Bharati Vidyapeeth

(Deemed to be University)
Pune, India

College of Engineering, Pune

B.Tech. (Computer Science and Engineering)
Program Curriculum

(2020 Course)

VISION OF UNIVERSITY:

Social Transformation through Dynamic Education

MISSION OF UNIVERSITY:

- To make available quality education in different areas of knowledge to the students as per their choice and inclination.
- To offer education to the students in a conducive ambience created by enriched infrastructure and academic facilities in its campuses.
- To bring education within the reach of rural, tribal and girl students by providing them substantive fee concessions and subsidized hostel and mess facilities.
- To make available quality education to the students of rural, tribal and other deprived sections of the population.

VISION OF THE INSTITUTE:

To be World Class Institute for Social Transformation Through Dynamic Education.

MISSION OF THE INSTITUTE:

- To provide quality technical education with advanced equipment, qualified faculty members, infrastructure to meet needs of profession and society.
- Toprovide an environment conducive to innovation, creativity, research, and entrepreneurial leadership.
- To practice and promote professional ethics, transparency and accountability for social community, economic and environmental conditions.

VISION OF THE DEPARTMENT

To be focused on innovative and quality education in computer science and engineering that prepares professionals for development of society.

MISSION OF THE DEPARTMENT

- To provide academic environment for the development of skilled professionals
- To cultivate research culture that contributes to the sustainable development of the society.
- To enhance academic and industry collaborations for global exposure.

PROGRAM EDUCATIONAL OBJECTIVES

The students of B.TECH. (Computer Science and Engineering), after graduating will able to,

1. Demonstrate technical and professional competencies by applying Engineering Fundamentals, knowledge of computing and technologies.
2. Exhibit effective personality, good communication and team building skills
3. Adopt to the latest trends in the field of computer science and engineering.

PROGRAM SPECIFIC OUTCOMES

1. To design, develop and implement computer programs on hardware towards solving problems.
2. To employ expertise and ethical practice through continuing intellectual growth and adapting to the working environment.

PROGRAM OUTCOMES

a. Apply the knowledge of mathematics, science, engineering, and computing to provide a solution of complex engineering problems.
b. Identify, analyse complex engineering problems to derive conclusions using computer science and engineering knowledge.
c. Outline resolutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration, societal, and environmental considerations.
d. Use existing research knowledge and research techniques including design of experiments, data analysis, and synthesis to provide valid inferences.
e. Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools.
f. Apply inferences obtained by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the subsequent responsibilities relevant to the professional engineering practice.
g. Recognize the impact of the professional engineering solutions in societal and environmental contexts to demonstrate the knowledge for sustainable development.
h. Apply ethical principles and execute professional ethics and responsibilities and norms of the engineering practice.
i. Work effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary surroundings.
j. Talk effectively on complex engineering activities with the engineering community such as being able to comprehend and write effective reports and design documentation, make effective presentations.
k. Prove knowledge and understanding of the engineering and management principles and apply these to one's work, as a member and leader in a team.
l. Recognise the need for and have the preparation and ability to engage in independent and life-long learning in context of technological change.

CORELATION BETWEEN GRADUATE ATTRIBUTES AND PROGRAMME OUTCOMES

Graduate Attributes/ Programme Outcomes	a	b	c	d	e	f	g	h	i	j	k	l
Engineering Knowledge	□											
Problem Analysis		□										
Design/Development of solutions			□									
Conduct Investigations of Complex Problems				□								
Modern Tool Usage					□							
The Engineer and Society						□						
Environment and Sustainability							□					
Ethics								□				
Individual and teamwork									□			
Communication										□		
Project management and finance											□	
Life-long learning												□

DEFINITION OF CREDITS:

1 Hour Lecture (L) per week	1 credit
1 Hour Tutorial (T) per week	1 credit
2 Hour Practical (P) per week	1 credit
4 Hours Practical (P) per week	2 credit

STRUCTURE OF UNDERGRADUATE ENGINEERING PROGRAMME

Sr. No.	Category	Breakup of Credits
1	Basic Science Course (BSC)	22
2	Engineering Science Course (ESC)	15
3	Core Course (CC)	140
4	Elective Course (EC)	08
5	Project (PROJ)	08
6	Internship (INT)	03
7	Vocational Course (VC)	04
8	MOOCs (MOOC)	04 (Add-on course)
9	Research Paper Publication (Research)	02 (Add-on course)
10	Social Activity (SA)	04 (Add-on course)
11	Mandatory Course (MC)	Non-Credit
12	Internal Assessment (IA)	-
13	End Semester Examination (ESE)	-
TOTAL		200

DISTRIBUTION OF COURSE COMPONENTS

Sr. No.	Category	Number of Courses
1.	Basic Science Course	5
2.	Engineering Science Course	4
3.	Core Courses	34
4.	Elective Course	2
5.	Project	2
6.	Internship	1
7.	Vocational Course	4
8.	MOOCs	3
9.	Research Paper Publication	1
10.	Mandatory Course	1
11.	Social Activities	2
TOTAL		59

Program: **B.TECH. (Computer Science and Engineering)** **Semester – I** **CBCS 2021 Course**

Sr. No.	Course Code	Name of Course	Teaching Scheme (Hrs./Week)			Examination Scheme (Marks)						Credits			
			L	P	T	ESE	IA	TW	OR	PR	Total	L	P	T	Total
1		Mathematics for Computing-I	3	-	1	60	40	-	-	-	100	3	-	1	4
2		Internet Programming	4	2	-	60	40	25	25	-	150	4	1	-	5
3		Organic and Electrochemistry	4	2	-	60	40	25	-	-	125	4	1	-	5
4		Digital Electronics	4	2	-	60	40	50	-	-	150	4	1	-	5
5		Programming and Problem Solving	4	2	-	60	40	50	-	50	200	4	1	-	5
6		Computer Aided Drafting	-	2	-	-	-	25	-	-	25	-	1	-	1
		Total	**19**	**10**	**1**	**300**	**200**	**175**	**25**	**50**	**750**	**19**	**5**	**1**	**25**

Program: B.TECH. (Computer Science and Engineering) Semester – II CBCS 2021 Course

Sr. No.	Course Code	Name of Course	Teaching Scheme (Hrs./Week)			Examination Scheme (Marks)						Credits			
			L	P	T	ESE	IA	TW	OR	PR	Total	L	P	T	Total
1		Mathematics for Computing-II	3	-	1	60	40	-	-	-	100	3	-	1	4
2		Probability and Statistics	4	2	-	60	40	25	-	25	150	4	1	-	5
3		Physics for Computing Systems	3	2	-	60	40	25	-	-	125	3	1	-	4
4		Electrical Technology	4	2	-	60	40	25	-	-	125	4	1	-	5
5		Linear Data Structures	4	4	-	60	40	50	-	50	200	4	2	-	6
6		Computer Systems Workshop Technology	-	2	-	-	-	25	-	25	50	-	1	-	1
		Total	**18**	**12**	**1**	**300**	**200**	**150**	**-**	**100**	**750**	**18**	**6**	**1**	**25**

Program: B.TECH. (Computer Science and Engineering) Semester – III CBCS 2021 Course

Sr. No.	Course Code	Name of Course	Teaching Scheme (Hrs./Week)			Examination Scheme (Marks)						Credits			
			L	P	T	ESE	IA	TW	OR	PR	Total	L	P	T	Total
1		Non-Linear Data Structures	3	2	1	60	40	25	-	25	150	3	1	1	5
2		Discrete Mathematical Structures	3	2	-	60	40	25	25	-	150	3	1	-	4
3		Machine Organization and Microprocessor	4	-	1	60	40	-	-	-	100	4	-	1	5
4		Software Engineering	4	2	-	60	40	25	-	25	150	4	1	-	5
5		Object Oriented Methodology*	4	2	-	60	40	25	-	25	150	4	1	-	5
6		Vocational Course-I	-	2	-	-	-	25	25	-	50	-	1	-	1
		Total	**18**	**10**	**2**	**300**	**200**	**125**	**50**	**75**	**750**	**18**	**5**	**2**	**25**
		Social Activity – I	-	-	-	-	-	-	-	-	-	-	-	-	2

***Industry Taught Course – II**

List of Vocational Courses will be published by the department before the commencement of respective semester.

Program: B.TECH. (Computer Science and Engineering) Semester – IV CBCS 2021 Course

Sr. No.	Course Code	Name of Course	Teaching Scheme (Hrs./Week)			Examination Scheme (Marks)						Credits			
			L	P	T	ESE	IA	TW	OR	PR	Total	L	P	T	Total
1		Theory of Computation	3	-	1	60	40	-	-	-	100	3	-	1	4
2		System Programming and Operating System	4	2	-	60	40	25	25		150	4	1	-	5
3		Computer Graphics and Multimedia	3	-	-	60	40	-	-		100	3	-	-	3
4		Design of Algorithms	4	2	-	60	40	25	-	25	150	4	1	-	5
5		Database Systems*	4	2	-	60	40	25	-	25	150	4	1	-	5
6		CSE Skill Lab-I	-	4	-	-	-	25	-	25	50	-	2	-	2
7		Vocational Course-II	-	2	-	-	-	25	25	-	50	-	1	-	1
		Total	**18**	**12**	**1**	**300**	**200**	**125**	**50**	**75**	**750**	**18**	**6**	**1**	**25**
		MOOC - I[#]	-	-	-	-	-	-	-	-	-	-	-	-	2

*** Industry Taught Course – II**

[#] Add-on Course - List of MOOC and Vocational Courses will be published by the department before the commencement of respective semester.

Program: B.TECH. (Computer Science and Engineering) Semester – V CBCS 2021 Course

Sr. No.	Course Code	Name of Course	Teaching Scheme (Hrs./Week)			Examination Scheme (Marks)						Credits			
			L	P	T	ESE	IA	TW	OR	PR	Total	L	P	T	Total
1		Software Testing and Quality Assurance	3	2	-	60	40	25	25	-	150	3	1	-	4
2		Big Data Analytics	4	-	-	60	40	-	-	-	100	4	-	-	4
3		Human Machine Interaction	4	-	-	60	40	-	-	-	100	4	-	-	4
4		Computer Networks	4	2	-	60	40	25	-	25	150	4	1	-	5
5		Artificial Intelligence*	4	2	-	60	40	25	-	25	150	4	1	-	5
6		CSE Skill Lab –II	-	4	-	-	-	25	-	25	50	-	2	-	2
7		Vocational Course-III	-	2	-	-	-	25	25	-	50	-	1	-	1
	Total		**19**	**12**	**-**	**300**	**200**	**125**	**50**	**75**	**750**	**19**	**6**	**-**	**25**
		Social Activity-II	-	-	-	-	-	-	-	-	-	-	-	-	2
		Environmental Studies**	2	-	-	50	-	-	-	-	-	-	-	-	-

*** Industry Taught Course – III**
**** Mandatory Audit Course - 50 Marks Theory Examination**
List of Vocational Courses will be published by the department before the commencement of respective semester.

Program: B.TECH. (Computer Science and Engineering) Semester – VI CBCS 2021 Course

Sr. No.	Course Code	Name of Course	Teaching Scheme (Hrs./Week)			Examination Scheme (Marks)						Credits			
			L	P	T	ESE	IA	TW	OR	PR	Total	L	P	T	Total
1		Business Intelligence System*	3	2	-	60	40	25	-	25	150	3	1	-	4
2		Cryptography and Network Security	4	2	-	60	40	25	-	25	150	4	1	-	5
3		Natural Language Processing	4	2	-	60	40	25	25	-	150	4	1	-	5
4		Quantitative Techniques, Communication and Values	4		-	60	40	-	-	-	100	4	-	-	4
5		Design Thinking	4	-		60	40	-	-	-	100	4		-	4
6		CSE Skill Lab –III	-	4	-	-	-	25	-	25	50	-	2	-	2
7		Vocational Course-IV	-	2	-	-	-	25	25	-	50	-	1	-	1
		Total	**19**	**12**	**-**	**300**	**200**	**125**	**50**	**75**	**750**	**19**	**06**	**-**	**25**
		MOOC - II #	-	-	-	-	-	-	-	-	-	-	-	-	2

***Industry Taught Course- IV**

 # Add-on Course - List of MOOC and Vocational Courses will be published by the department before the commencement of respective semester.

Program: B.TECH. (Computer Science and Engineering) Semester – VII CBCS 2021 Course

Sr. No.	Course Code	Name of Course	Teaching Scheme (Hrs./Week)			Examination Scheme (Marks)						Credits			
			L	P	T	ESE	IA	TW	OR	PR	Total	L	P	T	Total
1		Machine Learning	3	2	-	60	40	25	-	25	150	3	1	-	4
2		Internet of Things *	4	2	-	60	40	25	25	-	150	4	1	-	5
3		Optimization Techniques	4	-	-	60	40	-	-	-	100	4	-	-	4
4		Elective I	3	2	-	60	40	25	25	-	150	3	1	-	4
5		CSE Skill Lab–IV	-	4	-	-	-	25	-	25	50	-	2	-	2
6		Project Stage-I	-	2	-	-	-	50	50	-	100	-	2	-	3
7		Internship	-	-	-	-	-	25	25	-	50	-	3	-	3
		Total	**14**	**12**	**-**	**240**	**160**	**175**	**125**	**50**	**750**	**14**	**10**	**-**	**25**

***Industry Taught Course- V**

Elective I	Deep learning	Game Theory	Semantic Web	Text Mining

Program: B.TECH. (Computer Science and Engineering) Semester – VIII CBCS 2021 Course

Sr. No.	Course Code	Name of Course	Teaching Scheme (Hrs./Week)			Examination Scheme (Marks)						Credits			
			L	P	T	ESE	IA	TW	OR	PR	Total	L	P	T	Total
1		Data Visualization & Reporting	3	-	1	60	40	25	-	-	125	3	-	1	4
2		Augmented and Virtual Reality	4	2	-	60	40	-	25	-	125	4	1	-	5
3		Block Chain and Digital Currency*	3	2	-	60	40	-	-	25	125	3	1	-	4
4		Elective –II	3	2	-	60	40	-	25	-	125	3	1	-	4
5		CSE Skill Lab–V	-	4	-	-	-	25	-	25	50	-	2	-	2
6		Project Stage-II	-	4	-	-	-	100	100	-	200	-	6	-	6
		Total	**13**	**14**	**1**	**240**	**160**	**150**	**150**	**50**	**750**	**13**	**11**	**1**	**25**
		Research Paper Publication#	-	-	-	-	-	-	-	-	-	-	-	-	2

***Industry Taught Course- VI**

 # Add-on Course

Elective -II	Pattern Recognition	Industrial IOT	Knowledge Management System	Information Retrieval

B.TECH (Computer Science and Engineering)

SEMESTER – I

COURSE SYLLABUS

Mathematics for Computing-I

Teaching Scheme		Examination Scheme		Credit Scheme	
	Hours/Week		Marks		Credits
Theory:	03 Hours/Week	End Semester Examination	60 Marks	Theory	03
Tutorial:	01 Hours/Week	Internal Assessment	40 Marks	Tutorial	01
		Total	100 Marks	Total	04

Course Objective:

- Linear equations and its basis and dimension.
- Linear mapping and its matrix representation.
- Orthogonalization and diagonalisation of matrices

Prerequisite:
The students should have knowledge of algebra of matrices and determinants.

Course Outcomes: On completion of the course, students will have the ability to:

1. Apply rank of matrix in solving system of equations.
2. Identify basis and dimension of matrix.
3. Solve problems on kernel and image of linear transformation.
4. Apply linear operator to represent matrix.
5. Evaluate orthogonalization of inner product space.
6. Use methods to find eigen values and eigen vectors.

Unit I **06 Hours**

System of Linear Equation: Vectors and linear combinations, Rank of a matrix, Gaussian elimination, LU Decomposition, Solving Systems of Linear Equations using the tools of Matrices.

Unit II **06Hours**

Vector Spaces: Definition, linear combination, spanning sets subspaces, linear dependence and independence, basis and dimension, rank of matrix.

Unit III **06 Hours**

Linear Mapping: Linear mapping, Kernel and image of linear mapping, rank and nullity of a linear mapping, singular and non-singular linear mapping.

Unit IV **06 Hours**

Linear mapping and matrices: Matrix representation of linear operator, change of base, similarity matrices.

Unit V **06 Hours**

Inner Product space and orthogonalization: Inner product space,Cauchy-schwarz equality,orthogonality, orthogonal sets and bases, projections, Gramschidtorthogonalization, orthogonal and positive definite matrices, matrix representation of inner produc**t.**

Unit VI **06Hours**

Diagonalisation: Eigen values and eigenvectors: Characteristic polynomial, Cayley-Hamilton theorem, eigen values and eigenvectors, properties.

Textbooks

1. P. N. Wartikar and J. N. Wartikar, Applied Mathematics (Volumes I and II), 7th Ed., Pune VidyarthiGrihaPrakashan, Pune, 2013
2. .B. S. Grewal, Higher Engineering Mathematics, 42nd Ed., Khanna Publication, Delhi
3. B.V. Ramana, Higher Engineering Mathematics, 6th Ed., Tata McGraw-Hill, New Delhi, 2008.

4. ErwinKreyszig, Advanced Engineering Mathematics, 10th Ed., John Wiley & Sons, Inc., 2015.

Reference Books

1. Peter V. O'Neil, Advanced Engineering Mathematics, 7th Ed., Cengage Learning, 2012.
2. MichaelGreenberg,Advanced Engineering Mathematics, 2nd Ed., Pearson Education, 1998.

List of Assignments

Six assignments to be given by the course coordinator (Theory)-one from each unit

Project Based Learning

Students are expected prepare report on any one topic, write its definition, applications and illustrate with few examples. Also, write pseudo code for it, wherever applicable.

