describe phases of Logical Database Design.(BL-2) 12. Explain the relational algebra operations on relations. (BL-2)		
MODULE - 3	**SQL**	**10 H**
SQL: Basic form of SQL Query, DDL, DML, Views in SQL, Joins, Nested & Correlated queries, Operators, Aggregate Functions, integrity Constraints.		
At the end of the Module 3, students will be able to: 8. Construct SQL queries in RDBMS. (BL-3) 9. Understand integrity and security Constraints in SQL (BL-2) 10. Construct PL/SQL programs in RDBMS. (BL-3)		
MODULE - 4	**Normalization**	**10 H**
Relational database design: Pitfalls of RDBD, Lossless join decomposition, Functional dependencies, Normalization for relational databases 1st, 2nd and 3rd normal forms.		
At the end of the Module 4, students will be able to: 4. Analyze functional dependencies. (BL-3) 5. Apply normal forms on functional dependencies. (BL-3) 6. Understand Multi Valued Dependencies and Join Dependencies (BL-2)		
MODULE - 5	**Transaction Management**	**9 H**
Transaction processing, Transaction Concept, Transaction State, Implementation of Atomicity and Durability, Concurrent Executions, Failure Classification, Recovery and Atomicity.Introduction to Index data structures, Hash-Based, Tree Based Indexing		

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

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

Total hours:	**48 Hours**

Content beyond syllabus:

Embedded SQL

Client/Server Database environment

Web Database environment

Text Book(s):

3. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, Database System Concepts, 6th Edition, Tata McGraw-Hill Publishing Company,2017.

4. Raghu Ramakrishnan, Database Management System, 3rd Edition, Tata McGraw-Hill Publishing Company, 2014.

Reference Book(s):

7. Peter Rob, A.Ananda Rao, Corlos Coronel, Database Management Systems (for JNTU), Cengage Learning, 2011.

8. Hector Garcia Molina, Jeffrey D. Ullman, Jennifer Widom, Database System Implementation, 1st Edition, Pearson Education, United States, 2000.

9. E. Ramez and Navathe, Fundamental of Database Systems, 7th Edition, Pearson Education

10. R.P. Mahapatra & Govind Verma, Database Management Systems, Khanna Publishing House, 2016.

11. 5Carlos Coronel and Steven Morris, Database Systems: Design, Implementation, and Management, 12th edition, Cengage Learning,2016.

12. John V. ,Absolute beginner's guide to databases, Petersen, QUE

NARAYANA ENGINEERING COLLEGE:GUDUR								
20CS3006	**OPERATING SYSTEMS CONCEPTS**							R20
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
IV	3	0	0	48	3	40	60	100

Pre-requisite: Fundamentals of computers

Course Objectives:

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

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

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

CO-PO Mapping

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

1: Low, 2-Medium, 3- High

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

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

Content beyond syllabus:

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

Text Book(s):

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

Reference Book(s):

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

NARAYANA ENGINEERING COLLEGE::GUDUR								
20CS3007	COMPUTER COMMUNICATION NETWORKS							R20
	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, 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:

CO1	Choose suitable transmission media depending on requirements. (BL-2)
CO2	etermine the errors in data transfer between source and destination. (BL-3)
CO3	Obtain the skills of subnetting and routing mechanisms. (BL-2)
CO4	Illustrate reliable, unreliable communication on public networks. (BL-3)
CO5	Demonstrate elements of socket programming, principles of protocols.(BL-3)

CO-PO Mapping

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

1: Low, 2-Medium, 3- High

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

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

Content beyond syllabus:

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

Text Book(s):

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

Reference Book(s):

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

NARAYANA ENGINEERING COLLEGE:GUDUR								
20CS3008	MOBILE APPLICATION DEVELOPMENT							R2021
	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	Explain the Android software stack and development environment.(BL-2)
CO 2	Apply Android application components, widgets, layouts, controls, and event handling to develop user interfaces. (BL-3)
CO 3	Design Android applications using layouts, views, resources, multimedia components, and screen orientation features. (BL-6)
CO 4	Implement selection widgets, dialogs, and fragments to develop interactive Android applications. (BL-3)
CO 5	Develop Android applications using menus, Action Bars, and SQLite databases. (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	1	3	3								2	2
CO2	3	3	3	3	3								3	3
CO3	3	3	3	2	3								3	3
CO4	3	3	3	1	3								3	3
CO5	3	3	3	3	3								3	3

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

Pre-requisite: Knowledge of Information Technology

Course Objectives:

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

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

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

CO-PO Mapping

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

1: Low, 2-Medium, 3- High

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

Working with XML: Document type Definition (DTD), XML schemas, XSLT, Document object model, Parsers - DOM and SAX. News Feed (RSS and ATOM). Java Web Services: Web services Basics – Creating, Publishing, Testing and Describing a Web services (WSDL)-Consuming a web service, SOAP.	
At the end of the Module 5, students will be able to: 1. Understand the structure of Document type Definition (DTD), XML schemas. (BL-2) 2. Analyze parsing of XML document with DOM, SAX. (BL-3) 3. Demonstrate web service with SOAP, WSDL in Java web application development. (BL-2)	
Total hours:	**48 Hours**

Text Book(s):

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

Reference Book(s):

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

Virtual Lab:

List editors which can be used to create HTML documents.

Understand: Describe the Structure of HTML document.

Apply: Identity different Tags are given in HTML.

Analyze: Compare the various HTML Tags.

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

NARAYANA ENGINEERING COLLEGE::GUDUR								
20CS3010	APPLIED ARTIFICIAL INTELLIGENCE							R20
	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
	3	0	0	48	3	40	60	100

Pre-requisite:

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

Course Objectives:

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

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

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

CO-PO Mapping

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

1: Low, 2-Medium, 3- High

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

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

Content beyond syllabus:

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

Text Book(s):

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

Reference Book(s):

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

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

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

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

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

TEXTBOOK:

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

REFERENCES:

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

NARAYANA ENGINEERING COLLEGE::GUDUR								
20CS3012	CLOUD COMPUTING							R20
	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
	3	0	0	48	3	40	60	100

Course Outcomes: After successful completion of the course, student will be able to:	
CO 1	Explain the fundamentals, characteristics, models, and service concepts of cloud computing. (BL-2)
CO 2	Design and develop cloud applications using appropriate cloud architecture, service models, and deployment models. (BL-6)
CO 3	Explain and classify virtualization technologies, virtual machines, and cloud virtualization platforms. (BL-2)
CO 4	Apply CloudSim and Aneka programming models to simulate and develop cloud applications. (BL-3)
CO 5	Deploy SaaS applications using cloud platforms such as Google App Engine, Microsoft Azure, and AWS. (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			2								2	2
CO2	3	3	3	2	3								3	3
CO3	2	2	2		3								3	2
CO4	3	3	3	2	3								3	3
CO5	3	2	3	2	3								3	3
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		**9H**
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:	**48 hours**

NARAYANA ENGINEERING COLLEGE::GUDUR								
	INTRODUCTION TO MACHINE LEARNING							R20
Course Code	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
20CS3013	3	0	0	48	3	40	60	100

Course Outcomes: After successful completion of the course, student will be able to:	
CO 1	Explore regression methods in Machine learning
CO 2	Familiar with basic concepts in artificial neural network and its learning methods
CO 3	Understand various methods of Evaluation
CO 4	Understand propagation and Clusturing Algorithms
CO 5	Apply various techniques of Machine Learning Models

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	3	2	1	1										
CO2	1	3			1	2								
CO3	1	1	3	2	2									
CO4	1	3												
CO5	1	3	2	2										
1: Low, 2-Medium, 3- High														

COURSE CONTENT		
MODULE – 1	**REGRESSION ANALYSIS**	**9H**
Introduction: Learning methods, Statistical Decision Theory - Regression, Classification, Bias Variance, Linear Regression, Multivariate Regression, Statistical Techniques-Subset Selection, Shrinkage Methods, Partial Least squares, Linear Classification, Linear Discriminant Analysis, Numerical Problems.		
MODULE – 2	**NEURAL NETWORKS**	**10H**
Perceptron, Support Vector Machines, Neural Networks - Introduction, Early Models, Perceptron Learning, Backpropagation, Training & Validation, Parameter Estimation, Bayesian Estimation, Decision Trees, Regression Trees, Categorical Attributes, Multiway Splits, Missing Values, Decision Trees - Instability Evaluation Measures, Naive Bayes, k-Nearest Neighnours, Numerical Problems.		
MODULE – 3	**METHODS OF EVALUATION**	**10H**
ANN Architectures, Training/Tuning methods, Bootstrapping & Cross Validation, Class Evaluation Measures, ROC curve, MDL, Ensemble Methods - Bagging, Committee Machines and Stacking, Boosting, Random Forests, Multi-class Classification, Bayesian Networks, Numerical Problems.		
MODULE – 4	**PROPAGATION AND ALGORITHMS**	**10H**
Necessity of various skills of Machine Learning, Undirected Graphical Models, HMM, Variable Elimination, Belief Propagation, Hierarchical Clustering, Birch Algorithm, CURE Algorithm, Numerical Problems.		
MODULE – 5	**IMPLEMENTING MACHINE LEARNING**	**9H**
Language choice, Gaussian Mixture Models, Expectation Maximization, Learning Theory, Introduction to Reinforcement Learning, Numerical Problems.		
	Total hours:	**48 hours**

Textbook:

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

References:

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

PROFESSIONAL ELECTIVES
R20
REGULATIONS

PROFESSIONAL ELECTIVE-1

NARAYANA ENGINEERING COLLEGE::GUDUR								
	NETWORK PROTOCOLS AND PROGRAMMING							R20
Course Code	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
20CS4001	4	0	0	48	3	40	60	100

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

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

COURSE CONTENT		
MODULE – 1		**9H**
Introduction: Day Time Client/Server, Concurrent Client/Server, Error Handling, Protocol Independence, Port Numbers. **Sockets:** Address structures, value – result arguments, Byte ordering and manipulation function and related functions, Elementary TCP sockets – Socket, connect, bind, listen, accept, fork and exec function, concurrent servers, Close and related function.		
MODULE – 2		**10H**
TCP Client Server: Introduction, TCP Echo server functions, Normal startup, terminate and signal handling server process termination, Crashing and Rebooting of server host shutdown of server host.		
MODULE – 3		**10H**
I/O Multiplexing and socket options: I/O Models, Select function, Batch input, shutdown function, Poll function, TCP Echo server, getsockopt and setsockopt functions. Socket states, Generic socket option, IPV6 socket option, ICMPV6 socket option, IPV6 socket option and TCP socket options.		
MODULE – 4		**10H**
Elementary UDP sockets: Introduction UDP Echo server function, lost datagram, summary of UDP example, Lack of flow control with UDP, determining outgoing interface with UDP. **Elementary name and Address conversions:** Domain Name System, gethostbynamefunction, RES_USE_INET6 Resolver option, gethostbyname2 function and IPv6 support, gethostbyaddr function, name function, gethostname function, getservbyname andgetservbyport functions.		
MODULE – 5		**9H**
IPv4 and IPv6 interoperability: IPv4 client,IPv6 server, IPv6 client, IPv4 server. **Network Management and Debugging:** Troubleshooting a Network, ping, trace route, netstat, Packet Sniffers, Network Management Protocols, SNMP.		
	Total hours:	**48 hours**

TEXTBOOK:

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

REFERENCES:

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

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

Course Outcomes: After successful completion of the course, the student will be able to:	
CO 1	Explain conventional software management, the waterfall model, software management performance, software economics, and pragmatic software cost estimation. (BL-2)
CO 2	Apply modern software economics practices to reduce product size, improve software processes and team effectiveness, increase automation, achieve required quality, conduct peer inspections, and transition to iterative processes. (BL-3)
CO 3	Analyze software lifecycle phases, including inception, elaboration, construction and transition, and classify management, engineering and programmatic artifacts from management and technical perspectives. (BL-4)
CO 4	Apply software process workflows, milestones, status assessments, iterative process planning, work breakdown structures, cost and schedule estimation, project organization, responsibilities and process automation. (BL-3)
CO 5	Analyze software project control and process instrumentation using metrics, management and quality indicators, lifecycle expectations, metrics automation, process tailoring, and future software project management practices. (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	3	3	3	3	2
CO2	3	3	2						3	3	3	3	3	3
CO3	3	3	3						3	3	3	3	3	3
CO4	3	3	3						3	2	3	3	3	3
CO5	3	3	3						2	2	3	3	3	3
1: Low, 2-Medium, 3- High														

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

Textbook:

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

Reference

1. Robert K. Wysocki "Effective Software Project Management" Publication, 2011. Wiley
2. Walker Royce: "Software Project Management"- Addison-Wesley, 1998. Gopalaswamy Ramesh, "Managing Global Software Projects" - McGraw HillEducation (India), Fourteenth Reprint 2013.

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

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

CO-PO Mapping

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

1: Low, 2-Medium, 3- High

COURSE CONTENT		
MODULE – 1		**10H**
Basic Concepts – Data Warehousing Components – Building a Data Warehouse – Database Architecturesfor Parallel Processing – Parallel DBMS Vendors – Multidimensional Data Model Data Warehouse Schemas for Decision Support, Concept Hierarchies Characteristics of OLAP Systems – Typical OLAP Operations, OLAP and OLTP.		
MODULE – 2		**9H**
Introduction to Data Mining Systems – Knowledge Discovery Process – Data Mining Techniques – Issues – applications- Data Objects and attribute types, Statistical description of data, Data Preprocessing – Cleaning, Integration, Reduction, Transformation and discretization, Data Visualization, Data similarity and dissimilarity measures.		
MODULE – 3		**9H**
Mining Frequent Patterns, Associations and Correlations – Mining Methods- Pattern Evaluation Method – Pattern Mining in Multilevel, Multi Dimensional Space – Constraint Based Frequent Pattern Mining, Classification using Frequent Patterns.		
MODULE – 4		**10H**
Decision Tree Induction – Bayesian Classification – Rule Based Classification – Classification by Back Propagation – Support Vector Machines — Lazy Learners – Model Evaluation and Selection-Techniques to improve Classification Accuracy. Clustering Techniques – Cluster analysis-Partitioning Methods – Hierarchical Methods – Density Based Methods – Grid Based Methods – Evaluation of clustering – Clustering high dimensional data- Clustering with constraints, Outlier analysis-outlier detection methods.		
MODULE – 5		**10H**
Datasets – Introduction, Iris plants database, Breast cancer database, Auto imports database – Introduction to WEKA, The Explorer – Getting started, Exploring the explorer, Learning algorithms, Clustering algorithms, Association–rule learners.		
	Total hours:	**48hours**

Textbook:

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

References:

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

NARAYANA ENGINEERING COLLEGE::GUDUR								
	DISTRIBUTED SYSTEMS							R20
Course Code	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
20CS4004	3	0	0	48	3	40	60	100

Course Outcomes:

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

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

CO-PO Mapping

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

1: Low, 2-Medium, 3- High

COURSE CONTENT		
MODULE – 1	**INTRODUCTION**	**9H**
Characterization of Distributed Systems: Introduction, Examples of Distributed Systems, Resource Sharing and the Web, Challenges. **System Models:** Introduction, Architectural Models, Fundamental Models		
MODULE – 2	**Time and Global States & Coordination and Agreement**	**10H**
Time and Global States: Introduction, Clocks Events and Process States, Synchronizing Physical Clocks, Logical Time and Logical Clocks, Global States, Distributed Debugging. **Coordination and Agreement:** Introduction, Distributed Mutual Exclusion, Elections, Multicast Communication, Consensus and Related Problems...		
MODULE – 3	**Inter Process Communication**	**10H**
Inter Process Communication: Introduction, The API for the Internet Protocols, External Data Representation and Marshalling, Client-Server Communication, Group Communication, Case Study: IPC in UNIX. **Distributed Objects and Remote Invocation:** Introduction, Communication between Distributed Objects, Remote Procedure Call, Events and Notifications, Case Study: JAVA RMI.		
MODULE – 4	**Distributed File Systems**	**10H**
Distributed File Systems: Introduction, File Service Architecture, Case Study 1: Sun Network File System, Case Study 2: The Andrew File System. **Name Services:** Introduction, Name Services and the Domain Name System, Directory Services, Case Study of the Global Name Services. **Distributed Shared Memory:** Introduction, Design and Implementation Issues, Sequential Consistency and IVY case study, Release Consistency, Munin Case Study, Other Consistency Models.		
MODULE – 5	**Transactions and Concurrency Control**	**9H**
Transactions and Concurrency Control: Introduction, Transactions, Nested Transactions, Locks, Optimistic Concurrency Control, Timestamp Ordering, Comparison of Methods for Concurrency Control. **Distributed Transactions:** Introduction, Flat and Nested Distributed Transactions, Atomic Commit Protocols, Concurrency Control in Distributed Transactions, Distributed Deadlocks, Transaction Recovery		
	Total hours:	**48 hours**

Textbook:

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

References:

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

NARAYANA ENGINEERING COLLEGE::GUDUR								
	COMPILER DESIGN							R20
Course Code	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
20CS4005	3	0	0	48	3	40	60	100

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

CO-PO Mapping

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

1: Low, 2-Medium, 3- High

COURSE CONTENT		
MODULE – 1		**9H**
Introduction: The structure of a compiler, the science of building a compiler, programming language Basics **Lexical Analysis:** The Role of the Lexical Analyzer, Input Buffering, Recognition of Tokens, The Lexical-Analyzer Generator Lex, Finite Automata, From Regular Expressions to Automata, Design of Lexical-Analyzer Generator, Optimization of DFA-Based Pattern Matchers		
MODULE – 2		**10H**
Syntax Analysis: Introduction, Context-Free Grammars, Writing a Grammar, Top-Down Parsing Bottom-Up Parsing, Introduction to LR Parsing: Simple LR, More Powerful LR Parsers, Using Ambiguous Grammars and Parser Generators..		
MODULE – 3		**10H**
Syntax-Directed Translation: Syntax-Directed Definitions, Evaluation Orders for SDD's, Applications of Syntax-Directed Translation, Syntax-Directed Translation Schemes, and Implementing L-Attributed SDD's. **Intermediate-Code Generation:** Variants of Syntax Trees, Three-Address Code, Types and Declarations, Type Checking, Control Flow, Switch-Statements, Intermediate Code for Procedures.		
MODULE – 4		**10H**
Run-Time Environments: Stack Allocation of Space, Access to Nonlocal Data on the Stack, Heap Management, Introduction to Garbage Collection, Introduction to Trace-Based Collection. **Code Generation:** Issues in the Design of a Code Generator, The Target Language, Addresses in the Target Code, Basic Blocks and Flow Graphs, Optimization of Basic Blocks, A Simple Code Generator, Peephole Optimization, Register Allocation and Assignment, Dynamic Programming Code-Generation.		
MODULE – 5		**9H**
Machine-Independent Optimization: The Principal Sources of Optimization, Introduction to Data-Flow Analysis, Foundations of Data-Flow Analysis, Constant Propagation, Partial-Redundancy Elimination, Loops in Flow Graphs..		
	Total hours:	**48 hours**

Textbook:

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

References:

1. Compiler Construction, Louden, Thomson.

PROFESSIONAL ELECTIVE-II

NARAYANA ENGINEERING COLLEGE::GUDUR								
	SOFTWARE DEFINED NETWORKS							R20
Course Code	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
20CS4006	3	0	0	48	3	40	60	100

Course Outcomes: On successful completion of the course, student will be able to:	
CO 1	Describes History of Software Defined Networking
CO 2	Identifies various Drawbacks of Open SDN, SDN via APIs, SDN ,Various Partitioning Techniques.
CO 3	Defines SDN Solutions for the Data Center Network – VLANs – EVPN – VxLAN – NVGRE
CO 4	Describes various SDN PROGRAMMING
CO 5	Explains Data Centre Orchestration

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

COURSE CONTENT		
MODULE – 1	**INTRODUCTION**	**9H**
History of Software Defined Networking (SDN) – Modern Data Center – Traditional Switch Architecture – Why SDN – Evolution of SDN – How SDN Works – Centralized and Distributed Control and Date Planes		
MODULE – 2	**OPEN FLOW & SDN CONTROLLERS**	**9H**
Open Flow Specification – Drawbacks of Open SDN, SDN via APIs, SDN via Hypervisor-Based Overlays – SDN via Opening up the Device – SDN Controllers – General Concepts		
MODULE – 3	**DATA CENTERS**	**10H**
Multitenant and Virtualized Multitenant Data Center – SDN Solutions for the Data Center Network – VLANs – EVPN – VxLAN – NVGRE		
MODULE – 4	**SDN PROGRAMMING**	**10H**
Programming SDNs: Northbound Application Programming Interface, Current Languages and Tools, Composition of SDNs – Network Functions Virtualization (NFV) and Software Defined Networks: Concepts, Implementation and Applications		
MODULE – 5	**SDNFrameworks**	**10H**
Juniper SDN Framework – IETF SDN Framework – Open Daylight Controller – Floodlight Controller – Bandwidth Calendaring – Data Center Orchestration		
	Total hours:	**48 hours**

Textbook:

1. Paul Goransson and Chuck Black, ―Software Defined Networks: A Comprehensive Approach, First Edition, Morgan Kaufmann, 2014.
2. Thomas D. Nadeau, Ken Gray, ―SDN: Software Defined Networks, O'Reilly Media, 2013.