1. Gauss Elimination method.
2. LU-decomposition method
3. Rank of matrix
4. Linear combination
5. Basis and dimension
6. Spanning sets
7. Kernel and image of linear transformation
8. Rank-nullity theorem
9. Non-singular linear mapping
10. Linear operator
11. Similarity matrices
12. Change of base
13. Cauchy Schwarz equality
14. Orthogonality
15. Gram Schmidt Orthogonalization
16. Matrix representation of matrix
17. Cayley-Hamilton theorem
18. Eigen values and Eigen vectors

(Note:- *Students in a group of 3 to 4 shall complete any one project from the above list)

Syllabus for Unit Tests:

Unit Test -1	Unit – I, Unit – II, Unit - III
Unit Test -2	Unit – IV, Unit – V, Unit - VI

Internet Programming

Teaching Scheme		Examination Scheme		Credit Scheme	
	Hours/Week		Marks	Credits	
Theory:	04 Hours/Week	End Semester Examination	60 Marks	Theory	04
Practical:	02 Hours/Week	Internal Assessment	40 Marks		
		Term work	25 Marks	Practical	01
		Oral	25 Marks		
		Total	150 Marks	Total	05

Course Objectives:
To introduce students about all web programming languages with detailed study about HTML, CSS, DHTML, XML and DNS.

Prerequisite:
Basic knowledge about computers, web applications and internet.

Course Outcomes: On completion of the course, students will have the ability to:
1. Explain the fundamentals of programming languages.
2. Implement the Hyper Text Markup Language.
3. Use of Cascading Style Sheets in web page development.
4. Elucidate with implementation of Dynamic Hyper Text Markup Language.
5. Apply the knowledge to implement the Extensible Markup Language.
6. Implement the Hyper Text Transfer Protocol and DNS.

Unit I **08 Hours**

Introduction to internet programming: Computer Network, working of internet, Web applications, Introduction to web programming languages: HTML, DHTML, JSP, PHP, Role of the Server on the internet, Introduction to JSP, Introduction about Node JS and angular JS

Unit II **08 Hours**

Hyper Text Markup Language: Introduction to HTML, Tags, Div Span, Lists, Images, Hyperlink, Table, Iframe, Form, Headers, all content with HTML5

Unit III **08 Hours**

Cascading Style Sheets: Introduction to CSS, Syntax, Selectors, background, Text Fonts, Lists Tables, Box Models,Display Positioning, Floats.

Unit IV **08 Hours**

Dynamic Hyper Text Markup Language: Introduction of DHTML- HTML vs. DHTML, Advantages of DHTML, CSS of DHTML, Event Handling, Data Binding, Browser Object Models

Unit V **08 Hours**

Extensible Markup Language: Introduction of XML- Features of XML, Anatomy of XML document, The XML Declaration, Element Tags- Nesting and structure, XML text and text formatting element, Table element, Mark-up Element and Attributes,
XML Objects, Checking Validity, Understanding XLinks, XPointer, Event-driven Programming, XML Scripting, XML with Style Sheet Technologies- Concept of XSL, XML Schema, Importance of XML schema, Creating Element in XML Schema, XML Schema Types.

Unit VI **08 Hours**

Hyper Text Transfer Protocol and DNS: DNS, WWW, HTTP, HTTPs, XML HTTP Request-Introduction, XMLHttpRequest, The XMLHttpRequest Object, Events for the XMLHttpRequest Object, Request Object for XMLHttpRequest, Response Object for XMLHttpRequest, Complete working of web browser

Textbooks/ Reference Books:

1.HTML & CSS: The Complete Reference, Fifth Edition Paperback byThomas Powell, McGraw

Hill Education.
2.HTML & XHTML: The Complete Reference, byThomas Powell,McGraw Hill Education, McGraw-Hill Education.
3.XML: The Complete Reference, by Heather Williamson, McGraw Hill Education.
4.HTTP Pocket Reference (Pocket Reference (O'Reilly)), Clinton Wong, O′Reilly Publication.
5.HTML & XHTML: The Definitive Guide, 5th Edition, by Bill Kennedy and Chuck Musciano, O'Reilly Publications.

List of Assignments:

(Course coordinator can design his/her own theory assignment. Following are samples of theory assignments.)

1. Explain the role of web programming languages in internet.
2. Explain any five HTML tags with example.
3. Consider any web-based example to explain the role of CSS in web programming.
4. Explain the role of DHTML in web programming and web applications.

List of Laboratory Exercises:

1. Introduction to web format files and file extensions.
2. Implementation of simple HTML page.
3. Implementation of Images and Tables.
4. Implementation of frames.
5. Implementation of form.
6. Implementation of CSS.
7. Implementation of DHTML.
8. Implementation of XML.
9. Develop the web page with any scenario where HTML, CSS, XML will be used.
10. Develop any web project for any website or any portal.
11. Case Study on web programming languages.
12. Case Study on any web project

Project Based Learning

1. Website Development Hotel management
2. Website Development Personal Website
3. Website Development Organization website
4. Website Development Dummy Ecommerce website
5. Website Development Login page with user credentials
6. Development of aEmployee Interests Survey form / Student survey form
7. Technical documentation page
8. Create image slider
9. Railway concession form
10. Website development for personal portfolio

(Note:- *Students in a group of 3 to 4 shall complete any one project from the above list)

Syllabus for Unit Tests:

Unit Test -1	Unit – I, Unit – II, Unit - III
Unit Test -2	Unit – IV, Unit – V, Unit – VI

Organic and Electrochemistry

Teaching Scheme		Examination Scheme		Credit Scheme	
	Hours/Week		Marks		Credits
Theory:	04 Hours/Week	End Semester Examination	60 Marks	Theory	04
Practical:	02 Hours/Week	Internal Assessment	40 Marks		
		Term Work	25 Marks	Practical	01
		Total	125 Marks	Total	05

Course Objectives:

The student should acquire the knowledge of

- To develop the interest among the students regarding chemistry and their applications in engineering.
- To develop confidence among students about chemistry, how the knowledge of chemistry is applied in technological field.
- The student should understand the concepts of chemistry to lay the groundwork for subsequent studies in the computing field.

Prerequisite:

Basic Chemistry

Course Outcomes: On completion of the course, students will have the ability to:

1. Differentiate between ionic and covalent bonding and classify the bonding in a compound as ionic or covalent.
2. Develop a working knowledge of the twelve fundamental principles of green chemistry and what it is all about.
3. Apply standard reduction potential data to determine the relative strength of oxidizing/reducing agents
4. Demonstrate the knowledge of polymer materials for futuristic engineering applications
5. Describe the properties of materials and Application of semiconductor electronics
6. Describe the manufacturing and refining process of fuels and lubricants

Unit I **06 Hours**

Chemical Bonding in Molecules:MO theory, Structure, bonding and energy levels of bonding and shapes of many atom molecules, Coordination Chemistry, Electronic spectra, and magnetic properties of complexes with relevance to bio-inorganic chemistry, organometallic chemistry.

Unit II **06 Hours**

Green Chemistry: Introduction, Twelve Principles of Green chemistry, numerical on atom economy, synthesis, adipic acid and indigo. Organic dye- Traditional methods of organic dye. Green solvents (ionic liquid supercritical CO2), and products from natural materials.

Unit III **06 Hours**

Electrochemistry: Electrochemical cells and Galvanic cells, EMF of a cell, Single electrode potential, Nernst equation, Electrochemical series, Types of electrodes, Reference electrodes, pH, pOH, acids and basis, Fuel cells, Construction and Working of - Acid and Alkaline Storage Battery, Dry Cell, Ni-Cd Batteries, Li-Ion Batteries, Li-Po Batteries.

Unit IV **06 Hours**

Polymers for The Electronics Industry: Polymers, Conduction mechanism, Preparation of conductive polymers, Polyacetylene, Poly (p- phenlylene), Polyhetrocyclic systems, Polyaniline Poly (Phenylene sulphide), Poly (1,6-heptadiyne), Applications, Photonic applications.

Unit V **06 Hours**

Semi-Conductors, Insulators and Superconductors: Semi conductivity in non-elemental materials, Preparations of semiconductors, Chalcogen photoconductors, photocopying process

Introduction to Superconductors, types of Superconductors, Properties of superconductors, Applications of Superconductors, Electrical insulators, or Dielectrics.

Unit VI **06 Hours**

Fuels & Lubricants: Classification of fuels, Calorific values, Comparison between solid, liquid, and gaseous fuels, Theoretical calculation of calorific value of a fuel, Selection of coal, analysis of coal, Natural Gas, Producer gas, water gas, Lubricants, Mechanism of lubrication, classification of lubricants, lubricating oils, Solid lubricants, Greases or Semi-Solid lubricants, Synthetic lubricants, Lubricating emulsions, Properties of lubricating oils.

Textbooks:

1. Polymer Science and technology (2nd Edition), P. Ghosh, Tata McGraw Hill, 2008.
2. Polymers: Chemistry & Physics of Modern Materials (2nd edition) J.M.G.Cowie, Blackie Academic & Professional, 1994.
3. A Textbook of Engineering Chemistry, Shashi Chawla, DhanpatRai& Co, 2004
4. Engineering Chemistry (16th Edition) Jain, Jain, DhanpatRai Publishing Company, 2013.

Reference Books:

1. Inorganic Chemistry (4th edition), D. F. Shrives and P. W. Atkins, Oxford University, Oxford, 2006.
2. Reactions, Rearrangements and Reagents (4th edition), S. N. Sanyal, Bharti Bhawan (P & D), 2003.
3. Applications of Absorption Spectroscopy of Organic Compounds (4th edition), John R. Dyer, Prentice Hall of India Pvt. Ltd., 1978.

List of Assignments:

Six assignments to be given by the course coordinator (Theory)-one from each unit/one mini project with report-students can work in group of 4 Maximum

Project Based Learning

1. 1.Green Chemistry approach to Nano-Structured Electronics
2. Assessment of Environmentally Benign Photopolymers as an Alternative to the Use of Formaldehyde Based Textile Finishing Agents
3. Solvent-Free Synthesis of Phthalocyanines
4. Synthesis of Conjugated Polymers and Molecules Using Sugar Reagents and Solventless Reactions
5. Environmentally Benign Control of Polymer Solubility: Photoresist Materials Using DNA Mimics
6. Enzymatic Synthesis of Non-Formaldehyde Phenolic Polymers: Control of Hydrogen Peroxide Concentration.
7. The materials chemistry and electrochemistry of lithium and sodium-ion batteries
8. Electroplating- the principles, how different metals can be used and the practical applications
9. Electroplating, Metal Polishing, Anodizing, Phosphating Metal Finishing and Powder Coating Projects.
10. To determine calorific value of a fuel by any suitable method
11. To study various properties of lubricants
12. To study various types of lubricants and its properties.
13. To determine quality of coal sample & its analysis.
14. To study mechanism of lubrication.
15. To study coal analysis & its significance.

Note: -*Students in a group of 3 to 4 shall complete any one project from the above list)

List of Laboratory Exercises:

1. Determination of Hardness of water sample by EDTA method.
2. Determination of Chloride content in water sample by precipitation titration method.
3. To determine strength of acid by pH – metric Titration
4. To measure the Conductance of a solution by conductometric titration
5. Measurement of Surface tension of a given liquid by Stalagmometer.
6. Determination of viscosity of a given liquid by Ostwald's Viscometer.
7. Determination of Saponification value of an oil sample.
8. To determine alkalinity water sample
9. Determination of Hardness of water sample by EDTA method.
10. Determination of Chloride content in water sample by precipitation titration method

11. To determine strength of acid by pH – metric Titration
12. To Prepare Phenol formaldehyde/Urea formaldehyde resin
13. To study set up of Daniel cell.

Syllabus for Unit Tests:

Unit Test -1	Unit – I, Unit – II, Unit - III
Unit Test -2	Unit – IV, Unit – V, Unit - VI

Digital Electronics

Teaching Scheme		Examination Scheme		Credit Scheme	
	Hours/Week		Marks		Credits
Theory:	04 Hours/Week	End Semester Examination	60 Marks	Theory	04
Practical:	02 Hours/Week	Internal Assessment	40 Marks		
		Term work	50 Marks	Practical	01
		Total	150 Marks	Total	05

Course Objective:

- To present the Digital fundamentals, Boolean algebra and its applications in digital systems
- To familiarize with the design of various combinational digital circuits using logic gates
- To introduce the analysis and design procedures for synchronous and asynchronous sequential circuits
- To understand the various semiconductor memories and related technology

Prerequisite:
Mathematics and Elementary Physics

Course Outcomes: On completion of the course, students will have the ability to:

1. Comprehend different number systems and Boolean algebraic principles.
2. Apply logic design minimization techniques to simplify Boolean expressions
3. Analyse and design combinational logic circuits.
4. Demonstrate the operations of systems with sequential circuit elements.
5. Comprehend characteristics and structure of Programmable Logic Devices and Memory.
6. Draw ASM charts for sequential circuit design.

Unit I **08 Hours**

Digital systems: Number Systems: Introduction to Number Systems-Decimal, Binary, Octal, Hexadecimal, Conversion of number system, Representation of Negative Numbers, 1's complement and 2's complement.
Binary Arithmetic: Binary addition, Binary subtraction, Subtraction using 1's complement and 2's complement, Binary multiplication, and division.
Digital Codes: BCD code, Excess-3 code, Gray code and ASCII code.
Logic Gates: Logical Operators, Logic Gates-Basic Gates, Universal Gates, realization of other gates using universal gates.

Unit II **08 Hours**

Logic Design Minimization: Boolean algebra, De Morgan's Theorems, Standard representation of logic functions, Sum of Product (SOP) form, Product of Sum (POS) form, Simplification of logical functions, Minimization of SOP and POS forms using Karnaugh-Maps up to 4 variables Don't care condition, Quine-McCluskey Method.

Unit III **08 Hours**

Combinational Circuits: Binary and BCD arithmetic, Half Adder, Full Adder, Half Subtractor, Full Subtractor, Binary Adder (IC 7483), BCD adder, Code converters Multiplexers, De multiplexer, Decoder (IC 74138) and their use in combinational logic design, Priority Encoder, Digital Comparators, Parity generators and Checker(IC 74180), ALU

Unit IV **08 Hours**

Sequential Circuits: Flip- flop: SR, JK, D, T flip flops, Truth Tables and Excitation tables, Conversion from one type to another type of Flip Flop.
Registers: Buffer register, Shift register.
Counters: Asynchronous counters, Synchronous counters, Modulus counters

Unit V **08 Hours**

FSM and ASM charts: Introduction to FSM, Moore and Mealy State machine, state machine as a sequential controller. Design of state machines: state table, state assignment, transition/excitation table, excitation maps and equations, logic realization, ASM chart notations, ASM block, State diagram, ASM chart for sequential circuits, Multiplexer Controller.

Unit VI **08 Hours**

Memory and PLD: Semiconductor memories: memory organization, memory expansion, Classification and characteristics of memories, RAM, ROM, EPROM, EEPROM, NVRAM, SRAM, DRAM.

Programmable logic devices: Study of PROM, PAL, PLAs. Architecture of PLA, Designing combinational circuits using PLDs.

Textbooks:

1. M. Morris Mano and M. D. Ciletti, Digital Design, Pearson Education.
2. RP Jain, Modern Digital Electronics, Tata McGraw Hill Publication.
3. F.J. Hill and G.L. Peterson, Switching Theory and Logic Design, John Wiley
4. J.F.Wakerly "Digital Design: Principles and Practices", 3rd edition, 4th reprint, Pearson Education, 2

Reference Books:

1. David J. Comer, Digital Logic & State Machine Design, Oxford University Press.
2. Digital Integrated Electronics- H. Taub&D.Shilling, McGraw Hill.

List of Assignments:

Six assignments to be given by the course coordinator (Theory)-one from each unit

Project Based Learning

1. Survey report of basic gates ICs 7432, 4011, 4050, 4070,4071,4010
2. Implement combinational logic Circuit of given Boolean Equation.
3. Implement Half Adder and Half Subtractor.
4. Implement Full Adder using two Half Adders
5. Build 4-bit parallel Adder / Subtractor using IC.
6. Build Code Converters: Binary to Gray
7. Build Code Converters: Excess 3 to Binary)
8. Implement Two Bit Magnitude Comparator using IC 7485
9. Implement given combinational logic using MUX
10. Implement 7 segment decoder driver using IC 7447.
11. Build a Decade counter and Up-Down Counter.
12. Build a Shift Registers: SISO and SIPO
13. Implement the Johnson Counter and Ring Counter.
14. Survey Report on Static I/O and transfer Characteristic of TTL and CMOS.
15. Implement given Boolean Function using PLA.(Function and Equation will be given by Subject Teacher)

(Note:- *Students in a group of 3 to 4 shall complete any one project from the above list)

List of Laboratory Exercises:

1. Verify truth tables of logic gates. (AND, OR, XOR, NOT, NAND, NOR). Simplify the given Boolean expression using K-map and implement using gates
2. State De-Morgan's theorem and write Boolean laws. Implement NAND and NOR as Universal gates.
3. Design (truth table, K-map) and implement half and full adder/ subtractor.
4. Design (truth table, K-map) and implement 4-bit BCD to Excess-3 Code converters.
5. Study of magnitude Comparator using IC 7485
6. Implement of logic functions using multiplexer IC 74151 (Verification, cascading & logic function implementation)
7. Implement logic functions using 3:8 decoder IC 74138.
8. Verify truth tables of different types of flip flops.

9. Design (State diagram, state table & K map) and implement 3 bit Up and Down Asynchronous and Synchronous Counter using JK flip-flop
10. Design and implement modulo ‘n’ counter with IC 7490.