References:

1. Siamak Azodol molky, ―Software Defined Networking withOpen Flow , Packet Publishing, 2013.
2. Vivek Tiwari, ― SDN and Open Flow for Beginners‖, AmazonDigital Services, Inc., 2013.
3. Fei Hu, Editor, ―Network Innovation through Open Flow andSDN: Principles and Design, CRC Press, 2014.

NARAYANA ENGINEERING COLLEGE::GUDUR							
	SOFTWARE ARCHITECTURE						R20
Course Code	Hours / Week			Total hrs	Credit	Max Marks	
	L	T	P		C	CIE	SEE	TOTAL
20CS4007	3	0	0	49	3	40	60	100

Course Outcomes: After successful completion of the course, the student will be able to:	
CO 1	Demonstrate Software Architecture Reference Models and Architecture Business Cycle for making a good Software Architecture(BL-3)
CO 2	Choose different Software Architectural Life Cycles for designing a good Architecture(BL-5)
CO 3	Identify Quality Attributes, Functional attributes, and different types of tactics for creating architecture.(BL-1)
CO 4	Develop the document of software architecture and views for creating architecture.(BL-6)
CO 5	Develop real time projects by combining ATAM and CBAM frameworks with quality attributes. (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	2		2								2	2
CO2	3	3	3		3								2	2
CO3	3	3	3		3								3	2
CO4	3	2	3		3								3	1
CO5	3	3	3		3								3	1
1: Low, 2-Medium, 3- High														

COURSE CONTENT		
MODULE – 1	**SOFTWARE ARCHITECTURE**	**10H**
What is software Architecture-What is Software Architecture, Other Points of View, Architectural Patterns, Reference Models, and Reference Architectures, Importance of Software Architecture, Architectural Structures and views. **ENVISIONING ARCHITECTURE**: Architecture Business Cycle- Architectures influences, Software Processes and the Architecture Business Cycle, Making of ―Good‖ Architecture.		
MODULE – 2	**DESIGNING THE ARCHITECTURE WITH STYLES**	**10H**
Designing the Architecture: Architecture in the Life Cycle, Designing the Architecture, Formatting the Team Structure, Creating a Skeletal System. Architecture Styles: Architectural Styles, Pipes and Filters, Data Abstraction and Object Oriented Organization, Event-Based, Implicit Invocation, Layered Systems, Repositories, Interpreters.2013-2014		
MODULE – 3	**CREATING AN ARCHITECTURE-I**	**10H**
Creating an Architecture: Understanding Quality Attributes – Functionality and Architecture, Architecture and Quality Attributes, System Quality Attributes, Quality Attribute. Scenarios in Practice, Other System Quality Attributes, Business Qualities, Architecture Qualities. Achieving Qualities: Introducing Tactics, Availability Tactics, Modifiability Tactics, Performance Tactics, Security Tactics, Testability Tactics, Usability Tactics.		
MODULE – 4	**CREATING AN ARCHITECTURE-II**	**10H**
Documenting Software Architectures: Use of Architectural Documentation, Views, Choosing the Relevant Views, Documenting a view, Documentation across Views. Reconstructing Software Architecture: Introduction, Information Extraction, Database Construction, View Fusion, and Reconstruction.		
MODULE – 5	**ANALYZING ARCHITECTURES**	**9H**
The ATAM: Participants in the ATAM, Outputs of The ATAM, Phases Of the ATAM. The CBAM: Decision-Making Context, The Basis for the CBAM, Implementing the CBAM. The World Wide Web: A Case study in Interoperability- Relationship to the Architecture Business Cycle, Requirements and Qualities, Architecture Solution, Achieving Quality Goals.		
	Total hours:	**49 hours**

TEXTBOOK:

Software Architectures in Practice , Len Bass, Paul Clements, Rick Kazman, 2nd Edition, Pearson Publication.

Software Architecture, Mary Shaw and David Garlan, First Edition, PHI Publication, 1996.

REFERENCES:

Software Design: From Programming to Architecture, Eric Braude, Wiley, 2004.

N. Domains of Concern in Software Architectures and Architecture Description Languages. Medvidovic and D. S. Rosenblum. USENIX.

NARAYANA ENGINEERING COLLEGE::GUDUR								
	BUSINESS INTELLIGENCE AND ANALYTICS							R20
Course Code	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
20CS4008	3	0	0	48	3	40	60	100

Course Outcomes: After successful completion of the course, the student will be able to:	
CO 1	Understanding the scope of Business Intelligence solutions
CO 2	Understanding components of Business Intelligence solutions
CO 3	Apply BI concepts to build BI project
CO 4	Building reports with relational and Multidimensional data models
CO 5	Understand differences between Centralized and Decentralized Architecture.

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

COURSE CONTENT		
MODULE – 1	**Introduction to Business Intelligence**	**10H**
Understanding the scope of today's BI solutions and how they fit into existing infrastructure Assessing new options such as SaaS and cloud-based technology. Describe BI, its components & architecture, previewing the future of BI Crafting a better experience for all business users, End User Assumptions, Setting up Data for BI, The Functional Area of BI Tools, Query Tools and Reporting, OLAP and Advanced Analytics, Supporting the requirements of senior executives, including performance management.		
MODULE – 2	**Elements of Business Intelligence Solutions**	**10H**
Reports & ad hoc queries; Analyze OLAP data; Dashboards & Scorecards development, Metadata Models; Automated tasks & events; Mobile & disconnected BI; Collaboration capabilities; Real time monitoring capabilities; Software development kit; Consume BI through portals, web applications, Desktop applications.		
MODULE – 3	**Building the BI Project**	**9H**
Planning the BI project, Project Resources; Project Tasks, Risk Management and Mitigation, Cost-justifying BI solutions and measuring success, Collecting User Requirements, Requirements-Gathering Techniques; Prioritizing & Validating BI Requirements, Changing Requirements; BI Design and Development, Best Practices for BI Design; Post-Implementation Evaluations, Maintaining Your BI Environment.		
MODULE – 4	**Reporting authoring**	**10H**
Building reports with relational vs. Multidimensional data models ; Types of Reports – List, crosstabs, Statistics, Chart, map, financial etc; Data Grouping & Sorting, Filtering Reports, Adding Calculations to Reports, Conditional formatting, Adding Summary Lines to Reports. Drill up, drill- down, drill-through capabilities. Run or schedule report, different output forms – PDF, excel, csv, xml etc.		
MODULE – 5	**BI Deployment, Administration & Security**	**9H**
Centralized Versus Decentralized Architecture, BI Architecture Alternatives, phased & incremental BI roadmap, System Sizing, Measurements and Dependencies, System Sizing, Measurements, and Dependencies. Setting Early Expectations and Measuring the Results. End-User Provisos. OLAP Implementations. Expanding BI Authentication Authorization, Access Permissions, Groups and Roles, Single-sign on Server Administration, Manage Status & Monitoring, Audit, Mail server & Portal integration, Back Up and Restore.		
Total hours:		**48 hours**

TEXTBOOK:

1. Business Intelligence - IBM ICE Publication, 2012

REFERENCES:

1. http://en.wikipedia.org/wiki/Business_intelligence.
2. http://www.webopedia.com/TERM/B/Business_Intelligence.html.
3. Http://www.cio.com/article/40296/Business_Intelligence_Definition_and_Solutions.

NARAYANA ENGINEERING COLLEGE::GUDUR								
	GREEN COMPUTING							R20
CourseCode	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
20CS4009	3	1	0	49	3	40	60	100

Course Outcomes: After successful completion of the course, Student will be able to:	
CO 1	Learn the fundamentals of Green Computing
CO 2	Analyze the Green computing Grid Framework
CO 3	Understand the issues related with Green compliance
CO 4	Study and develop various case studies
CO 5	Identify Environmentally Responsible Business Strategies

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

COURSE CONTENT		
MODULE – 1		**9H**
Green IT Fundamentals: Business, IT, and the Environment – Green computing: carbon foot print, scoop on power – Green IT Strategies: Drivers, Dimensions, and Goals – Environmentally Responsible Business: Policies, Practices, and Metrics.		
MODULE – 2		**9H**
Green Assets: Buildings, Data Centers, Networks, and Devices – Green Business Process **Management:** Modelling, Optimization, and Collaboration – Green Enterprise Architecture – Environmental Intelligence – Green Supply Chains – Green Information Systems: Design and Development Models.		
MODULE – 3		**10H**
Virtualization of IT systems – Role of electric utilities, Telecommuting, teleconferencing and teleporting – Materials recycling – Best ways for Green PC – Green Data center – Green Grid framework.		
MODULE – 4		**11H**
Socio-cultural aspects of Green IT – Green Enterprise Transformation Roadmap – Green Compliance: Protocols, Standards, and Audits – Emergent Carbon Issues: Technologies and Future		
MODULE – 5		**10H**
The Environmentally Responsible Business Strategies (ERBS) – Case Study Scenarios for Trial Runs – Case Studies – Applying Green IT Strategies and Applications to a Home, Hospital, Packaging Industry and Telecom		
	Total hours:	**49 hours**

TEXTBOOK:

1. Bhuvan Unhelkar, ―Green IT Strategies and Applications-Using Environmental Intelligence‖, CRC Press, June 2014.
2. Woody Leonhard, Katherine Murray, ―Green Home computing for dummies‖, August 2012

REFERENCES:

1. Alin Gales, Michael Schaefer, Mike Ebbers, ―Green Data Center: steps for the Journey‖, Shroff / IBM rebook, 2011.
2. John Lamb, ―The Greening of IT‖, Pearson Education, 2009.
3. Jason Harris, ―Green Computing and Green IT- Best Practices on regulations& industry‖, Lulu.com, 2008
4. Carl speshocky, ―Empowering Green Initiatives with IT‖, John Wiley & Sons, 2010. Wu Chun Feng (editor), ―Green computing: Large Scale energy efficiency‖, CRC.

NARAYANA ENGINEERING COLLEGE::GUDUR								
	ROBOTICS PROCESS AUTOMATION							R20
Course Code	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
20CS4010	3	0	0	49	3	40	60	100

Course Outcomes: On successful completion of the course, student will be able to:	
CO-1	Describe RPA, where it can be applied and how it's implemented
CO-2	Describe the different types of variables, Control Flow and data manipulation techniques
CO-3	Identify and understand Image, Text and Data Tables Automation
CO-4	Describe how to handle the User Events and various types of Exceptions and strategies.
CO-5	Understand the Deployment of the Robot and to maintain the connection

CO-PO Mapping

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

1: Low, 2-Medium, 3- High

COURSE CONTENT		
MODULE – 1		**9H**
RPA Foundations & RPA Skills What Is RPA? Flavours of RPA History of RPA, The Benefits of RPA, The Downsides of RPA, RPA Compared to BPO, BPM, and BPA, Consumer Willingness for Automation, The Workforce of the Future. RPA Skills: On-Premise Vs. the Cloud, Web Technology, Programming Languages and Low Code.OCR (Optical Character Recognition), Databases, APIs (Application Programming Interfaces), AI (Artificial Intelligence), Cognitive Automation, Agile, Scrum, Kanban, and Waterfall, DevOps, Flowcharts		
MODULE – 2		**9H**
Process Methodologies & Planning: Lean, Six Sigma, How to Implement Six Sigma, Six Sigma Roles and Levels, Lean Six Sigma, Finding the Right Balance, Applying Lean and Six Sigma to RPA. Planning: The Preliminaries , Use a Consulting Firm? PA Consulting: Some Case Studies, What to Automate? ROI for RPA, RPA Use Cases, Plan.		
MODULE – 3		**10H**
RPA Vendor Evaluation & Center of Excellence(CoE): Be Realistic, Check Out Third Parties, Minimum Capabilities, Who Is the User?, Funding, Ecosystem, Costs, Training and Education, Support, Best-of-Breed vs. End-to-End, Thought Leadership and Vision, Industry Expertise, Security, Monitoring, and Deployment, What Type of RPA?, The Design, Next-Generation Technologies Center of Excellence (CoE): What Is the CoE? Why Have a CoE? Forming the Team, Business Analyst, Developer, RPA Solution Architect, RPA Supervisor, What Should a CoE Do? Communication, Change Management, CoE Case Study: Intuit.		
MODULE – 4		**11H**
Bot Development, Deployment and Monitoring & Data Preparation: Preliminaries, Installation of UiPath, Getting Started, Activities, Flowcharts and Sequences, Log Message, Variables, Loops and Conditionals, For Each Loop, Do While Loop and While Loop,IF/THEN/ELSE Conditionals, Switch, Debug, Common UiPath Functions, The UiPath Orchestrator, Best Practices for Bot Development Deployment and Monitoring: Testing, Going into Production, Monitoring, Security, Scaling Data Preparation: Types of Data, Big Data, The Issues with Big Data, The Data Process, Types of Algorithms, The Perils of the Moonshot, Bias		
MODULE – 5		**10H**
Open Source RPA, Process Mining & Future of RPA: What Is Open Source Software? The Business Model of Open Source? The Pros and Cons of Open Source Software, Open RPA, UI. Vision, Robot Framework, Robocorp, Orchestra, TagUI Process Mining: Old Way Vs. Process Mining, Backgrounder on Process Mining, How ProcessMining Works, Celonis, ProM, Signavio, Fluxicon, ABBYY, The Future of Process Mining Future of RPA: Consolidation and IPOs, Microsoft, Attended Automation, Vertical-Specific Companies, Hype Factor, Software-as-a-Service (SaaS) and Open Source, Chatbots, Artificial Intelligence, Privacy and Ethics		
	Total hours:	**49 hours**

Textbook:

1. Tom Taulli, “The Robotic Process Automation Handbook”, Apress, 2020
2. Alok Mani Tripathi, “Learning Robotic Process Automation”, March 2018

References:

1. .Robotic process and Cognitive Automation by, Mary C Lacity& Leslie P Willcocks, 2018.

PROFESSIONAL ELECTIVE-3

NARAYANA ENGINEERING COLLEGE::GUDUR							
	INFORMATION AND CYBER SECURITY						R20
Course Code	Hours / Week			Total hrs	Credit	Max Marks	
	L	T	P		C	CIE	SEE	TOTAL
20CS4011	3	1	0	50	3	40	60	100

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

CO-PO Mapping

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

1: Low, 2-Medium, 3- High

COURSE CONTENT		
MODULE – 1		**10H**
Cyber crime: Mobile and Wireless devices-Trend mobility-authentication service security Attacks on mobile phones-mobile phone security Implications for organizations-Organizational measurement for Handling mobile-Security policies and measures in mobile computing era. Cases.		
MODULE – 2		**10H**
Tools and methods used in cyber crime-Proxy servers and Anonymizers-Phishing Password cracking-Key loggers and Spy wares-Virus and worms-Trojan Horse and Backdoors Steganography-SQL Injection-Buffer overflow-Attacks on wireless network. Cases		
MODULE – 3		**10H**
Understanding computer forensic-Historical background of cyber forensic Forensic analysis of e-mail-Digital forensic life cycle-Network forensic-Setting up a computer forensic Laboratory-Relevance of the OSI 7 Layer model to computer Forensic-Computer forensic from compliance perspectives. Cases.		
MODULE – 4		**10H**
Forensic of Hand –Held Devices-Understanding cell phone working characteristics-Hand-Held devices and digital forensic- Toolkits for Hand-Held device-Forensic of i-podand digital music devices-Techno legal Challenges with evidence from hand-held Devices. Cases.		
MODULE – 5		**10H**
Cyber Security –Organizational implications-cost of cybercrimes and IPR issues Web threats for organizations: the evils and Perils-Social media marketing Security and privacy Implications-Protecting people privacy in the organizations Forensic best practices for organizations. Cases		
	Total hours:	**50 hours**

Textbook:

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

References:

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

NARAYANA ENGINEERING COLLEGE::GUDUR							
	SOFTWARE TESTING						R20
Course Code	Hours / Week			Total hrs	Credit	Max Marks	
	L	T	P		C	CIE	SEE	TOTAL
20CS4012	2	1	0	48	3	40	60	100

Course Outcomes: After successful completion of the course, the student will be able to:	
CO 1	Illustrate the purpose of testing and adequacy assessment using control flow and path testing techniques
CO 2	Demonstrate the strategies in data flow testing to find the test paths of a program
CO 3	Identify the boundary point using domain testing to access appropriate output of system
CO 4	Simplify the path from flow graph using reduction procedure of a program
CO 5	Demonstrate the states and state graph strategies of a program

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

COURSE CONTENT		
MODULE – 1		**9H**
Introduction: Purpose of Testing, Dichotomies, Model for Testing, Consequences of Bugs, Taxonomy of Bugs. **Flow graphs and Path testing:** Basics Concepts of Path Testing, Predicates, Path Predicates and Achievable Paths, Path Sensitizing, Path Instrumentation, Application of Path Testing.		
MODULE – 2		**10H**
Transaction Flow Testing: Transaction Flows, Transaction Flow Testing Techniques. Dataflow testing: Basics of Dataflow Testing, Strategies in Dataflow Testing, Application of Dataflow Testing.		
MODULE – 3		**9H**
Domain Testing: Domains and Paths, Nice & Ugly Domains, Domain testing, Domains and Interfaces Testing, Domain and Interface Testing, Domains and Testability.		
MODULE – 4		**9H**
Paths, Path products and Regular expressions: Path Products & Path Expression, Reduction Procedure, Applications, Regular Expressions & Flow Anomaly Detection. Logic Based Testing: Overview, Decision Tables, Path Expressions, KV Charts, Specifications.		
MODULE – 5		**9H**
State, State Graphs and Transition Testing: State Graphs, Good & Bad State Graphs, State Testing, Testability Tips. **Graph Matrices and Application:** Motivational Overview, Matrix of Graph, Relations, Power of a Matrix, Node Reduction Algorithm, Building Tools.		
	Total hours:	**48hours**

Textbook:

1. Boris Beizer, “Software testing techniques”, Dreamtech, second edition, 2002

References:

2. Brian Marick, “The craft of software testing”, Pearson Education.
3. Yogesh Singh, “Software Testing”, Camebridge
4. P.C. Jorgensen, “Software Testing” 3rd edition, Aurbach Publications (Dist. bySPD).
5. N.Chauhan, “Software Testing”, Oxford University Press.
6. P.Ammann & J.Offutt, “Introduction to Software Testing” , Cambridge Univ.Press.
7. Perry, “Effective methods of Software Testing”, John Wiley, 2nd Edition, 1999.