Syllabus for Unit Tests:

Unit Test -1	Unit – I, Unit – II, Unit - III
Unit Test -2	Unit – IV, Unit – V, Unit – VI

Programming and Problem Solving

Teaching Scheme		Examination Scheme		Credit Scheme	
	Hours/Week		Marks		Credits
Theory:	04 Hours/Week	End Semester Examination	60 Marks	Theory	04
Practical:	02 Hours/Week	Internal Assessment	40 Marks		
		Term Work	50 Marks	Practical	01
		Practical	50 Marks		
		Total	200 Marks	Total	05

Course Objective:

The course is designed to provide complete knowledge of C language. Students will be able to develop logics which will help them to create programs, applications in C. Also by learning the basic programming constructs they can easily switch over to any other language in future.

Prerequisite:

Basic knowledge of mathematics.

Course Outcomes: On completion of the course, students will have the ability to:

1. Describe the steps in problem-solvingand write a pseudocode for a given problem.
2. Identify the suitable control structure and write a C code for the same.
3. Write the C code for a given algorithm.
4. Illustrate use of pointers and functions
5. Write programs that perform operations using derived data types.
6. Validate the logic building and code formulation by designing code capable of passing various test cases

Unit I **08 Hours**

Introduction to Computer Problem Solving: The problem solving Aspect, Top Down Design, Implementation of Algorithms, Program Verification, The Efficiency of Algorithms, The Analysis of Algorithms, Fundamental Algorithms:
General problem solving strategies: Introduction to program Planning tools- algorithm, flowcharts, and pseudo codes. Introduction to Programming Logic.

Unit II **08 Hours**

Control structures: Features of C, basic concepts, structure of C program, program, declarations, variables, data types, expressions, operators assignment, arithmetic, relational, logical, increment and decrement, precedence of operators, type conversions, scanf and printf functions if-else, nested if-else, ladder if-else and switch statement. C Conditional control structures: for, while do-while Unconditional control structures: break, continue, goto statement.

Unit III **08 Hours**

Arrays and strings: Declaration initialization of one dimensional Array, two dimensional array, accessing array elements, Character Array/String, Character - Handling Library Functions, Standard Input/Output Library Functions for string.

Unit IV **08 Hours**

Functions and structures: What is a Function , Benefits of a Function , Function Terminology , Array of Structures, How does Function Works , Scope and Lifetime of Variables in function ,Storage Classes of Variables , Call by value and call by reference ,Recursion ,Overview of Structures , Defining and Using a Structure , Structures within a Structure.

Unit V **08 Hours**

Pointers: Declaring and Initializing Pointers, Function and Pointer Parameters, Pointer Arithmetic, Pointer and Arrays, Two Dimensional Arrays and Pointers.

Unit VI **08 Hours**

Files : FILE , Opening and Closing of Files , Writing and Reading in Text Format, Writing and Reading in Binary Format, Command Line Arguments

Textbooks:

1. Let Us C by YashavantKanetkar, 13e, BPB Publication.
2. BrainW. Kernighan& Dennis Ritchie, C Programming Language, 2nd edition, PHI.
3. E.Balaguruswamy, Programming in ANSI C 5th Edition McGraw-Hill.
4. How to Solve it by Computer by R. G. Dromey, 1e, Pearson Education.

Reference Books:

1. C: The Complete Reference by Herbert Schildt.

List of Assignments:

1. Write a pseudocode and draw a flowchart for a given problem.
2. Justify the selection of appropriate control structure
3. Write a function to check whether the string is palindrome.
4. List and explain the working of standard string I/O functions.
5. Define a dynamic array to store the student record.
6. List and explain the different modes of opening file.

Project Based Learning

1. Calendar using C
2. Snake Game
3. Cricket score display
4. Quiz game
5. Phone-book application
6. Election System
7. Simple Result system
8. Typing Tutor
9. Bill Calculator
10. Grade Calculator
11. CGPA Calculator
12. Digital Clock
13. Contact Management System
14. IP finder
15. Bank Management System.
16. Departmental Store Management.
17. Hangman Game Project.
18. Librar Management System

List of Laboratory Exercises:

1. Describe the problem-solving steps.
2. Write a pseudocode and draw a flowchart.
3. Use mathematical operators and basic data types.
4. Demonstrate use of control structures.
5. Demonstrate use of logical operators.
6. Solve the real time problem using single and two dimensional array.
7. Perform the operations on string.
8. Solve the problems using recursive and non-recursive functions.
9. Solve the problems using dynamic memory allocations.
10. Perform the operations on files.

Syllabus for Unit Tests:

Unit Test -1	Unit – I, Unit – II, Unit - III

Computer Aided Drafting

Teaching Scheme		Examination Scheme		Credit Scheme	
Hours/Week			Marks		Credits
Practical:	**02 Hours/Week**	**Term Work**	**25 Marks**	**Practical**	**01**
		Total	**25 Marks**	**Total**	**01**

Course Objectives:
To provide knowledge about

- Fundamentals of engineering drawing and curves
- Isometric views and projection
- Projections of points, lines, planes & solids
- Use of CAD tools.

Prerequisite:
Basics of Mathematics at Secondary School Level

Course Outcomes: On completion of the course, students will have the ability to:

1. Understand dimensioning methods and drawing of engineering curves.
2. Draw orthographic projections using 1st angle method of projection.
3. Draw Isometric views from given orthographic projections.
4. Draw projection of Lines, its traces and projections of planes.
5. Draw projection of different solids.
6. Draw development of lateral surfaces of solids.

Unit I **04 Hours**

Lines and Dimensioning in Engineering Drawing and Engineering Curves: Different types of lines used in drawing practice, Dimensioning–linear, angular, aligned system, unidirectional system, parallel dimensioning, chain dimensioning, location dimension and size dimension.
Ellipse by Arcs of Circles method, Concentric circles method. Involutes of a circle, Cycloid.
Introduction to Auto CAD commands.

Unit II **04 Hours**

Orthographic Projections: Basic principles of orthographic projection (First and Third angle method). Orthographic projection of objects by first angle projection method only. Procedure for preparing scaled drawing, sectional views and types of cutting planes and their representation, hatching of sections.(Using AutoCAD commands)

Unit III **04 Hours**

Isometric Projections: Isometric view, Isometric scale to draw Isometric projection, Non-Isometric lines, and construction of Isometric view from given orthographic views and to construct Isometric view.(Using AutoCAD commands)

Unit IV **04 Hours**

Projections of Points & Lines: Projections of points, projections of lines, lines inclined to one reference plane, Lines inclined to both reference planes. (Lines in First Quadrant Only). (Using AutoCAD commands).

Unit V **04 Hours**

Projections of Planes: Projections of Planes, Inclination of the plane with HP, VP. (Using AutoCAD commands)

Unit VI **04 Hours**

Projections of Solids: Projection of prism, pyramid, cone and cylinder by rotation method. (Using AutoCAD commands)

T**extbooks:**

1. "Elementary Engineering Drawing", N. D. Bhatt, Charotar Publishing house, Anand India,
2. "AutoCAD 2020 Beginning and Intermediate", MunirHamad, Mercury Learning & Information Publication, 2019.
3. "Engineering Drawing and Graphics", Venugopal K., New Age International publishers.

Reference Books:

1. "Textbook on Engineering Drawing", K. L. Narayana& P. Kannaiah, Scitech Publications, Chennai.
2. "Fundamentals of Engineering Drawing", Warren J. Luzzader, Prentice Hall of India, New Delhi.
3. "Engineering Drawing", M. B. Shah and B.C. Rana,1st Ed, Pearson Education, 2005.
4. "Engineering Drawing", P. J. Shah, C. Jamnadasand Co., 1stEdition,1988.
5. "Engineering Drawing (Geometrical Drawing)", P. S. Gill, 10thEdition, S. K. Kataria and Sons, 2005.

List of Laboratory Exercises:

1. Types of lines, Dimensioning practice, free-hand lettering, 1ndand 3rdangle methods symbol.
2. Engineering curves.
3. Orthographic Projections.
4. Isometric views.
5. Projections of Points and Lines and planes.
6. Projection of Solids.

B.TECH (Computer Science and Engineering)

SEMESTER – II

COURSE SYLLABUS

Mathematics for Computing - II

Teaching Scheme		Examination Scheme		Credit Scheme	
	Hours/Week		Marks		Credits
Theory:	03 Hours/Week	End Semester Examination	60 Marks	Theory	03
Tutorial:	01 Hours/Week	Internal Assessment	40 Marks	Tutorial	01
		Total	100 Marks	Total	04

Course Objectives:

- Fourier series and integral transforms.
- Multiple integrals and its applications.
- Vector calculus and its applications.

Prerequisite:
The students should have knowledge of vector algebra, derivative and integration.

Course Outcomes: On completion of the course, students will have the ability to:

1. Use periodic functions as Fourier series.
2. Apply methods of finding Fourier and Z-transforms.
3. Apply methods of Laplace transform of piecewise continuous functions.
4. Identify concepts of double and triple integrals.
5. Apply vector derivative for physical quantities.
6. Evaluate line, surface and volume integrals.

Unit I **06 Hours**

Fourier Series: Definition, Dirichlet's conditions, Fourier Series and Half Range Fourier Series, Harmonic Analysis

Unit II **06 Hours**

Fourier and Z-Transform: Fourier Transform (FT): Complex Exponential Form of Fourier series, Fourier Integral Theorem, Sine & Cosine Integrals, Fourier Transform, Fourier Sine and Cosine Transform and their Inverses. Introductory
Z-Transform (ZT): Definition, Standard Properties, ZT of Standard Sequences and their Inverses. Solution of Simple Difference Equations.

Unit III **06 Hours**

Laplace Transform and its application: Definition of LT, Inverse LT. Properties & theorems. LT of standard functions. LT of some special functions viz., Periodic, Unit Step, Unit Impulse, ramp, jump,. Problems on finding LT & inverse LT. Applications of LT and Inverse LT for solving ordinary differential equations.

Unit IV **06 Hours**

Multiple Integrals and their Application: Double and Triple integrations, Applications to Area, Volume, Mean and Root Mean Square Values, moment of inertia, centre of gravity

Unit V **06 Hours**

Vector Differential Calculus: Physical interpretation of Vector differentiation, Vector differential operator, Gradient, Divergence and Curl, Directional derivative, Solenoidal, Irrotational and Conservative fields, Scalar potential, Vector identities.

Unit VI **06 Hours**

Vector Integral Calculus and Applications: Line, Surface and Volume integrals, Work-done, Green's Lemma, Gauss's Divergence theorem, Stoke's theorem. Applications to problem in engineering.

Textbooks:

1. P. N. Wartikar and J. N. Wartikar, Applied Mathematics (Volumes I and II), 7th Ed., Pune VidyarthiGrihaPrakashan, Pune, 2013.
2. B. S. Grewal, Higher Engineering Mathematics, 42nd Ed., Khanna Publication, Delhi
3. B.V. Ramana, Higher Engineering Mathematics, 6th Ed., Tata McGraw-Hill, New Delhi, 2008.

Reference Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10th Ed., John Wiley & Sons, Inc., 2015.
2. Peter V. O'Neil, Advanced Engineering Mathematics, 7th Ed., Cengage Learning, 2012.

List of Assignments:

Six assignments to be given by the course coordinator one from each unit.

Project Based Learning

Students are expected prepare report on any one topic, write its definition, applications and illustrate with few examples. Also, write pseudo code for it, wherever applicable.

1. Fourier series
2. Harmonic analysis
3. Fourier transform
4. Z-Transform
5. Laplace transform technique to solve ODE
6. Multiple Integral to evaluate area and volume
7. Directional derivative
8. Divergence and curl
9. Greens theorem
10. Gauss Divergence Theorem
11. Stokes theorem
12. Unit step function
13. Solenoidal and irrotational fields
14. Simple difference equation
15. Periodic functions

Note: -*Students in a group of 3 to 4 shall complete any one project from the above list.

Syllabus for Unit Tests:

Unit Test -1	Unit – I, Unit – II, Unit - III
Unit Test -2	Unit – IV, Unit – V, Unit - VI

Probability and Statistics

TEACHING SCHEME		EXAMINATION SCHEME	CREDIT SCHEME	
				Credits
Lecture:	**4 Hours/Week**	**End Semester Examination: 60 Marks**	**Theory**	**4**
Practical:	**2 Hours/Week**	**Internal Assessment: 40 Marks**		
		Term Work : 25 Marks	**Practical**	**1**
		Practical: 25 Marks		
		Total: 150 Marks	**Total**	**5**

Course Objectives:

- Probability theory and expected value.
- Probability distribution and its applications.
- Multiple regression and ANOVA.

Course Outcomes: On completion of the course, students will have the ability to:

1. Apply Bayes theorem to find probability.
2. Compute mathematical expectations.
3. Identify various theoretical distributions.
4. Use correlation coefficient to interpret numerical data.
5. Use regression to estimate the dependent variable.
6. Apply concept of graph in optimization.

Unit I **08 Hours**

Probability Theory: Definition of probability: classical, empirical, and axiomatic approach of probability, Addition theorem of probability, Multiplication theorem of probability, Bayes' theorem of inverse probability, Properties of probabilities

Unit II **08 Hours**

Random Variable and Mathematical Expectation. Definition of random variables, Probability distributions, Probability mass function, Probability density function, Mathematical expectation, Join and marginal probability distributions, Properties of expectation and variance with proofs, Examples

Unit III **08 Hours**

Theoretical Probability Distributions: Binomial distribution, Poisson distribution, Normal distribution, Fitting of binomial distributions, Properties of binomial, Poisson and normal distributions, Relation between binomial and normal distributions, Relation between Poisson and normal distributions, Importance of normal distribution

Unit IV **08 Hours**

Correlation: Introduction, Types of correlation, Correlation and causation, Methods of studying correlation, Karl Pearson's correlation coefficient, Spearman's rank correlation, Coefficient, Properties of Karl Pearson's correlation coefficient, Properties of Spearman's rank correlation coefficient, Probable errors, Examples...

Unit V **08 Hours**

Linear Regression Analysis: Introduction, Linear and non-linear regression, Lines of regression, Derivation of regression lines of y on x and x on y, Angle between the regression lines, Coefficients of regression, Theorems on regression coefficient, Properties of regression coefficient

Unit VI **08 Hours**

Multiple Regression and AVOVA: Multiple regression & multiple correlation, Analysis of variance (one way, two way with as well as without interaction)

Textbooks

1.S. C. Gupta, "Fundamentals of Statistics", 46th Edition, Himalaya Publishing House.
2.G. V. Kumbhojkar, "Probability and Random Processes", 14th Edition, C. Jamnadas and company.
3.Murray Spiegel, John Schiller, R. ALU Srinivasan, Probability and Statistics, Schaum's Outlines
Kishor S. Trivedi, "Probability, Statistics with Reliability, Queuing and Computer Science Applications", 2nd Edition, Wiley India Pvt. Ltd.
5.Vijay K. Rohatgi, A. K. Md. Ehsanes Saleh, An Introduction to Probability And Statistics, 3rd Edition, Wiley Publication
6.I.R. Miller, J.E. Freund and R. Johnson. Fun “Probability and Statistics for Engineers” (4th E dition)

List of Theory Assignments

One assignment on each unit

Project Based Learning

Students are expected prepare report on any one topic, write its definition, applications and analyse the hypothetical data. Also, write pseudo code for it, wherever applicable.

1. Bayes theorem
2. Additive and multiplicative law of probability
3. Mathematical expectation
4. Joint and marginal probability distribution
5. Theoretical probability distribution
6. Coefficient of correlation
7. Regression estimates
8. Simple regression model
9. Multiple regression model
10. One way ANOVA
11. Two way ANOVA
12. Correlation
13. Multiple correlation

Note: - *Students in a group of 3 to 4 shall complete any one project from the above list.

List of Laboratory Experiments (The course co-ordinator may frame 8-10 experiments)

Syllabus for Unit Tests:

Unit Test -1	Unit – I, Unit – II, Unit - III
Unit Test -2	Unit – IV, Unit – V, Unit - VI

Physics for Computing Systems

Teaching Scheme		Examination Scheme		Credit Scheme	
	Hours/Week		Marks		Credits
Theory:	03 Hours/Week	End Semester Examination	60 Marks	Theory	03
Practical:	02 Hours/Week	Internal Assessment	40 Marks		
		Term work	25 Marks	Practical	01
		Total	125 Marks	Total	04

Course Objective:

To impart knowledge of basic concepts in physics relevant to engineering applications in a broader sense with a view to lay foundation for the Computer Engineering and Science.

Prerequisite:

Basic understanding of physics and calculus.

Course Outcomes: On completion of the course, students will have the ability to:

1. Interpret the properties of charged particles to develop modern instruments such as electron microscopy.
2. Appraise the wave nature of light and apply it to measure stress, pressure, and dimension etc.
3. Summarise the structure and properties of lasers to their performance and intended applications.
4. Classify the optical fiber, understanding the structure, types, and its applications in the field of communication.
5. Solve quantum physics problems to micro level phenomena and solid-state physics
6. Explain mechanical properties of solid matter and connect to applications in the field of engineering.

Unit I **06 Hours**

Modern Physics Motion of a charged particle in electric and magnetic fields, Electrostatic and Magnetostatic focusing, Electron microscope, Wavelength and resolution, Specimen limitation, Depth of field and focus, Transmission electron microscope (TEM), Scanning electron microscope (SEM), Separation of isotopes by Bainbridge mass spectrograph, Cathode ray tube (CRT).

Unit II **06 Hours**

Wave Optics: Interference of waves, interference due to thin film (Uniform and nonuniform (only formula-no derivation is expected), Newton's ring, Applications of interference (optical flatness, highly reflecting films, non-reflecting coatings). Diffraction Introduction, Classes of diffraction, Diffraction at a single slit (Geometrical method), Conditions for maximum and minimum, Plane diffraction grating, Conditions for principal maxima and minima Polarisation, Introduction, Double refraction and Huygen's theory, Positive and negative crystals, Nicol prism, Dichroism.

Unit III **06 Hours**

Lasers : Principle of laser, Einstein's coefficients, Spontaneous and stimulated emission, Population inversion, Ruby laser, Helium-Neon laser, Semiconductor laser, Single Hetro-junction laser, Gas laser: CO2 laser, Properties of lasers, Laser speckles, Applications of lasers (Engineering/ industry, medicine, Computers)

Unit IV **06 Hours**

Fibre Optic: Principle of fibre optics, Construction, Numerical Aperture for step index fibre; critical angle, angle of acceptance, V number, number of modes of propagation, types of optical fibres, Fibre optic communication system, advantages, and disadvantages of fibre optics.

Unit V **06 Hours**

Quantum Mechanics: Dual nature of matter, DeBroglie's hypothesis, Heisenberg's uncertainty principle with illustrations, Physical significance of wave function, Schrodinger's time dependant and time independent wave equation, Application of Schrodinger's time independent wave equation to the problems of Particle in a rigid box, step potential and potential barrier (analytical discussion), tunnelling effect.

Unit VI **06 Hours**

Solid state physics: Free electron theory, Density of states, Bloch theorem (Statement only), Origin of band gap, Energy bands in solids, Effective mass of electron, Fermi-Dirac probability function and position of Fermi level in intrinsic semi-conductors (with derivation) and in extrinsic semi-conductors, Band structure of p-n junction diode under forward and reverse biasing, Conductivity in conductor and semi-conductor, Hall effect and Hall coefficient, Photovoltaic effect, Solar cell and its characteristics.

Textbooks:

1. A Textbook of Engineering Physics, M N Avadhanulu, P G Kshirsagar and TVS Arun Murthy, S. Chand Publishing (2018)
2. Engineering Physics, R K Gaur and S L Gupta, DhanpatRai Publishing Co Pvt Ltd (2015)
3. Concepts of Modern Physics, Arthur Beiser, Shobhit Mahajan and S. Rai Choudhury, McGraw Hill Education (2017)

Reference Books:

1. Fundamentals of Physics, Jearl Walker, David Halliday and Robert Resnick, John Wiley and Sons (2013
2. Optics, Francis Jenkins and Harvey White, Tata McGraw Hill (2017)
3. Principles of Physics, John W. Jewett, Cengage publishing (2013
4. Introduction to Solid State Physics, C. Kittel, Wiley and Sons (2004)
5. Principles of Solid State Physics, H. V. Keer, New Age International (1993)
6. Laser and Non-Linear Optics, B. B. Laud, New Age International Private Limited (2011)
7. Nanotechnology: Principles and Practices, Dr. S. K. Kulkarni, Capital Publishing Company (2014)
8. Science of Engineering Materials- C.M. Srivastava and C. Srinivasan, New Age International Pvt. Ltd. (1997)
9. Introduction to Electrodynamics –David R. Griffiths, Pearson (2013
10. Renewable Energy: Power for a Sustainable Future, Boyle, Oxford University Press (2012)

List of Assignments:

Six assignments to be given by the course coordinator (Theory)-one from each unit/one mini project with report-students can work in group of 4 Maximum

Project Based Learning

1. Measurement and effect of environmental noise in the college
2. Design and simulation of automatic solar powered time regulated water pumping
3. Solar technology: an alternative source of energy for national development
4. Design and construction of digital distance measuring instrument
5. Design and construction of automatic bell ringer
6. Design and construction of remote control fan
7. Design and construction of sound or clap activated alarm
8. Electronic eye (Laser Security) as autos witch/security system
9. Electric power generation by road power
10. Determination of absorption coefficient of sound absorbing materials
11. Determination of velocity of O-ray and E-ray in different double refracting Materials.

12. Need of medium for propagation of sound wave
13. Tesla Coil
14. Thin film interference in soap film-formation of colours
15. LiFi- wireless data transfer system using light

Note: -*Students in a group of 3 to 4 shall complete any one project from the above list)

List of Laboratory Exercises:

1. Study of lissajous figure by Cathode Ray Oscilloscope (CRO)
2. Determination of e/m by Thomson method
3. Determination of radius of planoconvex lens/wavelength of light/Flatness testing by Newton's rings
4. Determination of wavelength of light using diffraction grating
5. Determination of resolving power of telescope
6. Determination of thickness of a thin wire by air wedge
7. Determination of refractive index for O-ray and E-ray
8. Determination of divergence of a laser beam
9. Particle size by semiconductor laser
10. Determination of wavelength of laser by diffraction grating
11. To study Hall effect and determine the Hall volatge
12. Calculation of conductivity by four probe method
13. Study of solar cell characteristics and calculation of fill factor
14. Determination of band gap of semiconductor
15. Determination of Planck's Constant by photoelectric effect

Syllabus for Unit Tests:

Unit Test -1	Unit:- Unit -I, Unit-II Unit-III
Unit Test -2	Unit – IV, Unit – V, Unit - VI

Electrical Technology

Teaching Scheme		Examination Scheme		Credit Scheme	
	Hours/Week		Marks		Credits
Theory:	04 Hours/Week	End Semester Examination	60 Marks	Theory	04
Practical:	02 Hours/Week	Internal Assessment	40 Marks		
		Term work	25 Marks	Practical	01
		Total	125 Marks	Total	05

Course Objective:

To study of power system basics, magnetic circuits electrical machines, transformers, wiring, measurements, illumination and batteries.

Prerequisite: NIL

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Course Outcomes: On completion of the course, students will have the ability to:

1. Explain the various parameters related to magnetic circuit.
2. Describe basic concepts of AC fundamentals and circuits.
3. Illustrate constructional features and describe different parameters of transformer.
4. Describe basic concepts of power system and three phase circuits.
5. Demonstrate AC and DC electrical machines.
6. Classify types of batteries.

Unit I **08 Hours**

Magnetic Circuits:Magnetic effect of electric current, Cross & DotConvention, Right hand thumb rule, Concept of flux, flux linkages, magnetic field, magnetic field strength, magnetic field intensity, absolute permeability, relative permeability Kirchhoff's laws for magnetic circuits. Magnetic circuit concepts, analogy between electric& magnetic circuits, magnetic circuits with DC and AC excitations, magnetic leakage, B-H curve, hysteresis and eddy current losses, magnetic circuit calculations, mutual coupling.

Unit II **08 Hours**

AC Fundamentals and circuits:AC Fundamentals: Sinusoidal, square and triangular waveforms – average and effective values, form and peak factors, concept of phasor, phasor representation of sinusoidally varying voltage and current. Analysis of series, parallel and series-parallel RLC Circuits: apparent, active & reactive powers, power factor, causes and problems of low power factor, power factor improvement; resonance in series and parallel circuits, bandwidth and quality factor (simple numerical problems.

Unit III **08 Hours**

Single Phase Transformer: Faradays law of electromagnetic induction, statically and dynamically induced emf, self-inductance, mutual inductance , coefficient of coupling. Single Phase Transformer: Principle of operation, construction, e .m. f. equation, voltage ratio, current ratio, KVA rating ,determination of efficiency and regulation by direct load test, equivalent circuit, power losses,(simple numerical problems), introduction to auto transformer. Three phase transformer and its different winding connections.

Unit IV **08 Hours**

Introduction to Power System and Three Phase: Circuits: General layout of electrical power system and functions of its elements, standard transmission and distribution voltages, concept of grid (elementary treatment only) Power generation to distribution through overhead lines and underground cables with single line diagram. Three phase system-its necessity and advantages, meaning of phase sequence, star and delta connections, balanced supply and balanced load, line and phase voltage/current relations, three phase power and its measurement (simple numerical problems).

Unit V **08 Hours**

Electrical Machines: DC & AC:Principles of electromechanical energy conversion, DC machines: types, e. m. f. equation of generator and torque equation of motor, characteristics, and applications of dc motors (simple numerical problems). single Phase Induction motor: Principle of operation and introduction to methods of starting, applications. Three Phase Induction Motor: types, Principle of operation, slip-torque characteristics, applications (numerical problems related to slip only).

Unit VI **08 Hours**

Batteries: Basic idea of primary and secondary cells, Construction, working principle and applications of Lead-Acid, Nickel Cadmium and Silver-Oxide batteries, charging methods used for lead-acid battery (accumulator), Care and maintenance of lead-acid battery, Series and parallel connections of batteries, General idea of solar cells, solar panels and their applications, Introduction to maintenance free batteries, Safe disposal of Batteries; Fuel cell: Principle & Types of fuel cell.

Textbooks:

1. B.L.Theraja, A Textbook of Electrical Technology, Vol.1, S.Chand& Company Ltd. New Delhi
2. V.K.Mehta, Basic Electrical Engineering, S Chand & Company Ltd. New Delhi.
3. J.Nagarath and Kothari, Theroy and applications of Basic Electrical Engineering, Prentice Hall of India Pvt. Ltd.

Reference Books:

1. Electrical Technology - Edward Huges (Pearson
2. Basic Electrical Engineering - D. P. Kothari, J Nagarath (TMC)
3. Electrical power system technology - S. W. Fordo, D. R. Patric (Prentice Hall)
4. Electrical, Electronics Measurements and Instruments - (SatyaPrakashan)

List of Assignments:

Six assignments to be given by the course coordinator (Theory)-one from each unit.

Project Based Learning

1. Building a small resistive load lamp bank
2. Building a small resistive load lamp bank for various types of connections like series, parallel, star, delta
3. Building a small inductive load lamp bank for various types of connections like series, parallel, star, delta
4. Building a small capacitive load lamp bank for various types of connections like series, parallel, star, delta
5. Building a small resistive load lamp bank
6. Building a staircase wiring model on a board
7. Building a Go down wiring model on a board
8. Rewinding of a choke
9. Rewinding of a small transformer
10. Building a small rectifier circuit on bread board
11. Building a mobile charger circuit on a bread board
12. Building an electric buzzer circuit
13. Building a solar charger for mobile phone
14. Building a small wind turbine
15. Small Agricultural pump model with DC motor
16. Small Agricultural pump model with AC motor

(Note:- *Students in a group of 3 to 4 shall complete any one project from the above list)

List of Laboratory Exercises:

1. Plotting B-H characteristics for a material.
2. Load test on single phase transformer.
3. Testing and maintenance of batteries.
4. Verification of voltage and current relationships in star and delta connected 3-phase networks.
5. Load test on DC machine.
6. To find the performance of series R-L-C circuit at different condition
7. OS & SC test on single phase transformer to find efficiency and regulation
8. Speed control of DC motor
9. Study of different types of starters for DC & AC Machine
10. Load test on 3 phase Induction motor.

Syllabus for Unit Tests:

Unit Test -1	Unit – I, Unit – II, Unit - III
Unit Test -2	Unit – IV, Unit – V, Unit - VI

Linear Data Structures

Teaching Scheme		Examination Scheme		Credit Scheme	
	Hours/Week		Marks		Credits
Theory:	04 Hours/Week	End Semester Examination	60 Marks	Theory	04
Practical:	04 Hours/Week	Internal Assessment	40 Marks		
		Term Work	50 Marks	Practical	02
		Practical	50 Marks		
		Total	200 Marks	Total	06

Course Objective:
The objective of the course is to provide the students in-depth knowledge of different Linear Data structures and their use to solve the programming problems.

Prerequisite: Basic knowledge of computer

Course Outcomes: On completion of the course, students will have the ability to:

1. Use appropriate data structure to solve a particular problem
2. Demonstrate the use of linked list and compare it with array.
3. Demonstrate the use of stack as an ADT.
4. Perform the operations on queue.
5. Apply the searching and sorting algorithms
6. Demonstrate the use of Files and different File Organizations

Unit I **08 Hours**

Introduction to Data structures: Introduction to algorithm, Algorithm analysis, Big O Notations, Need of Data structure, Classification of Data Structures, Operations on Data Structures. **Arrays:** Introduction, Array Operations, representation of Arrays in Memory, One- & Two-dimensional array in function, Implementation of One- & Two-Dimensional Arrays in Memory, Abstract Data Types.

Unit II **08 Hours**

Linear Lists: Introduction, Singly linked list, Circularly Linked List, Doubly Linked lists, Basic operations, - Insertion, Deletion, retrieval, traversal, create List, insert node, delete node, List Search, Empty list, Destroy list, Applications of Linked List

Unit III **08 Hours**

Stacks: Stack Structure, Operations on Stacks – create stack, Push stack, Pop stack, Array and Linked Representation, operations (For both array and Linked representation),Types of Notations, Applications of Stack: Reversing Data, Converts Decimal to Binary, Parsing, Postponement.

Unit IV **08 Hours**

Queue: Introduction, Definition, Storage Methods Queue Operations- Enqueue, Dequeue, Queue front, Queue rear, Queue Example, Create Queue, priority Queue, Circular Queue, Application of Queue: Categorising Data, Queue. Simulation, Array and Linked representation of queue (operations on array and Linked representation.

Unit V **08 Hours**

Implementation &Application: Searching: Linear Search, Binary Search, Hashing: Introduction. Hash Tables, Hash Functions, Collision, Applications
Sorting – Selection Sort, Bubble Sort, Insertion Sort, Merge Quick Sort, Shell Sort

Unit VI **08 Hours**

Files and Organization: Introduction, Data Hierarch, FileAttributes, Text and Binary Files, Basic File Operations, File Organization, Sequential Organization, Relative File Organization, Indexed Sequential File `Organization.

Textbooks:

1. Richard F Gilberg&Behrouz A Forouzan, Data Structures (A PseudocodeApproach with C), second edition, Cengage Learning, 2004.
2. PAI, Data Structures, Tata McGraw-Hill Education, 2008
3. Data Structures Using C, ReemaThareja, OXFORD University Press

Reference Books:

1. Mayank Patel, Data Structure and Algorithm With C, Educreation Publishing, 2018
2. Thomas H. Cormen, Charles E Leiserson, Ronald L Rivest, Clifford Stein, Introduction to Algorithms, MIT Press, 2001.

List of Assignments:

1. Write an algorithm for a given problem and analyse it's complexity
2. Describe representation of a linked list in the memory and Write a pseudocode to perform deletion operation on list.
3. Illustrate the use of stack to solve the Tower of Hanoi problem.
4. Write a pseudocode to perform operations on priority queue.
5. Compare bubble sort and selection sort
6. Describe the sequential file organization.

Project Based Learning

1. Expression Evaluation
2. Traffic Management System
3. Library Management System for a small library in a department
4. Employee Record System
5. Dictionary
6. Calendar Application
7. Medical Store Management System
8. Cricket Score Sheet
9. Bank Management System that handles only savings account
10. Ticket booking system for bus

(Note:- *Students in a group of 3 to 4 shall complete any one project from the above list)

List of Laboratory Exercises:

1. Use of array and operations on Array.
2. Operations on singly and doubly linked list.
3. Polynomial operations using linked list.
4. Create stack and demonstrate it's use.
5. Develop a priority queue and perform the operations.
6. Demonstrate the use of different file organizations.

Syllabus for Unit Tests:

Unit Test -1	Unit – I, Unit – II, Unit - III
Unit Test -2	Unit – IV, Unit – V, Unit - VI

Computer System Workshop Technology

Teaching Scheme		Examination Scheme		Credit Scheme	
	Hours/Week		Marks		Credits
Practical:	02 Hours/Week	Term Work	25 Marks	Practical	1
		Practical	25 Marks		
		Total	50 Marks	Total	01

Course Objective:
Provide student a much-needed knowledge of computer hardware and networking, enabling them to identify computer hardware, software and network related problems, and develop an ability to use the basics of computing, necessary for computing courses

Prerequisite:
Basic knowledge of Computer and Electronics.

Course Outcomes: On completion of the course, students will have the ability to:

1. Identify the architecture of a computer and its different components, including their technology evolution.
2. Apply their knowledge about computer peripherals to identify problems.
3. Install and uninstall given software step-by-step.
4. Learn the working of Internet.
5. Prepare document using Latex.
6. Learn GitHub tool for coding and collaboration.

Unit I **04 Hours**

Computer hardware peripherals: Introduction to hardware components, random access memory (ram), Types Of RAM & their speed, tips for buying ram, how to add memory to a computer, problems when installing memory, Central Processing Unit (CPU), Types Of CPU: considerations when buying a new CPU (Types & Differences), different speeds available for CPU and what do they mean, 32 Bit vs 64 Bit – Which One To Choose &Why? How to choose a CPU type for different needs? Graphic Card & Types, How to install a Graphics Card, Installing a CD or DVD burner, Jumper Switch settings, Hard Disk upgrade, Different ports and why we use them - USB, PS2, DivX, Graphic card & types, Virtual Memory and how to configure it for optimum system performance.

Unit II **04 Hours**

Assembly of Computer and Software Installations: Assembling the motherboard, Replacing fan, how to avoid common mistakes during assembly, Installation of system software: Operating system (Windows and Linux), Installations step for operating system, Dual booting, Configure the BIOS, Installation of Antivirus, Installation of the open source software such as Scilab, Latex Installation of Ms Office.

Unit III **04 Hours**

Basic Diagnostic of Hardware and Software : Diagnosis of Power Up problem, Boot Drive, Errant Keyboard, mouse problems, slow computer performance, Computer freezes and displays BSOD (Blue screen of death), no display on monitor, no sound, computer rebooting or turning itself off, how to troubleshoot a computer that does not boot, Registry Cleaner

Unit IV **04 Hours**

Computer network environments: Network connecting devices. Configure the TCP/IP setting, connect to Local Area Network and access the Internet, Configuring Wireless network. Server and Its Configuration, Email Clients, Browsers, Office tools, customize web browsers with the LAN proxy settings, bookmarks, search toolbars and pop-up blockers, Browsing netiquettes and cyber laws. Cloud Access Tools

Unit V **04 Hours**

Configuration of External devices: Physical set-up of Printers- Performing test print out, Printing of document etc, Scanner set-up, Webcam, Bluetooth device, Memory card reader etc

Unit VI **04 Hours**

Productivity tools: Open Source Tools Such as Latex, GitHubLaTeX: Format words, lines, and paragraphs, design pages, create lists, tables, references, and figures in LATEX. Introduction to LaTeX Packages and classes. Using Git, Version Control Systems, interacting with GitHub, Reverting Changes, Creating Pull Requests.