NARAYANA ENGINEERING COLLEGE::GUDUR							
	INFORMATION STORAGE AND RETRIEVAL SYSTEMS						R20
Course Code	Hours / Week			Total hrs	Credit	Max Marks	
	L	T	P		C	CIE	SEE	TOTAL
20CS4013	3	0	0	48	3	40	60	100

Course Outcomes: After successful completion of the course, the student will be able to:	
CO 1	Understand the different information retrieval models
CO 2	Know about evaluation methods of the information retrieval model
CO 3	Know about text categorization and its implementation
CO 4	Demonstrate the challenges associated with each topic on new domain of retrieval and classification
CO 5	Understand in detail about text search algorithms

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

COURSE CONTENT		
MODULE – 1		**9H**
Introduction to Information Retrieval Systems: Definition of Information Retrieval System, Objectives of Information Retrieval Systems, Functional Overview, Relationship to Database Management Systems, Digital Libraries and Data Warehouses Information Retrieval System Capabilities: Search Capabilities, Browse Capabilities, Miscellaneous Capabilities		
MODULE – 2		**10H**
Cataloging and Indexing: History and Objectives of Indexing, Indexing Process, Automatic Indexing, Information Extraction Data Structure: Introduction to Data Structure, Stemming Algorithms, Inverted File Structure, N-Gram Data Structures, PAT Data Structure, Signature File Structure, Hypertext and XML Data Structures, Hidden Markov Models		
MODULE – 3		**10H**
Automatic Indexing: Classes of Automatic Indexing, Statistical Indexing, Natural Language, Concept Indexing, Hypertext Linkages Document and Term Clustering: Introduction to Clustering, Thesaurus Generation, Item Clustering, Hierarchy of Clusters		
MODULE – 4		**10H**
User Search Techniques: Search Statements and Binding, Similarity Measures and Ranking, Relevance Feedback, Selective Dissemination of Information Search, Weighted Searches of Boolean Systems, Searching the INTERNET and Hypertext Information Visualization: Introduction to Information Visualization, Cognition and Perception, Information Visualization Technologies		
MODULE – 5		**9H**
Text Search Algorithms: Introduction to Text Search Techniques, Software Text Search Algorithms, Hardware Text Search Systems Multimedia Information Retrieval: Spoken Language Audio Retrieval, Non-Speech Audio Retrieval, Graph Retrieval, Imagery Retrieval, Video Retrieval		
	Total hours:	**48 hours**

Textbook:

1. Information Storage and Retrieval Systems – Theory and Implementation, Second Edition,Gerald J. Kowalski, Mark T. Maybury, Springer

References:

1. Frakes, W.B., Ricardo Baeza-Yates: Information Retrieval Data Structures and Algorithms,
2. Prentice Hall, 1992.
3. Information Storage & Retrieval By Robert Korfhage – John Wiley & Sons.
2. Modern Information Retrieval By Yates and Neto Pearson Education.

NARAYANA ENGINEERING COLLEGE::GUDUR								
	CLOUD COMPUTING							R20
Course Code	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
20CS4014	3	0	0	48	3	40	60	100

Course Outcomes: After successful completion of the course, student will be able to:	
CO 1	Explain the fundamentals, characteristics, models, and service concepts of cloud computing. (BL-2)
CO 2	Design and develop cloud applications using appropriate cloud architecture, service models, and deployment models. (BL-6)
CO 3	Explain and classify virtualization technologies, virtual machines, and cloud virtualization platforms. (BL-2)
CO 4	Apply CloudSim and Aneka programming models to simulate and develop cloud applications. (BL-3)
CO 5	Deploy SaaS applications using cloud platforms such as Google App Engine, Microsoft Azure, and AWS. (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			2								2	2
CO2	3	3	3	2	3								3	3
CO3	2	2	2		3								3	2
CO4	3	3	3	2	3								3	3
CO5	3	2	3	2	3								3	3
1: Low, 2-Medium, 3- High														

COURSE CONTENT		
MODULE – 1		**9H**
Cloud Computing Insights- Distributed Computing, High Performance Computing, Utility and Enterprise Grid Computing, Cluster Computing**,** Cloud Computing fundamentals, Essential Characteristics, On Demand Self Service, Location independent resource pooling, Elastic Computing, Measured Service, Comparing cloud providers with traditional IT service providers, Vendor Lock-in, security level of third party- Security issues: Government policies.		
MODULE – 2		**10H**
Cloud computing architecture, Layers of Cloud computing- IaaS, PaaS and SaaS, Cloud deployment models- Private, Public, Hybrid and Community Clouds, Advantages of Cloud Computing.		
MODULE – 3		**10H**
Introduction, Characteristics of Virtualized Environments, Virtualization and Cloud Computing, Pros and Cons of Virtualization, Virtual machines and Virtualization of Clusters and Data Centres, Case studies – Xen Virtual Machine monitors – Xen API, VMware- VMware products-VMware features, Microsoft Virtual Server- Features of Microsoft Virtual Server, Open stack.		
MODULE – 4		**10H**
CloudsimOpen source framework, Simulate VMs, memory, network, disks; Aneka – Cloud computing Framework for Enterprise Cloud applications development, Aneka Architecture, Programming models: Thread, Task and MapReduce		
MODULE – 5		**9H**
Case studies – Salesforce.com for SaaS application development, GAE- Google App Engine, Microsoft Windows Azure – public resources for VMs and Services, AWS- Amazon Web Services – public cloud registration, Services, OpenStack – Open Source Development Platform for Clouds and tools.		
	Total hours:	**48 hours**

TEXTBOOK:

3. RajkumarBuyya, Christian Vecchiola, S. ThammaraiSelvi, "Mastering Cloud Computing – Foundations and applications", McGraw Hill Publications,
4. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing – A Practical Approach", Mc Graw Hill, Inc, New York, NY, USA.

REFERENCES:

1. Kai Hwang, Geoffrey C Fox, Jack J. Dongarra, "Distributed and Cloud Computing, Morgan Kaufmann.
2. Cloud Computing Principles and Paradigms, John Wiley & Sons publications

NARAYANA ENGINEERING COLLEGE::GUDUR								
	DIGITAL MARKETING							R20
Course Code	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
20CS4015	3	0	0	49	3	40	60	100

Course Outcomes: On successful completion of the course, student will be able to:	
CO 1	Demonstrate the difference between Traditional Vs. Digital Marketing
CO 2	Describes Search Engine Optimization
CO 3	Describes Website Analysis And Backlinks Building
CO 4	Apply the client-server model in networking applications.
CO 5	Describes various methods of Social media marketing

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

COURSE CONTENT		
MODULE – 1	**BASICS of DIGITAL MARKETING**	**9H**
Introduction To Online Digital Marketing, Importance Of Digital Marketing, How did Internet Marketing work?, Traditional Vs. Digital Marketing, Types of Digital Marketing, Increasing Visibility, Visitors' Engagement, Bringing Targeted Traffic, Lead Generation		
MODULE – 2	**SEARCH ENGINE OPTIMIZATION (SEO)**	**10H**
Introduction To Search Engine Optimization, How Did Search Engine work?, SEO Fundamentals & Concepts, Understanding the SERP, Google Processing, Indexing Crawling		
MODULE – 3	**SEO UPDATES AND ANALYSIS**	**10H**
Google Panda, Penguin, Humming Bird Algorithm, Google Penalties, SEO Tools For Website Analysis And Optimization, Competitor Website Analysis And Backlinks Building, Backlinks Tracking, Monitoring, And Reporting		
MODULE – 4	**SOCIAL MEDIA OPTIMIZATION (SMO)**	**10H**
Social Media Optimization Introduction To Social Media Networks, Types Of Social Media Websites, Social Media Optimization Concepts, Face book, Google+, LinkedIn, YouTube, Pinterest, Hash tags, Image Optimization		
MODULE – 5	**SOCIAL MEDIA MARKETING (SMM)**	**10H**
Face book Optimization Fan Page Vs Profile Vs Group, Creating Facebook Page For Business, Increasing Fans And Doing Marketing, Face book Analytics, Facebook Advertising And Its Types In Detail Creating Advertising Campaigns, Payment Modes, Introduction To Twitter, Creating Strong Profiles On Twitter, Followers, ReTweets, Clicks, Conversions, HashTags, LinkedIn Optimization, What Is LinkedIn?, Individual Profile Vs. Company Profile, Branding On LinkedIn, Marketing On LinkedIn Groups		
	Total hours:	**49 hours**

Text Book:

1. Ryan, D. (2014) Understanding Digital Marketing: Marketing Strategies for Engaging the Digital Generation, Kogan Page Limited.
2. The Beginner's Guide to Digital Marketing (2015). Digital Marketer. Pulizzi,J.(2014) Epic Content Marketing, McGraw Hill Education.

References:

1. Ryan Deiss& Russ Henneberry, Digital Marketing for Dummies
3. Simon Kings north, Digital Marketing Strategy: An Integrated Approach to Online Marketing

PROFESSIONAL ELECTIVE-4

NARAYANA ENGINEERING COLLEGE::GUDUR							
	WEB APPLICATION AND SECURITY						R20
Course Code	Hours / Week			Total hrs	Credit	Max Marks	
	L	T	P		C	CIE	SEE	TOTAL
20CS4016	4	0	0	52	4	40	60	100

Course Outcomes: After successful completion of the course, student will be able to:	
CO 1	Identify the vulnerabilities in the web applications
CO 2	Identify the various types of threats and mitigation measures of web applications
CO 3	Apply the security principles in developing a reliable web application
CO 4	Use industry standard tools for web application security
CO 5	Apply penetration testing to improve the security of web applications.