Textbooks:

1. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education.
2. PC Hardware and A Handbook – Kate J. Chase PHI (Microsoft).
3. LaTeX Companion – Leslie Lampert, PHI/Pearson.
4. https://nptel.ac.in/courses/106/105/106105081/.
5. http://nptel.ac.in/courses/106105084/.
6. https://guides.github.com/.
7. Introduction to Linux: Installation and Programming B Venkateswarlu, BS Publication.

Reference Books:

1. IT Essentials PC Hardware and Software Companion Guide Third Edition by David Anfinson and Ken Quamme. – CISCO Press, Pearson Education.
2. Computer Fundamentals, MS Office and Internet & Web Technology by Dinesh Maidasani.

Project Based Learning

1. Collect specifications of similar types of hardware and software and prepare report comparing them
2. Assembling and disassembling the PC back to working condition.
3. Installation of operating systems LINUX on Server and different packages on a PC.
4. Practice hardware troubleshooting exercises related to various components of computer like monitor, drives, memory devices, printers etc. and software troubleshooting related to BIOS etc
5. To start your own computer repair workshop. What would your initial planning involve? What would you look for in terms of building, furnishings, tools and any other equipment that you can think of?
6. Cyber Hygiene: Installing antivirus for Windows.
7. Prepare the report of need of programming language in 21st century.
8. Collect various types of computer hardware and prepare summary report
9. Prepare Seminar report using LaTex
10. Prepare Project report using LaText

(Note: -*Students in a group of 3 to 4 shall complete any one project from the above list)

List of Laboratory Exercises:

1. Demonstrate the Computer Hardware Components and explain its working.
2. Demonstrate the Networking Components and explain its working.
3. Installation of operating system MS windows, Unix on the personal computer
4. Installation of Application software Scilab, Latex, MS office on the personal computer
5. Troubleshooting hardware related problem.
6. Customize web browsers with the LAN proxy settings, bookmarks, search toolbars and pop up blockers. Also, plug-ins like Macromedia Flash and JRE for applets should be configured.
7. Execution of Important “layout” and formatting commands in Latex,
8. Installation of Antivirus and customize the browsers to block pop ups, block active x downloads to avoid viruses and/or worms
9. Assignment on Pull request, code review and collaboration using GitHub.

10. Demonstrate the Computer Hardware Components and explain its working.

B.TECH (Computer Science and Engineering)

SEMESTER – III

COURSE SYLLABUS

Non-Linear Data Structures

Teaching Scheme		Examination Scheme		Credit Scheme	
	Hours/Week		Marks		Credits
Theory:	03 Hours/Week	End Semester Examination	60 Marks	Theory	03
Practical:	02 Hours/Week	Internal Assessment	40 Marks	Tutorial	01
Tutorial:	01 Hours/Week	Term work	25 Marks	Practical	01
		Practical	25 Marks		
		Total	150 Marks	Total	05

Course Objective:
The objective of the course is to provide the students the knowledge of different Non-linear data structures and how to use these to solve real world problems.

Prerequisite:
Basic Knowledge of Algorithm, programming fundamentals, Data types.ADT, Linear data Structure.

Course Outcomes: On completion of the course, students will have the ability to:

1. Identify and Apply appropriate algorithms on the graph to solve real world problems.
2. Demonstrate the use of trees and binary search trees to solve the real world problem.
3. Compare the different types of trees like AVL trees, BTree,B+ Tree, red Black tree and select an appropriate one to solve a particular one
4. Perform insertion and deletion operation on heap.
5. Apply appropriate hash function for a search process.
6. Explains the use of dictionaries and concept of text processing.

Unit I **06 Hours**

Graphs: Introduction to Non-Linear data structure, Graphs, Representation of graph, AND/OR Graphs, ADT for Graph, Traversing a Graph, Dijkstra's Algorithm, Minimum Spanning Trees.

Unit II **06 Hours**

Trees: Introduction, Binary Trees, Binary Tree Representation, Tree Traversal Algorithms, Threaded Binary Tree, Binary Search Tree, Operations on Binary Search Tree, Huffman's Algorithm.

Unit III **06 Hours**

Special forms of trees:AVL Trees, m-way Search Trees, B Trees, B+ Trees, Red Black Tree, 2-3 Trees, Splay Trees, Applications of Trees.

Unit IV **06 Hours**

Heaps: Heaps as priority queues, Heap Implementation, Insertion and Deletion operations, binary heaps, binomial and Fibonacci heaps, heapsort, heaps in Huffman coding.

Unit V **06 Hours**

Hashing: Introduction, Hash functions, Collision Resolution Strategies,
Types of Hashing, Separate Chaining, Open Addressing, Linear Probing, Quadratic Probing, Double Hashing, Rehashing, Extendible Hashing.

Unit VI **06 Hours**

Dictionaries & Text Processing: Definition, Dictionary Abstract Data Type, Implementation of Dictionaries, Text Processing: String -+Operations, Brute-Force Pattern Matching, The Boyer-Moore Algorithm, The Knuth-Morris-Pratt Algorithm, Standard tries, Suffix Tries, The Huffman Coding Algorithm.

Textbooks:

1. Mark Allen Weiss, Data Structures and Algorithm Analysis in C++, 2nd Edition, Pearson, 2004.
2. M T Goodrich, Roberto Tamassia, Algorithm Design, John Wiley, 2002.
3. Fundamentals of Data Structures in C by Horowitz, Sahni& Anderson-Freed, 2e
Universal Press

Reference Books:

1. T. H. Cormen, C. E. Leiserson, R. L. Rivest, and C. Stein, Introduction to Algorithms,
MIT Press, 3/e, 2009.
2.A. M. Tenenbaum, Y. Langsam, and M. J. Augenstein, Data Structures Using C and
C++,Prentice Hall, 3/e.

List of Assignments:

The following are some sample assignments. The course co-ordinator will frame one assignment on each unit for internal assessment.

1. Apply the shortest path algorithm on the given graph.
2. Apply the appropriate algorithm and find the solution for the problem.
3. Generate Huffman code
4. Write a pseudocode for tree traversal operation
5. Explain the concept of linear probing
6. Explain the steps in text processing

Project Based Learning

1. Hashing for cryptography
2. Payroll system
3. Network route identifier
4. Path finder
5. Telephone directory
6. Library Management system
7. Document indexing
8. Data Compressor
9. Railway reservation system
10. Supermarket stock management

(Note: -*Students in a group of 3 to 4 shall complete any one project from the above list)

List of Laboratory Exercises:

1. Apply Graph traversal technique.
2. Demonstrate use of Dijkstra's Algorithm.
3. Perform operations on binary search trees.
4 Perform on Tree Traversal Algorithms.
5. Applications and Demonstration on different types of trees.
6. Perform the operations on Heaps.
7. Apply Hash Function to solve the real time problem.
8. Demonstrate use of dictionaries and concept of text processing.
9. Mini Project

Syllabus for Unit Tests:

Unit Test -1	Unit – I, Unit – II, Unit - III
Unit Test -2	Unit – IV, Unit – V, Unit - VI

Discrete Mathematical Structures

Teaching Scheme		Examination Scheme		Credit Scheme	
	Hours/Week		Marks		Credits
Theory:	03 Hours/Week	End Semester	60 Marks	Theory	03
Practical:	02 Hours/Week	Examination			
		Internal Assessment	40 Marks	Tutorial	00
		Term Work	25 Marks	Practical	01
		Oral	25 Marks		
		Total	150 Marks	Total	04

Course Objective:
The objective is to provide a mathematical foundation and skills those are required in further study of Computer Science and Engineering. The course Discrete Mathematical Structures deals with discrete objects, countable sets. It helps to develop logical thinking and a wide variety of real-world applications to computer science. It is a very good tool for improving reasoning and problem-solving capabilities.

Prerequisite:
Basic knowledge of Elementary Linear Algebra, Numerical Mathematical Computation, Programming basics.

Course Outcomes: On completion of the course, students will have the ability to:
1. Demonstrate the ability to write the sentences in the symbolic logic and evaluate a proof technique.
2. Apply the basic principles of set theory to analyse the data relationship and prove basic properties of set.
3. Analyse the properties of relations and functions to determine their properties.
4. Apply the knowledge of Boolean algebra for building basic electronic and digital circuits.
5. Solve problems of combinatorics and recurrence relations.
6. Model problems in Computer Science using graphs and trees.

Unit I **06 Hours**

Mathematical Logic: Propositional Logic, Predicate logic, First order logic, Rules of inference, Introduction to proof techniques, resolution, Mathematical induction, Methods of proofs.

Unit II **06 Hours**

Set Theory: Types of sets, Sets operations and laws, Algebra of Sets, Multisets, Application of the principle of inclusion and exclusion.
Number Theory: Modular arithmetic, prime numbers, and properties, GCD, Chinese remainder theorem, Extended Euclidean algorithm.

Unit III **06 Hours**

Relations: Basic definition, properties and types of relations, relations and digraphs, paths in relations and digraphs, equivalence and partially ordered relations, Transitive closure and Warshall's algorithm.
Functions: Types of functions, Identity functions, Composition of functions, Mathematical functions, Pigeonhole principle.

Unit IV **06 Hours**

Algebraic Structures: Isomorphism and Homomorphism, Groups, Algebraic Structures with Binary Operations, rings, Cyclicgroups, codes.
Lattice: Posets andHasse Diagrams, Lattice as an algebraic system, Properties of lattices. Group Codes: The Communication Model and Basic notion of Error Correction, Generation of Group codes, Parity Check, Error Recovery

Unit V
Combinatorics and Recurrence Relations: **06 Hours**
Combinatorics: Permutations, Sumrule, Product rule, Combinatorial proofs.
Recurrence Relations: Linear Recurrence relation, Second order RR with constant coefficients, Applications of Recurrence Relation.

Unit VI **06 Hours**

Concepts of Graphs and Trees: Definition, Degree, Types, Operations on graphs, Paths, Circuits, Connectedness, Planar graphs and their properties, Eulerian and Hamiltonian graphs.
Trees: Basic properties of trees, Binary trees, Application: Minimum Spanning Tree, Shortest Path.

Textbooks:

1. J.P. Tremblay and Manohar: Discrete mathematical structures with application to Computer Science, McGraw hill- New Delhi.
2. Kolman and R.C. Busby: Discrete mathematical structures for computer science Prentice Hall, New-Delhi.
3. Malik and M. K. Sen: Discrete Mathematics, Cengage Learning India Pvt. Ltd.
4. R.M. Somasundaram: Discrete Mathematical Structures, Prentice Hall India Learning Private Limited.
5. C.L.Liu, Elements of Discrete Mathematics, second edition, McGraw-Hill Book Company.

Reference Books:

1. Kenneth H. Rosen: Discrete Mathematics and its applications Eighth Edition McGraw Hill Education.
2. Stanat and McAlister: Discrete Mathematics for Computer Science, PHI.

List of Assignments:
The following are some sample assignments. The course co-ordinator will frame one assignment on each unit for internal assessment.

1. Given a fact or a statement prove or disprove using suitable technique.
2. Write the given English language sentences represent in the Symbolic logic.
3. Given the statement forms Infer the validity of the statement form.
4. Draw a Hasse diagram and find chains and antichains.
5. Find the number of ways for any event or given sample space.
6. Given a problem represent in a graph and compute the optimal solution.
7. Given a communication network find the path between the given nodes.

Project Based Learning

1. Discrete Mathematics in Railway Planning using graph theory and linear algebra.
2. Object transformations using linear algebra.
3. Discrete mathematics in cryptography.
4. In Google maps to determine fastest driving routes and times.
5. In image processing
6. In relation database using sets.
7. In cyber security using graph theory.
8. Shortest path between two cities using a transportation system.
9. Data compression system with the help of Huffman coding.
10. Find the shortest tour that visits each of a group of cities only once and then ends in the starting city using graphs.

List of laboratory Exercise:

1. Perform set Operations.
2. Compute a power set of a given set.
3. List various properties of Relation and construct a program to evaluate it with a program.
4. Apply Warshall's algorithm to compute a Transitive Closure of a given relation entered by the user.(Use any suitable programming language).
5. Solve a programming problem based on application of Eulerian and Hamiltonian Graph.
6. Develop a program using RSA algorithm

Syllabus for Unit Tests:

Unit Test -1	Unit – I, Unit – II, Unit - III
Unit Test -2	Unit – IV, Unit – V, Unit - VI

Machine Organization and Microprocessor

Teaching Scheme		Examination Scheme		Credit Scheme	
	Hours/Week		Marks		Credits
Theory:	04 Hours/Week	End Semester Examination	60 Marks	Theory	04
Tutorial:	01 Hours/Week	Internal Assessment	40 Marks	Tutorial	01
				Total	05

Course Objective:
The course would provide students with an understanding of the design of fundamental blocks used in organization of computer system and interfacing techniques of these blocks to achieve different configurations of Machine organization. Students will learn the basic operations of computing hardware and how it interfaces to software.

Prerequisite:
The students should have basic Knowledge Digital electronics and logic design.

Course Outcomes: On completion of the course, students will have the ability to:

1. Explain the architecture and functional blocks of Computer System.
2. List the functional requirements for implementing ALU.
3. Discuss design approaches implementing control unit.
4. Analyse the characteristics and hierarchy of memory system.
5. Describe Peripherals and Input-Output organization.
6. Describe the concepts of parallel processing and pipelining.

Unit I **08 Hours**

CPU:-Machine architecture and organization, Von Neumann architecture Structure of IAS machine, memory, input-output subsystems, control unit. Introduction to 80x86 microprocessor, Architecture, Register organization, Segmentation, Instruction execution cycle, Addressing modes, and Instruction set. Instruction Formats, Instruction Types.

Unit II **08 Hours**

ALU:-Computer arithmetic, Signed number representation, fixed and floating point representations, character representation. Integer addition and subtraction, signed number multiplication, Booth's multiplierit's Hardware Implementation, Restoring and Non-restoring Division techniques, floating point arithmetic, IEEE 754 format.

Unit III **08 Hours**

Control Unit :- Design approaches, Instruction cycle and micro operations, Control signals and timing sequence, design of Hardwired Control unit
Micro instructions and micro program, Organization and Optimization of micro-programmed Control unit, Microinstruction Sequencing, Sequencing Techniques, Address Generation, Microinstruction Execution, Microinstruction Encoding.

Unit IV **08 Hours**

Memory:- Characteristics of Memory system, Memory hierarchy, Cache memory, cache size and block size, mapping functions, replacement algorithms, cache coherency, Multilevel Caches, Cache Coherence, Snooping & MESI Protocols, Memory Segmentation & Interleaved Memory System.

Unit V **08 Hours**

I/O organization: - I/O module, Peripheral devices and their characteristics, Input-output subsystems, I/O device interface, I/O transfers, interrupt driven and DMA transfer, I/O device interfaces – SCSI, USB, Fire wire.

Unit VI **08 Hours**

Parallel Organization – Overview of Instruction Pipelining, Performance Improvement, Flynn's classification for Multiple Processor Organizations, Closely and Loosely Coupled Multiprocessors Systems, Symmetric Multiprocessor (SMP) Organization, Multithreading – Fine Grained, Coarse Grained & Simultaneous (SMT) Threading, Chip Multiprocessing, Cluster Configuration, UMA, NUMA & CC-NUMA. Multicore Architectures – Hardware & Software Issues in Multicore Organization.

Textbooks:

1. William Stallings. "Computer organization and architecture: designing for performance". Pearson Education India, 2010
2. Carl Hamacher, ZvonkoVranesic and SafwatZaky. "Computer Organization", McGraw Hill, 2011.
3. Computer System Architecture M. M. Mano:, 3rd ed., Prentice Hall of India, New Delhi, 1993.
4. Computer Architecture and Organization, John P. Hayes.

Reference Books:

1. Computer Organization and Design: The Hardware/Software Interface, David A. Patterson and John L. Hennessy.
2. David A. Patterson, John L. Hennessy. "Computer organization and design: the hardware/software interface". Elsevier, 2011

List of Assignments:

1. Describe the structure of IAS computer with neat block diagram.
2. Describe architecture of 8086 with neat block diagram.
3. Explain the concept of Segmentation and state its advantages and disadvantage.
4. Draw and explain working of Micro programmed Control Unit.
5. Describe structure of IAS computer with neat block diagram.
6. Describe architecture of 8086 with neat block diagram.

Project Based Learning

1. Automatic night lamp with morning alarm
2. Traffic light with sensor + 7segment
3. Multi pattern running lights.
4. .Washing machine
5. Simple Lock Using Keypad and 7 segment
6. Electronic quiz table
7. Electronic Digital Clock
8. .temperature controller
9. Plant Irrigation System
10. Car Parking Management
11. Customer counter for supermarket
12. Electronic queue management system in food stall
13. Safety box
14. Shop lot automatic door with 7segment display
15. Bank queue management system
16. Water level controller
17. Automatic home system
18. Commuter system
19. Automatic room light control
20. Elevator control system

(Note: -*Students in a group of 3 to 4 shall complete any one project from the above list)

Syllabus for Unit Tests:

Unit Test -1	Unit – I, Unit – II, Unit – III
Unit Test-2	Unit – IV, Unit – V, Unit – VI

Software Engineering

Teaching Scheme		Examination Scheme		Credit Scheme	
	Hours/Week		Marks		Credits
Theory:	04 Hours/Week	End Semester Examination	60 Marks	Theory	04
Practical:	02 Hours/Week	InternalAssessment	40 Marks		
		Term Work	25 Marks	Practical	01
		Practical	25 Marks		
		Total	150 Marks	Total	05

Course Objective:
The main purpose of this course is to impart knowledge on the basic principles of software development life cycle.

Prerequisite:
Programming paradigms, Basic mathematical ability

Course Outcomes: On completion of the course, students will have the ability to:

1. Outline the basic concepts of software engineering lifecycle.
2. Analyse and categorize the requirements of software systems.
3. Design the software qualitatively.
4. Implement the software with the standard guidelines.
5. Validate the software with standard testing techniques.
6. Demonstrate troubleshooting of software application.

Unit I **08 Hours**

Introduction:
Software and Software Engineering: The Nature of Software, The Software Process, Software Myths.
Process Models: A Generic Process Model, Prescriptive Process Models, Specialized Process Models, The Unified Process.
Agile Development: Agility, Agility and the Cost of Change, Agile Process, Agile Process Models.

Unit II **08 Hours**

Requirement engineering and modelling:
Understanding Requirements: Requirements Engineering, Eliciting Requirements, Building the use case, Building Analysis Model, negotiating requirements and Validating Requirements. Drafting the software requirement specification.
Requirement Analysis and Modelling: Domain Analysis, Object Oriented Analysis, Scenario based Modelling, Class Based Modelling, Behaviour Modelling. CASE Tools.

Unit III **08 Hours**

Software project management: Introduction to Software Project Management, Selection of a Project Approach, Project Estimation Techniques, Project Planning and Project Scheduling, Project Organization and Team Structures, Risk Management, Resource Allocation, Project Monitoring and Control, Software Configuration Management, Software Quality Management, CASE Tool.

Unit IV **08 Hours**

Design
Design Concepts: The Design Process, Design Model - Data Design model, Architecture Design model, Transform and Transaction Flow, Interface design Flow, Component Level and Deployment level design elements.
Design Concepts – Abstraction, Architecture, Patterns, Modularity, Functional Independence, Refinement, Refactoring, Object-Oriented Design Concepts. CASE Tools in Software Design.

Unit V **08 Hours**

Coding and Testing:

Coding Approach, Coding Standards, Error, Bug,Defects.
Software Testing Life Cycle, Software Testing Principles, Verification and Validation, Types of Testing, White Box Testing techniques, Black Box Testing techniques, Testing OO Applications, Website Testing. CASE Tool.

Unit VI **08 Hours**

Implementation and maintenance: Software Maintenance-Software Supportability. Reengineering-Business Process Reengineering- Software Reengineering- Reverse Engineering, Restructuring.
Forward Engineering- Economics of Reengineering.

Textbooks:

1. Roger S, "Software Engineering – A Practitioner's Approach", seventh edition, Pressman, 2010.
2. Pearson Edu, "Software Engineering by Ian sommerville", 9th edition, 2010.

Reference Books:

1. Van Vliet, "Software Engineering: Principles and Practices"–, 2008.
2. Richard Fairley, "Software Engineering Concepts", 2008..

List of Assignments:

1. Presentation on one topic related to this syllabus.
2. Conducting six Multiple choice question online test on each unit
3. Prepare a report based on the understanding by viewing the NPTEL videos of this subject.
4. Perform the following Assignments:
    i. Suggest Which SDLC model will be used to develop ATM software? Justify?
    ii. Develop Requirement Specification for ATM Software.
    iii. Design the Class Diagram and Use case Diagram for ATM software.
    iv. Discuss on Automated Software Testing. Create Test cases for Functionality of ATM software using a Test Tool (Test Link).
    v. Discuss and Prepare IEEE Quality Document for ATM software.
    vi. vi. Prepare a Gantt chart using MS Project CASE Tool for a small Project.

Project Based Learning

1. ATM system
2. Online Banking system
3. Airline reservation system
4. Railway reservation system
5. Library Management System
6. College Management System
7. Hospital Management system
8. Traffic Monitoring System
9. Hotel Management System
10. Bus ticket reservation system
11. Online shopping system

(Note: -*Students in a group of 3 to 4 shall complete any one project from the above list)

List of Laboratory Exercises:

1. For the given system, students are required to identify and document the RequirementsSpecifications.
2. To study and explore the working of any UML modelling CASE Tools.
3. For the given system, students are required to Model UML Use Case Diagrams and Capture the Use Case Scenarios.
4. For the given system, students are required to create data models like ER and EER.
5. For the given system, students are required to Model UML State chart and Activity diagrams.
6. For the given system, students are required to Model UML Class and sequence diagrams.
7. For the given system, students are required to Model UML collaboration, Component and Deployment diagrams.
8. To study and explore the working of any Software Testing CASE Tools.
9. For the given system, students are required to design and execute the test suites.
10. Prepare a case study on Agile Methodologies.

Syllabus for Unit Tests:

Unit Test -1	Unit – I, Unit – II, Unit - III
Unit Test -2	Unit – IV, Unit – V, Unit – VI

Object Oriented Methodology

Teaching Scheme		Examination Scheme		Credit Scheme	
	Hours/Week		Marks		Credits
Theory:	04 Hours/Week	End Semester Examination	60 Marks	Theory	04
Practical:	02 Hours/Week	Internal Assessment	40 Marks		
		Term Work	25 Marks	Practical	01
		Practical	25 Marks		
		Total	150 Marks	Total	05

Course Objective:

- To teach fundamentals of object-oriented concepts and programming.
- To apply the concepts of object-oriented paradigm.
- To develop object-oriented programming skills.
- To design and implement applications for real life problems by using object-oriented programming.

Prerequisite:
Paradigms of Programming.

Course Outcomes: On completion of the course, students will have the ability to:

1. Analyse the basics of object-oriented programming withJava.
2. Identify class, objects,methods for real time problems.
3. Make use of constructor,garbage collector and methods of string class.
4. Explore the concept of inheritance and polymorphism with the help of real time applications.
5. Handle exception with exception handling mechanism and understand the concept of multithreading.
6. Design the graphical user interface by using Applets AWT and SWING.

Unit I **08 Hours**

Introduction: History and Features of Java, Difference between Java, C, C++, Internals of Java Program, Difference between JDK, JRE and JVM, Internal Details of JVM,
Basics of Java Language-Variable and Reserve / Keywords present in Java, Primitive Data types, Java Operators, Decision making and branching statements in Java.

Unit II **08 Hours**

Classes, Objects and Methods: Creating a Class, Visibility/Access Modifiers, Encapsulation, Methods: Adding a Method to Class, returning a Value, adding a Method That Takes Parameters,' this' Keyword, Method Overloading, Object Creation, Using Object as a Parameters, Returning Object, Array of Objects, Memory Allocation: 'new', Static Data Members, Static Methods.

Unit III **08 Hours**

Constructors, Destructors and String Handling: Use of Constructor, Characteristics of Constructors, Types of Constructor, Constructor Overloading, Constructor with Default Arguments, Symbolic Constants, Garbage Collection, Destructors and Finalizers.
String Handling: String: Immutable String, String Comparison, String Concatenation, Substring, Methods of String class, String Buffer class, StringBuilder class, Creating Immutable class, to String method.

Unit IV **08 Hours**

Inheritance and Polymorphism: Use of Inheritance, Types of Inheritance in Java, Role of Constructors in inheritance, Polymorphism in OOP, Types of Polymorphism, static and dynamic polymorphism, Overriding Super Class Methods. Use of "super" keyword. Interfaces, Implementing interfaces.

Unit V **08 Hours**

Exception Handling and Multithreaded programming:

Exception Handling: try and catch block, catch block, Nested try, finally block, throw keyword, Exception Propagation, throws keyword, Exception Handling with Method Overriding, Custom Exception

Introduction to threads, life cycle of a thread, thread states, threadproperties, methods in Threads and Runnable, setting priority of threads,synchronization and inter thread communication Life Cycle of a Thread.

Unit VI **08 Hours**

Designing Graphical User Interfaces in Java: Applet and its use, Design Patterns using Applet and JApplet. Run Applet application by browser and applet tool. Applet Architecture. Parameters to Applet Life Cycle.

Basics of Components Using Containers, Layout Managers and User defined layout. Border Layout, Flow Layout, Grid Layout, Grid bagLayout, Box Layout. AWT Components, Adding a Menu to Window, Extending GUI Features Using SWING, Components Designing GUI, Advanced swing components like Progress, JSlider, JRadioButton, JTree, JTable, JToggleButton, etc.

Textbooks

1. E. Balaguruswamy, "Object Oriented Programming Using C++ and Java", Tata McGrawHill
2. Steven Holzner et al. "Java 2 Programming", Black Book, Dreamtech Press, 2009.

Reference Books

1. Java The complete reference, Herbert Schildt, McGraw Hill Education (India) Pvt. Ltd. 9th edition, 2014, ISBN: 978-0-07-180856-9 (E-book).
2. Object-Oriented Design Using Java, Dale Skrien, McGraw-Hill Publishing, 2008, ISBN - 0077423097, 9780077423094.
3. MitsunoriOgihara, "Fundamentals of Java Programming", Springer; 2018, ISBN 978-3-319-89490-4.
4. Brahma DathanSarnathRamnath, "Object-Oriented Analysis, Design and Implementation An Integrated Approach", Springer; 2nd ed. 2015, ISSN 1863-7310 ISSN 2197-1781 (electronic) Undergraduate Topics in Computer Science ISBN 978-3-319-24278-1, ISBN 978-3-319-24280-4.
5. T. Budd (2009), An Introduction to Object Oriented Programming, 3rd edition, Pearson Education, India.
6. J. Nino, F. A. Hosch (2002), An Introduction to programming and OO design using Java, John Wiley & sons, New Jersey.
7. Y. Daniel Liang (2010), Introduction to Java programming, 7th edition, Pearson education, India.

List of Assignments:

1. Write a program to implement Class and object.
2. Write a program to differentiate between method overloading and method overriding.
3. Write a program to implement Constructor Overloading
4. Write a program to implement different Types of Inheritance in Java
5. Write a program to implement concept of Exception Handling &Multithreaded Programming
6. Write a program to use different controls of AWT classes.
7. Write a program to implement Applet swings.

1. **Project Based Learning**
    1. **Smart City Project**
    2. Currency Converter
    3. Online Exam Project in Java
    4. Moving Balls mini project using Java Applet
    5. Text Editor in Java using AWT controls.
    6. Album Manager Project in Java
    7. Vehicle Management System in Java
    8. Music Player project in Java
    9. Student Management System Project in Java
    10. Simple Calculator project in Java
    11. Image to PDF Convertor in java
    12. Simple Chat System
    13. Online Quiz project
    14. Pong game in java
    15. Tokenize implementation.

(Note:- *Students in a group of 3 to 4 shall complete any one project from the above list)

List of Laboratory Exercises

1. Write a program that checks whether a given string is a palindrome or not.
2. Write a program that describes a class person. It should have instance variables to record name, age and salary. Create a person object. Set and display its instance variables.
3. Write a program that creates a class circle with instance variables for the centre and the radius. Initialize and display its variables.
4. Write a program that counts the number of objects created by using static variable.
5. Write a program to demonstrate the constructors in java.
6. Write a program to demonstrate the constructor overloading.
7. Write a program to display the use of this keyword.
8. Write a program to implement Class and Inheritance Concept.
9. Write an application that creates an interface' and implement it.
10. Write a program that can count the number of instances created for the class.
11. Write a program to implement the concept of Multithreaded Programming.
12. Create an abstract class shape. Let rectangle and triangle inherit this shape class. Add necessary functions.
13. Write an application that shows the usage of try, catch, throws and finally.
14. Write an Applet that displays ―Hello World (Background colour-black, text colour-blue and your name in the status window).
15. Develop mini project using Applet and Swings.

Syllabus for Unit Tests:

Unit Test -1	Unit – I, Unit – II, Unit - III
Unit Test -2	Unit – IV, Unit – V, Unit - VI

B.TECH (Computer Science and Engineering)

SEMESTER – IV

COURSE SYLLABUS

Theory of Computation

Teaching Scheme		Examination Scheme		Credit Scheme	
	Hours/Week		Marks		Credits
Theory:	03 Hours/Week	End Semester Examination	60 Marks	Theory	03
Tutorial:	01 Hours/Week	Internal Assessment	40 Marks	Tutorial	01
		Total	100 Marks	Total	04

Course Objective:

This course introduces some fundamental concepts in automata theory and formal languages including grammar, finite automaton, regular expression, formal language, pushdown automaton and Turing machine. This subject not only forms the basic models of computation, it also includes the foundation of many branches of computer science, e.g. compilers, software engineering, concurrent systems, etc.

Prerequisite:
Discrete Mathematics

Course Outcomes: On completion of the course, students will have the ability to:

1. Estimate the importance of automata theory in designing computer languages.
2. Demonstrate and understand the relationships between language classes and regular expression
3. Design grammars and recognizers for different formal languages
4. Identify the equivalence of languages described by pushdown automata
5. Evaluate the Language Acceptability by Turing Machine
6. Explain the basics of compiler

Unit I **06 Hours**

Preliminaries and Finite state machines: Introduction to Theory of Computation-Automata, Alphabet, Symbol, String, Formal Languages, Deterministic Finite Automaton (DFA)- Definition, Representation, Acceptability of a String and Language, Non Deterministic Finite Automaton (NFA), Equivalence of DFA and NFA, NFA with ε-Transition, Equivalence of NFA's with and without ε-Transition, Finite Automata with output- Moore machine, Mealy Machine, Equivalence of Moore and Mealy Machine, Minimization of Finite Automata.

Unit II **06 Hours**

Regular Languages -Definition and Examples. Conversion of RE To FA, FA to RE, algebraic laws, applications of RE. Pumping lemma for regular languages and applications. Closure properties of regular Languages Union, Concatenation, Complement, Intersection and Kleene closure. Decidability- Decision properties.

Unit III **06 Hours**

Context Free Grammar(CFG)-Definition, Derivations, Languages, Derivation Trees and Ambiguity, Regular Grammars-Right Linear and Left Linear grammars, Conversion of FA into CFG and Regular grammar into FA, Simplification of CFG, Normal Forms- Chomsky Normal Form(CNF), Greibach Normal Form (GNF),Chomsky Hierarchy, Programming problems based on the properties of CFGs.

Unit IV **06 Hours**

Push Down Automata (PDA): Introduction, Pushdown Automata (PDA), Transition Diagrams, Functions and Tables, Deterministic Push- down Automata (DPDA) - definition, Nondeterministic Pushdown Automata (NPDA), Equivalence of context free grammars and PDA, properties of context free languages. Introduction to Post Machines (PMs).

Unit V **06 Hours**

Turing Machines: The Turing Machine Model and Definition of TM, Language Acceptability of Turing Machines, Techniques for Turing Machine Construction,

Modifications of Turing Machine, Composite and Iterative Turing machines ,Multi Tape Turing machine ,Multi Stack and Multi Track Turing machine ,Universal Turing machine, Linear Bounded Automata, Church's Thesis, Halting Problem.

Unit VI **06 Hours**

Applications: Applications of Regular expressions, Lexical analyser, Text editor, and searching using RE, Context free grammar, Basics of parsing techniques, application of leftmost and rightmost derivations during parsing, Primitive recursive functions, Recursive and recursively enumerable languages, Introduction to Natural language Processing.

Textbooks:

1. Vivek Kulkarni "Theory Computation" Oxford higher education
2. Theory of Computer Science (Automata, Language & Computation) K. L. P. Mishra & N. Chandrasekaran, PHI Second Edition.
3. E.V. Krishnamurthy, "Theory of Computer Science", EWP Publication.

Reference Books:

1. Hopcroft Ullman, "Introduction to Automata Theory, Languages &Computations, Narosa.
2. Daniel A. Cohen, "Introduction to Computer Theory", Wiley Publication.
3. Automata Theory, Languages, and Computation, John E. Hopcroft Cornell University, Rajeev Motwani Stanford University, Jeffrey D. Ullman Stanford University,3rd Edition.

List of Assignments:

1. Study of JFLAP tool for Constructing FA.
2. Construct regular expressions defined over the alphabet Σ= {a, b}, which denote the given languages.
3. Translate the following Mealy machine into its equivalent Moore machine.
4. Write a context-free grammar (CFG) which generates the language L denoted by:(a+ b)*bbb(a+ b)*.
5. Construct a PDA that accepts the language defined by the following regular grammar.
6. Design a TM to recognize an arbitrary string divisible by 4, from Σ= {0, 1, 2}.

Project Based Learning

1. Develop a tool to illustrate the algorithm for converting an arbitrary NFA to a DFA .
2. Develop a tool to draw a transition diagram for any given DFA.
3. Approximation algorithms
4. Greedy algorithms.
5. Enumeration of finite automata
6. Enumeration of PDA
7. Enumeration of Turing machines
8. Ambiguous grammars
9. Disambiguation of Grammars
10. Enumeration of Context-free languages
11. . Enumeration of Turing machines
12. . Universal Turing machines.
13. Randomized Turing machines
14. NP Complete Algorithm
15. Problem solvability using Reduction
16. Design of TM to emulate a finite automata
17. . Design of TM to emulate a PDA
18. Complexity analysis of encryption algorithms using TM.
19. . Design of TM to perform sorting
20. Design TM to perform searching.

Note: -*Students in a group of 3 to 4 shall complete any one project from the above list.

Syllabus for Unit Tests:

Unit Test -1	Unit – I, Unit – II, Unit - III
Unit Test -2	Unit – IV, Unit – V, Unit – VI

System Programming and Operating System

Teaching Scheme		Examination Scheme		Credit Scheme	
	Hours/Week		Marks		Credits
Lecture:	04 Hours/Week	End Semester Examination:	60 Marks		
Practical:	02 Hours/Week	Internal Assessment:	40 Marks	Theory	04
		Term Work	25 Marks	Practical	01
		Oral	25 Marks		
		Total	150 Marks	Total	05

Course Objectives:

- To help the students understand functioning of various system programs and Compiler, Loaders and Linkers.
- To help students for different concepts of operating system and management with file system.