CO-PO Mapping

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

1: Low, 2-Medium, 3- High

COURSE CONTENT		
MODULE – 1	**Overview of Web Applications & Security**	**10H**
Introduction history of web applications interfaces and structure benefits and drawbacks of web applications Web application Vs Cloud application. Security Fundamentals: Input Validation - Attack Surface Reduction Rules of Thumb-Classifying and Prioritizing Threads		
MODULE – 2	**Web Application Vulnerabilities**	**11H**
Understanding vulnerabilities in traditional client server application and web applications, client state manipulation, cookie based attacks, SQL injection, cross domain attack (XSS/XSRF/XSSI) http header injection. SSL vulnerabilities and testing - Proper encryption use in web application - Session vulnerabilities and testing - Cross-site request forgery		
MODULE – 3	**Web Application Mitigations**	**11H**
Http request , http response, rendering and events , html image tags, image tag security, issue, java script on error , JavaScript timing , port scanning , remote scripting , running remote code, frame and iframe , browser sandbox, policy goals, same origin policy, library import, domain relaxation		
MODULE – 4	**Secure Website Design**	**10H**
Secure website design : Architecture and Design Issues for Web Applications, Deployment Considerations Input Validation, Authentication, Authorization, Configuration Management ,Sensitive Data, Session Management, Cryptography, Parameter Manipulation, Exception Management, Auditing and Logging, Design Guidelines, Forms and validity, Technical implementation		
MODULE – 5	**Cutting Edge Web Application Security**	**10H**
Click jacking - DNS rebinding - Flash security - Java applet security - Single-sign-on solution and security - IPv6 impact on web security, Recent Trends in Web Application Security		
	Total hours:	**52 hours**

Textbook:

1. Sullivan, Bryan, and Vincent Liu. Web Application Security, A Beginner's Guide.McGraw Hill Professional, 2011.
2. Stuttard, Dafydd, and Marcus Pinto. The Web Application Hacker's Handbook:Finding and Exploiting Security Flaws. John Wiley Sons, 2011

References:

1. Shema, M. & Adam. (2010). Seven deadliest web application attacks. Amsterdam: Syngress Media.
2. Stuttard, D. & Pinto, M. (2011). The web application hacker's handbook: Discovering and exploiting security flaws (2nd ed). Indianapolis, IN: Wiley, John & Sons.
3. Heiderich, M., Nava E.A.V., Heyes, G., & Lindsay, D. (2011). Web application obfuscation. Amsterdam: Syngress Media, U.S. Sullivan, Bryan (2012). Web Application Security, A Beginner's Guide. McGraw- Hill Education.

PROFESSIONAL ELECTIVE-4

NARAYANA ENGINEERING COLLEGE::GUDUR							
	OBJECT ORIENTED ANALYSIS AND DESIGN						R20
Course Code	Hours / Week			Total hrs	Credit	Max Marks	
	L	T	P		C	CIE	SEE	TOTAL
20CS4017	3	1	0	48	3	40	60	100
Course Outcomes: After successful completion of the course, the student will be able to:								
CO 1	Apply the basic concepts of object oriented techniques							
CO 2	Design the users view context and diagrams using UML modeling techniques							
CO 3	Identify the basic issues in reusable design and recognize the basic design pattens							
CO 4	Apply OOAD methodology concepts using UML							
CO 5	Design various test cases for OOAD problems							

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

COURSE CONTENT		
MODULE – 1		**9H**
Introduction: The Structure of Complex systems, The Inherent Complexity of Software, Attributes of Complex System, Organized and Disorganized Complexity, Bringing Order to Chaos, Designing Complex Systems, Evolution of Object Model, Foundation of Object Model, Elements of Object Model, Applying the Object Model.		
MODULE – 2		**10H**
Classes and Objects: Nature of object, Relationships among objects, Nature of a Class, Relationship among Classes, Interplay of Classes and Objects, Identifying Classes and Objects, Importance of Proper Classification, Identifying Classes and Objects, Key abstractions and Mechanisms.		
MODULE – 3		**10H**
Introduction to UML: Why model, Conceptual model of UML, Architecture, Classes, Relationships, Common Mechanisms, Class diagrams, Object diagrams.		
MODULE – 4		**9H**
Structural Modeling: Package Diagram, Composite Structure Diagram, Component Diagram, Deployment Diagram, Profile Diagram.		
MODULE – 5		**10H**
Behavioral Modeling: Use Case Diagram, Activity Diagrams, State Machine Diagrams, Sequence Diagram, Communication Diagram, Timing Diagram, Interaction Overview Diagram.		
	Total hours:	**48 hours**

Textbook:

1. Object- Oriented Analysis And Design with Applications", Grady BOOCH, Robert A. Maksimchuk, Michael W. ENGLE, Bobbi J. Young, Jim Conallen,Kellia Houston, PEARSON, 3rd edition, 2013.
2. "The Unified Modeling Language User Guide", Grady Booch, James Rumbaugh,Ivar Jacobson, PEARSON 12th Impression, 2012.

References:

1. Mahesh P. Matha, Object-oriented analysis and design using UML", , PHI
2. Head first object-oriented analysis and design", Brett D. McLaughlin, Gary Pollice, Dave West, O'Reilly
3. Satzinger, Robert B. Jackson, Stephen D. Burd,Object-oriented analysis and design with the Unified process", John W.Cengage Learning
4. The Unified modeling language Reference manual", James Rumbaugh, Ivar Jacobson, Grady Booch, Addison-Wesley

NARAYANA ENGINEERING COLLEGE::GUDUR								
	DEEP LEARNING							R20
Course Code	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
20CS4018	3	0	0	49	3	40	60	100

Course Outcomes: After successful completion of the course, the student will be able to:	
CO 1	Understand basic concepts of neural networks and back propagation algorithm
CO 2	Analyze the layers in the architecture of convolution neural networks
CO 3	Acquire knowledge on auto encoders, word2vec architecture
CO 4	Explore deep learning models for sequence analysis
CO 5	Understand recurrent and recursive nets.

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

COURSE CONTENT		
MODULE – 1		**9H**
Linear Algebra: Scalars, Vectors, Matrices and Tensors, Matrix operations, types of matrices, Norms, Eigen decomposition, Singular Value Decomposition, Principal Components Analysis. Probability and Information Theory: Random Variables, Probability Distributions, Marginal Probability, Conditional Probability, Expectation, Variance and Covariance, Bayes' Rule, Information Theory. Numerical Computation: Overflow and Underflow, Gradient-Based Optimization, Constrained Optimization, Linear Least Squares.		
MODULE – 2		**10H**
Machine Learning: Basics and Under fitting, Hyper parameters and Validation Sets, Estimators, Bias and Variance, Maximum Likelihood, Bayesian Statistics, Supervised and Unsupervised Learning, Stochastic Gradient Descent, Challenges Motivating Deep Learning. Deep Feed forward Networks: Learning XOR, Gradient-Based Learning, Hidden Units, Architecture Design, Back-Propagation and other Differentiation Algorithms		
MODULE – 3		**10H**
Regularization for Deep Learning: Parameter Norm Penalties, Norm Penalties as Constrained Optimization, Regularization and Under-Constrained Problems, Dataset Augmentation, Noise Robustness, Semi-Supervised Learning, Multi-Task Learning, Early Stopping, Parameter Tying and Parameter Sharing, Sparse Representations, Bagging and Other Ensemble Methods, Dropout, Adversarial Training, Tangent Distance, Tangent Prop and Manifold Tangent Classifier. Optimization for Training Deep Models: Pure Optimization, Challenges in Neural Network Optimization, Basic Algorithms, Parameter Initialization Strategies, Algorithms with Adaptive Learning Rates, Approximate Second-Order Methods, Optimization Strategies and Meta-Algorithms		
MODULE – 4		**10H**
Convolutional Networks: The Convolution Operation, Pooling, Convolution, Basic Convolution Functions, Structured Outputs, Data Types, Efficient Convolution Algorithms, Random or Unsupervised Features, Basis for Convolutional Networks		
MODULE – 5		**10H**
Sequence Modelling: Recurrent and Recursive Nets: Unfolding Computational Graphs, Recurrent Neural Networks, Bidirectional RNNs, Encoder-Decoder Sequence-to-Sequence Architectures, Deep Recurrent Networks, Recursive Neural Networks, Echo State Networks, LSTM, Gated RNNs, Optimization for Long-Term Dependencies, Auto encoders, Deep Generative Models		
	Total hours:	**49 hours**

Textbook:

1. Ian Goodfellow, YoshuaBengio, Aaron Courville, “Deep Learning”, MIT Press,2016.
2. Josh Patterson and Adam Gibson, “Deep learning: A practitioner's approach”, O'Reilly Media, First Edition,2017

References:

1. Fundamentals of Deep Learning, Designing next-generation machine intelligence algorithms, Nikhil Buduma, O’Reilly, Shroff Publishers,2019.
2. Deep learning Cook Book, Practical recipes to get started Quickly, O’Reilly, 2019

NARAYANA ENGINEERING COLLEGE::GUDUR								
	HIGH PERFORMANCE COMPUTING							R20
Course Code	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
20CS4019	3	1	0	50	3	40	60	100

Course Outcomes: On successful completion of the course, student will be able to:	
CO 1	Describe various Memory Hierarchies
CO 2	Describes optimization techniques for serial code
CO 3	Analyze Taxonomy of parallel computing paradigms
CO 4	Describes Distributed memory parallel programming
CO 5	Explains Shared memory parallel programming with Open MP