Prerequisite:

Knowledge of Microprocessor concepts and Assembly language and Concept of system software, application software, knowledge of input output devices and its usage.

Course Outcomes: On completion of the course, students will have the ability to:

1. Apply fundamental concepts and practical skills of system programming.
2. Design and Demonstrate working of assemblers, Loaders and Linkers.
3. Compare and evaluate different scheduling algorithms.
4. Outline the concept of concurrency and deadlocks.
5. Analyse of Memory Management and Virtual Memory.
6. Prepare a comparison report of different operating system.

Unit I **08 Hours**

Introduction to Systems Programming: Introduction: Components of System Software, Language Processing Activities, Fundamentals of Language Processing.
Assemblers: Elements of Assembly language programming. Simple assembler scheme, Structure of an assembler, Design of single and two pass assembler. Macro Processors: Macro Definition and call, Macro expansion, Nested Macro Calls, Advanced Macro Facilities, Design of a two-pass macro-processor, Case study related to unit contents**.**

Unit II **08 Hours**

Compiler, Loaders and Linkers: Compilers: Basic compilers function, Phases of compilation, memory allocation, compilation of expression, Compilation of expressions, compilation of control structures, Code of optimization.
Loaders: Loader Schemes: Compile and go, General Loader Scheme, Absolute loaders, subroutine linkages, relocating loaders, direct linking loaders, Design of an absolute loader. Linkers: Relocation and linking concepts, Design of linker, self-relocating programs, Static and dynamic linker, Case study related to unit contents.

Unit III **08 Hours**

Introduction to OS and Process management: Introduction to OS: Architecture, Goals & Structures of O.S, Basic functions, Interaction of O. S. & hardware architecture, System calls, Batch, multiprogramming. Multitasking, time sharing, parallel, distributed & real -time O.S. Process Management: Process Concept, Process states, Process control, Threads, Scheduling: Types of scheduling: Pre-emptive, Nonredemptive, Scheduling algorithms: FCFS, SJF, RR, Case study on Unix /Linux OS.

Unit IV **08 Hours**

Concurrency control: Concurrency: Interprocess communication, Mutual Exclusion, Semaphores, Classical Problems of Synchronization: Readers-Writers, Producer Consumer, and Dining Philosopher problem. Deadlock: Principles of deadlock,

Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Case study related to unit contents.

Unit V **08 Hours**

Memory Management: Basics of memory management, Swapping, Memory Allocation, Paging, Segmentation,Virtual memory, Demand Paging, Page replacement, Page replacement algorithms – Optimal FIFO, LRU, LRU approximation, Allocation of frames, Case study related to unit contents.

Unit VI **08 Hours**

Input and Output, File System: I/O management & Disk scheduling: I/O Devices, Organization of I/O functions, Operating System Design issues, I/O Buffering, Disk Scheduling (FCFS), RAID, Disk Cache. File Management: Concepts, File Organization, File Directories, File Sharing, Record Blocking, Allocation methods, Free Space management, Case study related to unit contents.

Textbooks:

1. System Programming by John J. Donovan, TATA McGRAW-HILL Edition.

Reference Books:

1. Operating System Concepts, 9th edition Peter B. Galvin, Greg Gagne, Abraham Silberschatz, John Wiley & Sons, Inc.
2. Operating Systems 5th Edition, William Stallings, Pearson Education India.
3. D. M. Dhamdere : "Systems programming and operating system", Tata McGraw Hill.

List of Assignments:

1. Describe the types of errors that can be identified in the process of language translation. Illustrate the same with example
2. Explain the different types of optimization techniques
3. Compute average waiting time and average response time for the given set of processes.
4. Apply page replacement algorithm and compute the number of page faults.
5. Case study 1
6. Case study 2

Project Based Learning

1. Develop Heap Memory Manager in C
2. Design the Processes and thread management with deadlock's, synchronization
3. Design Preemptive Priority Scheduling algorithm implementation in any language.
4. Java program to analyze page fault for a given page frame using NRU with paging.
5. The project on simulating the multiprogramming of a specific operating system and dealing with CPU scheduling and Job scheduling.
6. Design the project that computes FCFS, SSTF, and SCAN disk-scheduling algorithms
7. Operating Systems mini-project to explore the different algorithms of main memory page replacement
8. Develop any one project on one or two pass assemblers.
9. design a simple language and develop a compiler for the three-address code generation and evaluation using Lex and Yacc.
10. Construct a parser that recognizes a specific language.

Note:-*Students in a group of 3 to 4 shall complete any one project from the above list.

List of Laboratory Exercises:

1. Design one pass assembler
2. Design two pass assembler
3. Write a program to create Dynamic Link Library for any mathematical operation and write an application program to test it
4. Write a program using Lex specifications to implement lexical analysis phase of compiler to count no. of words, lines and characters of given input file.
5. Implement UNIX system calls like ps, fork, join, exec family, and wait for process management.
6. Implementation of various scheduling algorithm.
7. Implementation of Banker's algorithm.
8. Find out the page fault of any given string.
9. Implementation of various Page replacement Algorithm.
10. Study assignment on process scheduling algorithms for latest OS.

Syllabus for Unit Tests:

Unit Test -1	Unit – I, Unit – II, Unit - III
Unit Test -2	Unit – IV, Unit – V, Unit - VI

Computer Graphics and Multimedia

Teaching Scheme		Examination Scheme		Credit Scheme	
					Credits
Lecture:	03 Hours/Week	End Semester Examination:	60 Marks		
		Internal Assessment:	40 Marks	Theory	03
				Total	03

Course Objectives:

- To introduce the principles of computer graphics and the components of a graphics system.
- To introduce basic algorithms for drawing line, circle and curves.
- To develop understanding of the basic principles of 2D and 3D computer graphics and how to transform the shapes to fit them as per the picture definition.
- To introduce multimedia architecture and hardware.
- To introduce multimedia file formats.

Prerequisite:

Knowledge of C programming language, Linear Algebra.

Course Outcomes: On completion of the course, students will have the ability to:

1. Apply fundamental concepts and practical skills in computer graphics.
2. Design and apply two-dimensional graphics.
3. Implement and use classic and modern algorithms and data structures in computer graphic to 3-D geometry.
4. Apply Illumination and colour models.
5. Identify suitable file format to develop a multimedia application.
6. Design Basic 3- D Scenes using Blender.

Unit I **08 Hours**

Introduction to computer graphics and devices: Introduction to computer graphics, Graphics Primitives: Raster scan & random scan displays, display processor, display file structure, Output primitives, points and lines, line drawing algorithms, loading the frame buffer, line function; circle and ellipse generating algorithms; Pixel addressing and object geometry, filled area primitives. GRAPHIC DEVICES Cathode Ray Tube, Quality of Phosphors, CRTs for Colour Display, Beam Penetration CRT, The Shadow -Mask CRT, Direct View Storage Tube, Tablets, The light Pen, Three Dimensional Devices.

Unit II **08 Hours**

Two-dimensional graphics: Two dimensional geometric transformations — Matrix representations and homogeneous coordinates, composite transformations; Two-dimensional viewing — viewing pipeline, viewing coordinate reference frame; window-to-viewport coordinate transformation, Two dimensional viewing functions; clipping operations — point, line, and polygon clipping algorithms.

Unit III **08 Hours**

Three-dimensional graphics: Three dimensional concepts; Three-dimensional object representations — Polygon surfaces- Polygon tables- Plane equations — Polygon meshes; Curved Lines and surfaces, Quadratic surfaces; Blobby objects; Spline representations — Bezier curves and surfaces -B-Spline curves and surfaces. TRANSFORMATION AND VIEWING: Three dimensional geometric and modelling transformations — Translation, Rotation, Scaling, composite transformations; Three-dimensional viewing — viewing pipeline, viewing coordinates, Projections, Clipping; Visible surface detection methods.

Unit IV **08 Hours**

Illumination and colour models: Light sources, basic illumination models, halftone patterns and dithering techniques; Properties of light, Diffused illumination, point

source illumination, Standard primaries and chromaticity diagram; Intuitive colour concepts, RGB colour model, YIQ colour model, CMY colour model ,HSV colour model; Colour selection, ray tracing.

Unit V **08 Hours**

Multimedia system design & multimedia file handling: Multimedia basics – Multimedia applications – Multimedia system architecture – Evolving technologies for multimedia – Defining objects for multimedia systems – Multimedia data interface standards – Multimedia databases. Compression and decompression – Data and file format standards – Multimedia I/O technologies – Digital voice and audio – Video image and animation – Full motion video – Storage and retrieval technologies.

Unit VI **08 Hours**

Hypermedia: Multimedia authoring and user interface-Hypermedia messaging - Mobile messaging – Hypermedia message component – Creating hypermedia message – Integrated multimedia message standards– Integrated document management – Distributed multimedia systems. CASE STUDY: BLENDER GRAPHICS Blender Fundamentals—Drawing Basic Shapes— Modelling—Shading & Textures.

Textbooks

1. Donald Hearn and Pauline Baker M, Computer Graphics", Prentice Hall, New Delhi, second edition.
2. Andleigh, P. K and KiranThakrar, Multimedia Systems and Design, PHI, 2015.

Reference Books

1. Foley, Vandam, Feiner and Hughes, Computer Graphics: Principles and Practice, 2nd Edition, Pearson Education, 2003.
2. Peter Shirley, Michael Ashikhmin, Michael Gleicher, Stephen R Marschner, Erik Reinhard, KelvinSung, and AK Peters, Fundamentals of Computer Graphics, CRC Press, 2010.

List of Assignments:

1. Study on any latest data generating device in computer Graphics .
2. Describe in detail any one color model process.
3. Using the determinant to calculate the signed areas, determine whether the point $\boldsymbol{p}=[23]^T$ is in the triangle formed by the points $\boldsymbol{s}=[22]^T$, $\boldsymbol{t}=[51]^T$ and $\boldsymbol{r}=[35]^T$. Show all of your work.
4. Elaborate in detail the any one curve generation methods.
5. Describe how Multimedia system architecture process is used in real time.

Project Based Learning

1. Helicopter game
2. Sinking Ship
3. Scientific calculator
4. Traditional wall Clock
5. Tower of Hanoi game
6. Windmill
7. Steam engine
8. Traffic signal
9. Aquarium
10. Prepare a PowerPoint Presentation
11. Mobile app for online shopping
12. Arrival and departure of the train with announcement and signal
13. Mobile application for online tour guidance app
14. Create a small video on the given topic
15. Story tell mobile app

(Note: -*Students in a group of 3 to 4 shall complete any one project from the above list)

List of Laboratory Exercises:

1. Study of Fundamental Graphics Functions.
2. Implementation of Line drawing algorithms: DDA Algorithm, Bresenham's Algorithm.
3. Implementation of Circle drawing algorithms: Bresenham's Algorithm, Mid-Point Algorithm.
4. Programs on 2D and 3D transformations.
5. Write a program to implement Cohen Sutherland line clipping algorithm.
6. Using Flash/Maya perform different operations (rotation, scaling move etc..) on objects Create a Bouncing Ball using Key frame animation and Path animation.
7. Write a program to make wave audio file.
8. Write a program to create links in HTML.
9. Write a program to create file split.

Syllabus for Unit Tests:

Unit Test -1	Unit – I, Unit – II, Unit - III
Unit Test -2	Unit – IV, Unit – V, Unit - VI

Design of Algorithms

Teaching Scheme		Examination Scheme		Credit Scheme	
	Hours/Week		Marks		Credits
Lecture	04 Hours/Week	End Semester Examination:	60 Marks	Theory	04
Practical	02 Hours/Week	Internal Assessment:	40 Marks	Practical	01
		Term Work:	25 Marks		
		Practical:	25 Marks		
		Total	150 Marks	Total	05

Course Objective:
The Course gives an overview of about the Performance and Analysis of Algorithms.

Prerequisite:
The students should possess the knowledge of Data Structures and Discrete Mathematics.

Course Outcomes: On completion of the course, students will have the ability to:

1. Analyze the asymptotic performance of algorithms by providing Optimal Solution.
2. Synthesize divide-and-conquer algorithms. Derive and solve recurrences describing the performance of divide-and-conquer algorithms.
3. Analyze the performance of Greedy Methods and describe its limitations.
4. Analyse Dynamic Programming Problems.
5. Solve Problems using Backtracking Approach.
6. Compare NP-Hard, NP-Complete Problems and Online Algorithms.

Unit I **06 Hours**

Models of Computation: Algorithm Specification, Pseudocode Conventions Recursive Algorithms, PERFORMANCE ANALYSIS, Space Complexity Time Complexity Asymptotic Notation, Practical Complexities, Performance Measurement Randomized AlgorithmsIterative Algorithms: Measures of Progress and Loop Invariants. Steps to develop Iterative Algorithms.

Unit II **06 Hours**

Divide-and-Conquer: Binary Search Finding the Maximum and Minimum, Merge Sort, Quick Sort, Performance Measurement: Best Case and Worst-Case Analysis. Strassen's matrix Multiplication.

Unit III **06 Hours**

The Greedy Method: Knapsack Problem, Job Sequencing with deadlines, Minimum-Cost Spanning Trees: Prim's Algorithm, Kruskal's Algorithm, Single-Source Shortest Paths.

Unit IV **06 Hours**

Dynamic Programming: Multistage graph, All Pairs Shortest paths, Single-Source Shortest Path, Optimal Binary search trees, 0/1-knapsack, The Traveling Salesperson Problem, Basic Traversal and Search Technique.

Unit V **06 Hours**

Backtracking: Backtracking: The General Method, The 8- Queens Problem, Sum of Subsets, Graph Colouring, and Hamiltonian Cycles. Branch and Bound: Least Cost (LC) Search, The 15-puzzle Control abstraction of LC Search, Bounding, FIFO Branch and Bound, LC Branch and Bound.

Unit VI **06 Hours**

Files:NP-HARD AND NP-COMPLETE PROBLEMAlgorithm Complexities: Nondeterministic Algorithms, The classes NP-Hard and NP- Complete, Cook's Theorem, NP-Hard Graph Problems, NP-Hard Scheduling Problems, NP-Hard Code Generation Problems. Approximation Problems.Online Algorithms: The Online Paging Problem, Adversary Models, Paging against an Oblivious Adversary, Relating the Adversaries, The Adaptive Online Adversary, The k-Server Problem

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Textbooks:

1. Alfred Aho, John E. Hopcroft, "Design and Analysis of Computer Algorithms", Pearson Education.
2. Thomas Cormen, Charles E Leiserson, Ronald Rivest, "Introduction to Algorithms, Tata Mc-Graw Hill Publication, Second Edition.
3. Rod Stephens, "Essential Algorithms: A Practical Approach to Computer Algorithms", John Wiley and Sons Publications.
4. Jon Kleinberg, Eva Tardos, " Algorithm Design", Pearson Education.
5. Robert Sedgewick, Philippe Flajolet, "An Introduction to the Analysis of Algorithms", Adison-Wesley Publication, Second Edition.
6. Jeff Edmonds, How to think about Algorithms, York University, Cambridge University Press.
7. Python Algorithms: Mastering Basic Algorithms in the Python Language, by Magnus Lie, Hetland ,APress.
8. Ian Parberry and William Gasarch, WProblems on Algorithms, Second Edition, Prentice Hall Inc.
9. Rajeev Motwani, PrabhakarRaghavan, Randomized Algorithms, Cambridge University Press.

Reference Books:

1. ElitzHorowith and SartajSahani, S. Rajasekaran, "Fundamentals of Computer Algorithms", Galgotia Publications.

List of Assignments:

1. Calculate the space complexity of various algorithms.
2. Implement Knapsack Algorithm.
3. Implement Prim's Algorithm
4. Implement Kruskal's Algorithms
5. Study and analysis of 8-Queens Problem.
6. Implement Optimal Binary Search Tree.

Project Based Learning

1. Design a Sudoku using Recursion
2. Design a Phonebook
3. Simulate 15 Puzzle Problem
4. Design Tic Tac Toe
5. Travelling Salesman Problem
6. Design a board for simulating N-Queen Problem
7. Implement Multistage Graphs
8. Prime Number Generator
9. Random Number Generator
10. Devise and algorithm for large sparse matrix multiplication

(Note: -*Students in a group of 3 to 4 shall complete any one project from the above list)

Syllabus for Unit Tests:

Unit Test -1	Unit – I, Unit – II, Unit - III
Unit Test -2	Unit – IV, Unit – V, Unit - VI

Database Systems

Teaching Scheme		Examination Scheme		Credit Scheme	
					Credits
Lecture:	**04 Hours/Week**	**End Semester Examination:**	**60 Marks**		
Practical:	**02 Hours/Week**	**Internal Assessment:**	**40 Marks**	**Theory**	**04**
		Term Work	**25 Marks**	**Practical**	**01**
		Practical	**25 Marks**		
		Total	**150 Marks**	**Total**	**05**

Course Objective:
This course focuses on the core principles and techniques required in the design and implementation of database systems.

Prerequisite:
Discrete mathematics, Data structures and Programming languages.

Course Outcomes: On completion of the course, students will have the ability to:

1. Use the basic concepts of Database Systems in Database design.
2. Design a Database using ER Modelling
3. Apply SQL queries to interact with Database.
4. Apply normalization on database design to eliminate anomalies.
5. Analyse database transactions and can control them by applying ACID properties.
6. Investigate the knowledge about emerging trends in the area of database for unstructured data and applications for it.

Unit I **08 Hours**

Introduction to Databases and Database Design: Introduction, purpose of database system, Data Independence, view of data, Database System architecture- Levels, Mappings, Database users and DBA, applications of DBMS,The importance of data models, Basic building blocks, Business rules, The evolution of data models, Degrees of data abstraction., Database Design Process, ER Diagrams - Entities, Attributes, Relationships, Constraints, keys, extended ER features, Generalization, Specialization, Aggregation, Conceptual design with the E-Rmodel.