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

COURSE CONTENT		
MODULE – 1		**9H**
Modern Processors : Stored Program Computer Architecture-General purpose cache- based microprocessor-Performance based metrics and benchmarks- Moore's Law- Pipelining- Super scalarity-SIMD- Memory Hierarchies Cache- mapping- prefetch Multi-core processors- Multithreaded processors- Vector Processors- Design Principles- Maximum performance estimates- Programming for vector architecture		
MODULE – 2		**9H**
Basic optimization techniques for serial code : scalar profiling function and line based runtime profiling- hardware performance counters- common sense optimizations- simple measures, large impact- elimination of common sub expressions- avoiding branches using SIMD instruction sets- the role of compilers – general optimization options- in lining - aliasing- computational accuracy register optimizations- using compiler logs- C++ optimizations -temporaries- dynamic memory management- loop kernels and iterators data access optimization: balance analysis and light speed estimates- storage order- case study: Jacobi algorithm and dense matrix transpose.		
MODULE – 3		**10H**
Parallel Computers : Taxonomy of parallel computing paradigms- Shared memory computers- Cache coherence- UMA–NUMA Distributed-memory computers- Hierarchical systems- Networks-Basic performance characteristics- Buses- Switched and fat- tree networks- Mesh networks- Hybrids - Basics of parallelization -Why parallelize - Data Parallelism - Function Parallelism- Parallel Scalability- Factors that limit parallel execution- Scalability metrics- Simple scalability laws- parallel efficiency – serial performance Vs Strong scalability- Refined performance models-Choosing the right scaling baseline- Case Study: Can slow processors compute faster- Load balance.		
MODULE – 4		**11H**
Distributed memory parallel programming with MPI: message passing - introduction to MPI – example - messages and point-to point communication - collective communication – non blocking point-to-point communication- virtual topologies – MPI parallelization of Jacobi solver- MPI implementation – performance properties ion Examples. Efficient MPI programming : MPI performance tools communication parameters- Synchronization, serialization, contention- Reducing communication overhead- optimal domain decomposition- Aggregating messages – Non blocking Asynchronous communication- Collective communication- Understanding intra-node point-to-point communication		
MODULE – 5		**11H**
Shared memory parallel programming with Open MP : introduction to Open MP - parallel execution - data scoping- Open MP work sharing for loops- synchronization - reductions - loop scheduling -tasking - case study: Open MP- parallel Jacobi algorithm- advanced open Mp wave front parallelization- Efficient Open MP programming: Profiling Open MP programs - Performance pitfalls ,Case study: Parallel Sparse matrix-vector multiply.		
	Total hours:	**50 hours**

Textbook:

1. Georg Hager, Gerhard Wellein, Introduction to High Performance Computing for
2. Scientists and Engineers, Chapman & Hall / CRC Computational Science Series,2011.
3. 2Charles Severance, Kevin Dowd, High Performance Computing, O'Reilly Media, 2nd
4. Edition, 1998.

References:

1. Kai Hwang, Faye Alaye Briggs, Computer Architecture and Parallel Processing, McGraw Hill, 1984

NARAYANA ENGINEERING COLLEGE::GUDUR							
	AUGUMENTED AND VIRTUAL REALITY						R20
Course Code	Hours / Week			Total hrs	Credit	Max Marks	
	L	T	P		C	CIE	SEE	TOTAL
20CS4020	3	0	0	49	3	40	60	100

Course Outcomes: After successful completion of the course, student will be able to:	
CO 1	Demonstrate human interaction with computers
CO 2	Animate using Virtual reality and 3D Art optimization
CO 3	Design audio and video interaction paradigms
CO 4	Design Data visualization tools
CO 5	Apply VR/AR in various fields in industry

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

COURSE CONTENT		
MODULE – 1		**10H**
How Humans interact with Computers: Common term definition, introduction, modalities through the ages (pre- 20th century, through world war-II, post-world war-II, the rise of personal computing, computer miniaturization), why did we just go over all of this? Types of common HCI modalities, new modalities, the current state of modalities for spatial computing devices, current controllers for immersive computing systems, a note on hand tracking and hand pose recognition. Designing for our Senses, Not our Devices: Envisioning a future, sensory technology explained, who are we building this future for?, sensory design, five sensory principles, Adobe's AR story		
MODULE – 2		**9H**
Virtual Reality for Art: A more natural way of making 3D art, VR for animation. 3D art optimization: Introduction, draw calls, using VR tools for creating 3D art, acquiring 3D models vs making them from scratch. How the computer vision that makes augmented reality possible works:		
Who are we?, a brief history of AR, how and why to select an AR platform, mapping, platforms, other development considerations, the AR cloud.		
MODULE – 3		**10H**
Virtual reality and augmented reality: cross platform theory: Why cross platform? The role of game engines, understanding 3D graphics, portability lessons from video game design, simplifying the controller input. Virtual reality toolkit: open source framework for the community: What is VRTK and why people use it? The history of VRTK, welcome to the steam VR unity toolkit, VRTK v4, the future of VRTK, success of VRTK. Three virtual reality and augmented reality development practices: Developing for virtual reality and augmented reality, handling locomotion, effective use of audio, common interaction paradigms		
MODULE – 4		**10H**
Data and machine learning visualization design and development in spatial computing: Introduction, understanding data visualization, principles for data and machine learning visualization design and development in spatial computing, why data and machine learning visualization works in spatial computing, 2D data visualization vs 3D data visualization in spatial computing, interactivity in data visualizations and in spatial computing, animation, failures in data visualization, good data visualization design optimize 3D spaces, how to create data visualization: data visualization creation pipeline, webXR, data visualization challenges in XR, data visualization industry use case examples of data visualization		
MODULE – 5		**10H**
Character AI and Behaviors: Introduction, behaviors, current practice: Reactive AI, more intelligence in the system, Deliberative AI, machine learning. The virtual and augmented reality health technology ecosystem: VR/AR health technology application design, standard UX isn't intuitive, tutorial: insight Parkinson's experiment, companies, case studies from leading academic institutions		
	Total hours:	**49 hours**

Textbook:

1. Erin Pangilinan, Steve lukas, and Vasanth Mohan, "Creating Augmented & VirtualRealities", 1st edition, O'REILLY, 2019.

References:

1. Steve Aukstakalnis, "Practical Augmented Reality", Pearson Education, 2017.

PROFESSIONAL ELECTIVE-5

NARAYANA ENGINEERING COLLEGE::GUDUR								
	BLOCKCHAIN TECHNOLOGY							R20
Course Code	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
20CS4021	4	1	0	48	4	40	60	100

Course Outcomes: After successful completion of the course, student will be able to:	
CO 1	Demonstrate the foundation of the Block chain technology and understand the processes in payment and funding.
CO 2	Identify the risks involved in building Block chain applications.
CO 3	Review of legal implications using smart contracts.
CO 4	Choose the present landscape of Block chain implementations and Understand Crypto currency markets.
CO 5	Examine how to profit from trading crypto currencies

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

COURSE CONTENT		
MODULE – 1		**10H**
Blockchain concepts: Blockchain, Blockchain application example: Escrow, Blockchain stack, from web 2.0 to the next generation decentralized web, domain specific Blockchain application, Blockchain benefits and challenges. Blockchain application templates: Blockchain application components, design methodology for Blockchain applications, Blockchain applications templates		
MODULE – 2		**10H**
Setting up Ethereum development tools: Ethereum clients, Ethereum languages, Test RPC, Mist Ethereum walle, meta mask, web3 JavaScript API, truffle .Ethereum Accounts: Ethereum Accounts, key pairs, working with EOA Accounts, working with contract accounts.		
MODULE – 3		**10H**
Smart contracts: Smart contract, structure of a contract, setting up and interacting with a contract using Gethclient, setting up and interacting with a contract using Mist Wallet		
MODULE – 4		**9H**
Smart contracts (continued): Smart contract examples, Smart contract patterns. Decentralized Applications: implementing D pps, case studies,		
MODULE – 5		**9H**
Mining: Consensus on Blockchain network, mining, Block validation, state storage in Ethereum.		
	Total hours:	**48 hours**

Textbook:

1. Arshadeepbahga, Vijay madisetti, “Blockchain Applications A hands-on approach”, VPT2017.
2. Chandramouli Subramanian, Asha A George, Abhilash K A and MeenaKarthikeyan, Blockchain Technology”, Universty Press, 2021

References:

1. Imran Bashir, “Mastering Blockchain” Packt Publishing Ltd, March 2017.
2. Melanie swan, “Blokchain blueprint for a new economy”, O’REILLY

NARAYANA ENGINEERING COLLEGE::GUDUR							
	AGILE SOFTWARE DEVELOPMENT						R20
Course Code	Hours / Week			Total hrs	Credit	Max Marks	
	L	T	P		C	CIE	SEE	TOTAL
20CS4022	4	1	0	49	4	40	60	100

Course Outcomes: After successful completion of the course, the student will be able to:	
CO 1	Understand the different types of data sources.
CO 2	Explain data pre-processing model and demonstrate the working on every data type .
CO 3	Apply different Exploratory Data Analysis techniques.
CO 4	Apply different similarity measures, distance measures to find similarity or distances between data.
CO 5	Demonstrate the handling of very large data using Map Reduce.

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

COURSE CONTENT		
MODULE – 1		**10H**
Introduction: Need of Agile software development, agile context– Manifesto, Principles, Methods, Values, Roles, Artifacts, Stakeholders, and challenges. Business benefits of software agility.		
MODULE – 2		**10H**
Project Planning: Recognizing the structure of an agile team– Programmers, Managers, Customers. User stories– Definition, Characteristics and content. Estimation– Planning poker, Prioritizing, and selecting user stories with the customer, projecting team velocity for releases and iterations.		
MODULE – 3		**10H**
Project Design: Fundamentals, Design principles–Single responsibility, Open-closed, Liskov substitution, Dependency-inversion, Interface-segregation.		
MODULE – 4		**9H**
Design Methodologies: Need of scrum, Scrum practices –Working of scrum, Project velocity, Burn down chart, Sprint backlog, Sprint planning and retrospective, Daily scrum, Scrum roles– Product Owner, Scrum Master, Scrum Team. Extreme Programming- Core principles, values and practices. Kanban, Feature-driven development, Lean software development.		
MODULE – 5		**10H**
Testing: The Agile lifecycle and its impact on testing, Test driven development– Acceptance tests and verifying stories, writing a user acceptance test, Developing effective test suites, Continuous integration, Code refactoring. Risk based testing, Regression tests, Test automation.		
	Total hours:	**49 hours**

Textbook:

1. Ken Schawber, Mike Beedle, "Agile Software Development with Scrum",International Edition, Pearson.
2. Robert C. Martin, "Agile Software Development, Principles, Patterns and Practices",First International Edition, Prentice Hall.
3. Pedro M. Santos, Marco Consolaro, and Alessandro Di Gioia, "Agile Technical Practices Distilled: A learning journey in technical practices and principles of softwaredesign", First edition, Packt Publisher.

References:

1. Lisa Crispin, Janet Gregory, "Agile Testing: A Practical Guide for Testers and AgileTeams", International edition, Addison Wesley.
2. Alistair Cockburn, "Agile Software Development: The Cooperative Game", 2ndEdition, Addison-Wesley

NARAYANA ENGINEERING COLLEGE::GUDUR							
	PROGRAMMING FOR DATA SCIENCE						R20
Course Code	Hours / Week			Total hrs	Credit	Max Marks	
	L	T	P		C	CIE	SEE	TOTAL
20CS4023	3	0	2	48	4	40	60	100

Course Outcomes: After successful completion of the course, the student will be able to:	
CO 1	Understand basic concepts of data science
CO 2	Analyze data pre-processing techniques
CO 3	Understand algorithms of data science
CO 4	Apply R programming in data science
CO 5	Evaluate performance evaluation through R in data science

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

COURSE CONTENT		
MODULE – 1	**INTRODUCTION**	**9H**
Data Science: Introduction to Data Science – Digital Universe – Sources of Data – Information Commons – Data Science Project Life Cycle: OSEMN Framework		
MODULE – 2	**DATA PREPROCESSING**	**10H**
Introduction to Data Preprocessing – Reading, Selecting, Filtering Data – Filtering Missing Values – Manipulating, Sorting, Grouping, Rearranging, Ranking Data		
MODULE – 3	**CONCEPT LEARNING**	**10H**
Formulation of Hypothesis – Probabilistic Approximately Correct Learning - VC Dimension – Hypothesis elimination – Candidate Elimination Algorithm		
MODULE – 4	**ESSENTIALS OF R**	**9H**
R Basics - data types and objects - control structures – data frame -Feature Engineering - scaling, Label Encoding and One Hot Encoding, Reduction **MODEL FIT USING R** Regression Models- Linear and Logistic Model, Classification Models – Decision Tree, Naïve Bayes, SVM and Random Forest, Clustering Models – K Means and Hierarchical clustering		
MODULE – 5	**VISUALIZATION**	**10H**
VISUALIZATION: Data visualization: Box plot, histogram, scatter plot, heat map – Working with Tableau – Outlier detection – Data Balancing **PERFORMANCE EVALUATION in R:** Loss Function and Error: Mean Squared Error, Root Mean Squared Error – Model Selection and Evaluation criteria: Accuracy, Precision, F1 score, Recall Score – Binary Predictive Classification – Sensitivity – Specificity.		
	Total hours:	**48 hours**

Textbook:

1. Hadley Wickham, Garrett Grolemund, R for data science : Import, Tidy, Transform, Visualize, And Model Data Paperback, 2017
2. Ethem Alpaydin, Introduction to Machine Learning, Fourth Edition, MIT Press, 2020

References:

1. Han, J., Kamber, M., Pei, J. Data mining concepts and techniques. Morgan Kaufmann.2011
2. Carl Shan, Henry Wang, William Chen, Max Song. The Data Science Handbook: Advice and Insight from 25 Amazing Data Scientists. The Data Science Bookshelf.2016
3. James, G., Witten, D., T., Tibshirani, R. An Introduction to statistical learning with applications in R. Springer. 2013

NARAYANA ENGINEERING COLLEGE::GUDUR								
	CLOUD SECURITY							R20
Course Code	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
20CS4024	3	0	0	48	3	40	60	100

Course Outcomes: On successful completion of the course, student will be able to:	
CO 1	Identify different cloud delivery models.
CO 2	Evaluate security features offered by public cloud providers.
CO 3	Build cloud infrastructure with security in mind.
CO 4	Protect data stored in cloud environments.
CO 5	Build security controls into cloud technologies such as serverless and containers.

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

COURSE CONTENT		
MODULE – 1	**Cloud Computing Architectural Framework**	**9H**
Cloud Computing Architectural Framework: Cloud Benefits, Business scenarios, Cloud Computing Evolution, cloud vocabulary, Essential Characteristics of Cloud Computing, Cloud deployment models, Cloud Service Models, Multi- Tenancy, Approaches to create a barrier between the Tenants, cloud computing vendors, Cloud Computing threats, Cloud Reference Model, The Cloud Cube Model, Security for Cloud Computing, How Security Gets Integrated.		
MODULE – 2	**Cloud software security fundamentals**	**10H**
Cloud software security fundamentals: – Security objective, security service, Cloud security design principles, Secure cloud software requirements, Secure development practice, Approaches of cloud software requirements engineering, Security policy implementation, Secure cloud software testing, penetration testing, Disaster recovery, Cloud for BCP/DCP.		
MODULE – 3	**Security and Recovery**	**9H**
Traditional Security, Business Continuity, Disaster Recovery, Risk of insider abuse, Security baseline, Customers actions, Contract, Documentation, Recovery Time Objectives (RTOs), Customers responsibility, Vendor Security Process (VSP).		
MODULE – 4	**Cloud Risk Issues and Challenges**	**10H**
CIA triad, Privacy and Compliance Risk, PCIDSS, Information privacy and privacy law, Common threats and vulnerabilities, Access control issues, service provider Risk. Security policy Implementation, Computer Security incident response team (CSIRT), Virtualization security Management- virtual threats, VM security recommendations, VM security techniques – hardening, securing VM remote access.		
MODULE – 5	**Cloud Security Architecture**	**10H**
General issues, Trusted cloud, Secure execution environments and communications, Micro architecture, Identity management, Access control, Autonomic security, protection, self-healing. Cloud life cycle issues – cloud standards, DMTF, ISO, ETSI, OASI, SNIA, OGF, OWASP, Incident response, Internet Engineering Task Force Incident- Handling Guidelines, Computer security and response team, Encryption and key management, VM Architecture, Key Protection, Hardware protection, VM life cycle.		
	Total hours:	**48 hours**

TEXTBOOK:

1. Ronald L. Krutz, Russell Dean Vines, “Cloud Security”, Wiley publication 2010 J.R. ("Vic") Winkler, “Securing the Cloud” Syngress, 2011.
2. Tim Mather, Subra Kumaraswamy, Shahed Latif, “Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance” O'Reilly Media; 1 edition, 2009.

REFERENCES:

1. Toby Velte, Anthony Velte, Robert Elsenpeter, Cloud Computing, A Practical Approach, Tata McGraw-Hill Education, 2009.
2. GautamShroff, Enterprise Cloud Computing Technology Architecture Applications, Cambridge University Press, 2010.

NARAYANA ENGINEERING COLLEGE::GUDUR								
	VIRTUALIZATION TECHNOLOGIES							R20
Course Code	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
20CS4025	3	0	0	49	3	40	60	100

Course Outcomes: On successful completion of the course, student will be able to:	
CO 1	Describes the virtualisation process and Taxonomy of Virtual Machines
CO 2	Identifies Various Partitioning Techniques and Types of Server Virtualization
CO 3	Defines various Networks-Virtualizing, WAN Design and Virtualization Routing Protocols.
CO 4	Details the Storage Virtualization
CO 5	Differentiates various Virtualization Technologies

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

COURSE CONTENT		
MODULE – 1		**9H**
Introduction To Virtualization System Architectures - Virtual Machine Basics- Process Virtual Machines - System Virtual Machines - Taxonomy of Virtual Machines - Emulation: Basic Interpretation – Threaded Interpretation - Pre-Coded & Direct Interpretation - Binary Translation - Full and Para-Virtualization - Types of Hypervisor- Types of Virtualization.		
MODULE – 2		**10H**
Server Virtualization Server Virtualization - Partitioning Techniques-Hardware Virtualization - Virtual Hardware -Types of Server Virtualization -Business Cases for Sever Virtualization-Uses of Virtual Server Consolidation -Selecting Server Virtualization Platform.		
MODULE – 3		**10H**
Network Virtualization Design of Scalable Enterprise Networks-Virtualizing the Campus - WAN Design-WAN Architecture - WAN virtualization -Virtual Enterprise Transport Virtualization - VLANs and Scalability - Theory Network Device Virtualization Layer 2 -VLANs Layer 3 VRF In stances Layer 2 - VFls Virtual Firewall Contexts Network Device Virtualization -Datapath Virtualization Layer 2: 802.1q-Trunking Generic Routing Encapsulation -IPSec L2TPv3Label Switched Paths-Control-Plane Virtualization -Routing Protocols -VRF- Aware Routing - Multi-Topology Routing.		
MODULE – 4		**10H**
Storage Virtualization Devices - SCSI -SCSI Communication -Using SCSI Buses - Fiber Channel -Fiber Channel Cables -Fiber Channel Hardware Devices – i-SCSI Architecture – Securing i-SCSI SAN Backup & Recovery Techniques - RAID -Classic Storage Model - SNIA Shared Storage Model Host based Architecture - Storage based architecture - Network based Architecture - Fault tolerance to SAN-Performing Backups - Virtual Tape Libraries		
MODULE – 5		**10H**
Applying Virtualization Comparison of Virtualization Technologies: Guest OS, Host OS, Hypervisor, Emulation, Kernel Level -Shared Kernel-Enterprise Solutions: Vm ware Server, ESXi, Citrix Xen Server, Microsoft Virtual PC, Microsoft Hyper-V, Virtual Box - Server Virtualization: Configuring Server with Server Virtualization, Adjusting & Tuning Virtual Servers, VM Backup and Migration -Desktop Virtualization: Terminal Services, Hosted Desktop, Web Based Solutions, Localized Virtualized Desktop-Network and Storage Virtualization: VPN,VLAN, SAN and VSAN, NAS.		
	Total hours:	**49 hours**

Textbook:

1. Chris Wolf, Erick M. Halter, “Virtualization: From the Desktop to the Enterprise’, APress, 2005.
2. James E. Smith, Ravi Nair, “Virtual Machines: Versatile Platforms for Systems and Processes’, Elsevier/Morgan Kaufmann, 2005.
3. David Marshall, Wade A. Reynolds, “Advanced Server Virtualization: VMware and Microsoft Platform in the Virtual Data Center’, Auerbach Publications, 2006.

References:

1. William von Hagen, “Professional Xen Virtualization’, Wrox Publications, January, 2008.
2. Kumar Reddy, Victor Moreno, “Network virtualization”, Cisco Press, July, 2006.
3. Amy Newman, Kenneth Hess, “Practical Virtualization Solutions: Virtualization from the Trenches", Prentice Hall, October 2009.