Unit II **08 Hours**

Relational Model: Introduction to the relational model, Integrity constraints over relations, enforcing integrity constraints, querying relational data, Logical database design: E-R to relational, Introduction to views, Destroying/altering tables and views.
Relational Algebra and Calculus: Preliminaries, relational algebra operators, relational calculus - Tuple and domain relational calculus, expressive power of algebra and calculus.

Unit III **08 Hours**

Schema Refinement and Normal Forms: Introduction to schema refinement, functional dependencies, reasoning about FDs. Normal forms: 1NF, 2NF, 3NF, BCNF, properties of decompositions, normalization, schema refinement in database design, case studies**.**

Unit IV **08 Hours**

SQL: Basics of SQL, DDL, DML,DCL, structure – creation, alteration, defining constraints – Primary key, foreign key, unique, not null, check, IN operator, Functions - aggregate functions, Built-in functions – numeric, date, string functions, set operations, sub-queries, correlated sub-queries, Use of group by, having, order by, join and its types, Exist, Any, All, view and its types. transaction control commands – Commit, Rollback, Save point, cursors, stored procedures, Triggers.

Unit V **08 Hours**

Transactions Management: Transaction concept, transaction state, implementation of atomicity and durability, concurrent executions, Serializability, recoverability, implementation of isolation, transaction definition in SQL, testing for Serializability.
Concurrency Control and Recovery System: Concurrency control, lock based protocols, time-stamp based protocols, validation based protocols, multiple granularity. Recovery system - failure classification, storage structure, recovery and atomicity, log- based recovery, shadow paging, buffer management, failure with loss of non-volatile storage, advanced recovery techniques, remote backup systems.

Unit VI **08 Hours**

Emerging Database Technologies: Introduction to unstructured data, NOSQL, Introduction to unstructured data, NOSQL, spatial and geographic databases, Database Analysis Tools multimedia databases, Massive Datasets and Hadoop.

Textbooks:

1. Raghurama Krishnan, Johannes Gehrke , Database Management Systems, 3rd edition, Tata McGraw Hill, New Delhi,India**.**
2. ElmasriNavate, Fundamentals of Database Systems, Pearson Education,India.

Reference Books:

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan (2005), Database System Concepts, 5th edition, McGraw-Hill, New Delhi,India.
2. Peter Rob, Carlos Coronel (2009), Database Systems Design, Implementation and Management, 7thedition.

List of Assignments:

1. Define Database. Explain Importance of Data Models in detail
2. Write a short note on Following:
    a) Relational Algebra and Calculus
    b) Integrity Constraints
3. Define Normalization. Explain all Normal forms in detail
4. Explain DDL, DML and DCL in detail.

5.Explain ACID properties of TCL in detail.\
6. Explain NOSQL and Database Analysis Tools in detail.

Project Based Learning

1. Inventory Management System.
2. Online Jewelry Shopping System
3. Library Management System
4. Online Examination System
5. Hospital Management System
6. Railway Reservation System
7. Payroll Management System
8. Cooking Recipe Portal
9. Art Gallery Management System
10. Student Database Management System
11. Restaurant Management Database System
12. Electric Bill System Database
13. Online Examination System
14. Event Management System
15. Attendance Management System

(Note: -*Students in a group of 3 to 4 shall complete any one project from the above list)

Laboratory Exercises:

1. Draw E-R Diagram and extended ER Diagram (as given by course coordinator) on given System.
2. Demonstrate Queries on Relational Algebra(as given by course coordinator).
3. To discuss normalization and build normalized schema (as given by course coordinator)on given System.
4. Write a SQL Statement ((as given by course coordinator) on DDL,DML and DCL.
5. Demonstrate Queries on Joins(as given by course coordinator).
6. Demonstrate Queries on aggregate functions(as given by course coordinator).
7. Use WEKA tool to derive analytical model for the given dataset.
8. Case study on NOSQL database: MongoDB.

Syllabus for Unit Tests:

Unit Test -1	Unit – I, Unit – II, Unit - III
Unit Test -2	Unit – IV, Unit – V, Unit – VI

CSE Skill Lab - I

Teaching Scheme		Examination Scheme		Credit Scheme	
	Hours/Week		Marks		Credits
Practical:	04 Hours/Week	Term Work	25 Marks		
		Practical	25 Marks	Practical	02
		Total	50 Marks	Total	02

Course Objective:

The objective of this course is to impart students with the knowledge to setup the development environment, design and develop dynamic database driven web applications using PHP.

Prerequisite:

1. Create PHP programs that use various php library functions,
2. Design interactive forms using PHP.
3. Implement various operations on arrays and control structures in PHP
4. Create database and demonstrate the manipulation of Files, Directories and relational data.
5. Implement cookies and session
6. Develop dynamic web Content.

Unit I **08 Hours**

Introduction to Dynamic Web Content &Environment: Overview of HTTP & HTML, Request/Response Procedure, Advantage of PHP, MySQL, JavaScript, CSS & HTML 5, The Apache Web Server, Overview of Open Source. Basics of WAMP, MAMP,LAMP, Installation, Accessing document root, Working Remotely – Looking In, Using FTP, Using IDE.

Unit II **08 Hours**

Introduction to PHP, Expression & Control Flow: Incorporating PHP within HTML, Structure of PHP – Comments, Basic Syntax, variables, operators, Assignments, multiline commands, constants, echo & print commands, Functions, variable Scope. Expressions: TRUE or FALSE, Literals & Variables. Operators: Precedence, Associativity, Relational Operators. Conditionals – if, else, elseif, switch operator. Looping: While, do-while, breaking out of loop, continue statement

Unit III **08 Hours**

PHP Functions, Objects &Arrays:PHP Functions: Defining, returning a value, Returning an Array, do not Pass arguments by reference, Returning Global Variables, Include statement: include once, require &require once.

PHP Objects: Declaring a class, creating an object, accessing objects, constructors, PHP 5 Destructors, writing methods, declaring properties & constants, inheritance. Arrays: Basic Access, foreach as loop, multidimensional Arrays, Using Array functions.

Unit IV **08 Hours**

PHP in Action & Introduction to MySQL: UsingPrintf, Date and Time Functions, File handling, System Calls.Introduction to MySQL: Basics, Database Terms, Accessing MySQL via Command line, MySQL Commands, Data types, Indexes, MySql Functions, Accessing Mysql via PhpMyAdmin, Primary Keys, Relationships, Select Queries, creatingmysqldump, backup file, dumping data in CSV format.

Unit V **08 Hours**

Cookies, Sessions, Authentications and Accessing: Using cookies in PHP, HTTP Authentication, Using Sessions. Accessing: Querying a MySQL Database with PHP – The Process, create login file, connecting to database, Practical Example, Preventing Hacking Attempts: Using Placeholders, HTML Injection. Building Forms, Retrieving submitted Data.

Unit VI **08 Hours**

Exploring JavaScript: JavaScript and HTML Text – using within a Document Head, Older & Nonstandard Browsers, Including Javascripts, debugging Javascript errors, using variables, semicolon, variables, operators, variable typing, functions, global variables, local variables, Document Object Model, Document.write.

Textbooks:

1. Learning PHP, MySQL &Javascript, Robin Nixon, OREILLY, 4thEditon, 2015.
2. Head First PHP & MySQL-Lynn Beighley& Michael Morrison-O'Reilly.
3. PHP: A Beginner's Guide-VikramVaswani- McGraw-Hill Education.

Reference Books:

1. The Complete Reference PHP – Steven Holzner, Tata McGraw-Hill.
2. The Joy of PHP Programming: A Beginner's Guide – Alan Forbes, BeakCheck LLC,6th edition.

List of Laboratory Exercises:

1. Write a PHP function to count total number of vowels from the string. Accept a string using HTML form.
2. Write a PHP script to print Fibonacci series.
3. Create a student registration form using text box, check box, radio button, select, submit button. Display the user inserted value in new PHP page.
4. Write a program to perform the following operations on an associative array.
   Display elements of an array along with their keys.
   Display size of array.
   Delete an element from an array from the given index.
5. Write a Program to insert a roll no and student name in a database (use PostgreSQL data to create a database).
6. Write PHP script to demonstrate passing variables with cookies.
7. Implement Admin login/logout functionality and cookie wherever required.
8. Write a PHP script to connect MYSQL server from your web application. Write a PHP script to create and drop database.
9. Create database using phpMyAdmin. Write a program to read input data from table and display the information in tabular form.
10. Develop PHP application using forms and database.

Project Based Learning

1. Design personal website using HTML and CSS
2. Login page with user credentials and data base
3. Drawing palette based web page
4. Student registration form with data base connectivity
5. Dummy social networking website

6. Image editing using we page
7. Animation based website
8. Simple game website
9. Ecommerce website with data base connectivity
10. Any Complete web project with real time database connectivity
11. Login authentication
12. Design Survey Form
13. Quiz Game
14. Implement Employee Management System
15. Social Media Dashboard
16. Search Application
17. E-Commerce Website
18. Develop Freelance platform
19. Hospital Management System

Note: -*Students in a group of 3 to 4 shall complete any one project from the above list.

Program: B.TECH. (Computer Science and Engineering) Semester – V CBCS 2021 Course

Sr. No.	Course Code	Name of Course	Teaching Scheme (Hrs./Week)			Examination Scheme (Marks)						Credits			
			L	P	T	ESE	IA	TW	OR	PR	Total	L	P	T	Total
1		Software Testing and Quality Assurance	3	2	-	60	40	25	25	-	150	3	1	-	4
2		Big Data Analytics	4	-	-	60	40	-	-	-	100	4	-	-	4
3		Human Machine Interaction	4	-	-	60	40	-	-	-	100	4	-	-	4
4		Computer Networks	4	2	-	60	40	25	-	25	150	4	1	-	5
5		Artificial Intelligence*	4	2	-	60	40	25	-	25	150	4	1	-	5
6		CSE Skill Lab –II	-	4	-	-	-	25	-	25	50	-	2	-	2
7		Vocational Course-III	-	2	-	-	-	25	25	-	50	-	1	-	1
	Total		**19**	**12**	**-**	**300**	**200**	**125**	**50**	**75**	**750**	**19**	**6**	**-**	**25**
		Social Activity-II	-	-	-	-	-	-	-	-	-	-	-	-	2
		Environmental Studies**	2	-	-	50	-	-	-	-	-	-	-	-	-

*** Industry Taught Course – III**

**** Mandatory Audit Course - 50 Marks Theory Examination**

List of Vocational Courses will be published by the department before the commencement of respective semester.

Program: B.TECH. (Computer Science and Engineering) Semester – VI CBCS 2021 Course

Sr. No.	Course Code	Name of Course	Teaching Scheme (Hrs./Week)			Examination Scheme (Marks)						Credits			
			L	P	T	ESE	IA	TW	OR	PR	Total	L	P	T	Total
1		Business Intelligence System*	3	2	-	60	40	25	-	25	150	3	1	-	4
2		Cryptography and Network Security	4	2	-	60	40	25	-	25	150	4	1	-	5
3		Natural Language Processing	4	2	-	60	40	25	25	-	150	4	1	-	5
4		Quantitative Techniques, Communication and Values	4		-	60	40	-	-	-	100	4	-	-	4
5		Design Thinking	4	-		60	40	-	-	-	100	4		-	4
6		CSE Skill Lab –III	-	4	-	-	-	25	-	25	50	-	2	-	2
7		Vocational Course-IV	-	2	-	-	-	25	25	-	50	-	1	-	1
		Total	**19**	**12**	**-**	**300**	**200**	**125**	**50**	**75**	**750**	**19**	**06**	**-**	**25**
		MOOC - II #	-	-	-	-	-	-	-	-	-	-	-	-	2

***Industry Taught Course- IV**

#Add-on Course - List of MOOC and Vocational Courses will be published by the department before the commencement of respective semester.

Software Testing and Quality Assurance

Teaching Scheme		Examination Scheme		Credit Scheme	
	Hours/Week		Marks		Credits
Lecture:	03 Hours/Week	University Examination:	60 Marks		
Practical:	02 Hours/Week	Internal Assessment:	40 Marks	Lecture	03
		Term Work	25 Marks	Practical	01
		Oral	25 Marks		
		Total	150 Marks	Total	04

Course Objective:

To study the basics of testing ,various types of test in the life cycle of the software product.

To build design concepts for system testing and execution

To learn the software quality assurance ,metrics, defect prevention techniques

To learn the techniques for quality assurance and applying for applications.

Prerequisite:

1. Software Engineering.

Course Outcomes: On completion of the course, students will have the ability to:

7. Perform functional and non functional tests in the life cycle of the software product.
8. Understand system testing and test execution process.
9. Identify defect prevention techniques and software quality assurance metrics.
10. Apply techniques of quality assurance for typical applications.
11. Choose appropriate quality assurance models and develop quality.
12. Ability to conduct formal inspections, record and evaluate results of inspections.

Unit I - SOFTWARE TESTING - CONCEPTS, ISSUES, AND TECHNIQUES	**06 Hours**
Quality Revolution, Verification and Validation, Failure, Error, Fault, and Defect, Objectives of Testing, Testing Activities, Test Case Selection White-Box and Black ,test Planning and design, Test Tools and Automation, . Power of Test. Test Team Organization and Management-Test Groups, Software Quality Assurance Group ,System Test Team Hierarchy, Team Building.	
Unit II - SYSTEM TESTING	**06 Hours**
System Testing - System Integration Techniques-Incremental, Top Down Bottom Up Sandwich and Big Bang, Software and Hardware Integration, Hardware Design Verification Tests, Hardware and Software Compatibility Matrix Test Plan for System Integration. Built- in Testing. functional testing - Testing a Function in Context. Boundary Value Analysis, Decision Tables. acceptance testing - Selection of Acceptance Criteria, Acceptance Test Plan, Test Execution Test. software reliability - Fault and Failure, Factors Influencing Software, Reliability Models	
Unit III - SYSTEM TEST CATEGORIES	**06 Hours**
System test categories Taxonomy of System Tests, Interface Tests Functionality Tests. GUI Tests, Security Tests Feature Tests, Robustness Tests, Boundary Value Tests Power Cycling Tests Interoperability Tests, Scalability Tests, Stress Tests, Load and Stability Tests, Reliability Tests, Regression Tests, Regulatory Tests. Test Generation from FSM models- State-Oriented Model. Finite-State Machine Transition Tour Method, Testing with State Verification. Test Architectures-Local, distributed, Coordinated, Remote. system test design- Test Design Factors Requirement Identification, modeling a Test Design Process Test Design Preparedness,	

Metrics, Test Case Design Effectiveness. system test execution- Modeling Defects, Metrics for Monitoring Test Execution .Defect Reports, Defect Causal Analysis, Beta testing, measuring Test Effectiveness.	
Unit IV - SOFTWARE QUALITY	**06 Hours**
Software quality - People's Quality Expectations, Frameworks and ISO-9126, McCall's Quality Factors and Criteria – Relationship. Quality Metrics. Quality Characteristics ISO 9000:2000 Software Quality Standard. Maturity models- Test Process Improvement ,Testing Maturity Model.	
Unit V - SOFTWARE QUALITY ASSURANCE	**06 Hours**
Quality Assurance - Root Cause Analysis, modeling, technologies, standards and methodologies for defect prevention. Fault Tolerance and Failure Containment - Safety Assurance and Damage Control, Hazard analysis using fault-trees and event-trees. Comparing Quality Assurance Techniques and Activities. QA Monitoring and Measurement, Risk Identification for Quantifiable Quality Improvement. Case Study: FSM-Based Testing of Web-Based Applications.	
Unit VI – TEST AUTOMATION	**06 Hours**
Software test automation – skills needed for automation – scope of automation – design and architecture for automation – requirements for a test tool – challenges in automation – Test metrics and measurements – project, progress and productivity metrics. TestNG Testing Framework for Selenium.	
Textbooks	
3. Software Testing And Quality Assurance-Theory and Practice, Kshirasagar Nak Priyadarshi Tripathy, John Wiley & Sons Inc,2008	
4. Software Quality Engineering: Testing, Quality Assurance, and Quantifiable Improvement, Jeff Tian, John Wiley & Sons, Inc., Hoboken, New Jersey. 2005.	
Reference Books	
1. Software Quality Assurance - From Theory to Implementation, Daniel Galin, Pearson Education Ltd UK, 2004	
2. Software Quality Assurance, Milind Limaye, TMH ,New Delhi, 2011	
List of Assignments	
6. To Prepare Test Plan for the implemented system under test. The Test Plan shall be based on System Requirement Specification. The Test plan consists of following issues. a. Purpose of the test. /Location and schedule of the test. b. Test descriptions. /Pass and Fail Criteria	
7. To identify and narrate Test cases, Test scripts/procedures and Test incident Report identifier for the system under test. Refer Use case analysis document to prepare mentioned/ identified test documents. The expected specifications/ behaviors can be stated with the help of Test Oracle	
8. To perform Unit testing especially indicating the traced Independent data paths, Control paths and Error handling paths. Prepare control flow graphs for the unit under test. Compute the Cyclomatic complexity of the unit.	
9. 4. To perform Data Flow testing for the Program Segments by identifying the Definition-Use chain and type of data flow anomaly.	
10. To perform Mutation Analysis of the Program Segments along with mutant history, mutation score and type of mutation by using any Code analysis Tool / Mutation Testing Tool (JUNIT, MuJava).	
11. To perform Black-Box Testing for all the units contained in the architectural segments using Equivalence Partitioning, Boundary Value Analysis and Orthogonal	

Array testing methods. To study exploratory Testing for the Module under Test and merits/demerits of this technique.
12. To perform Regression Testing / GUI Testing of the System under construction with Unit and Integration profiles by using any Functional Testing Tool.
13. To perform Automated Testing using suitable CASE tool addressing Higher-Order testing strategies.
14. To perform Web Based Testing for Web Application incorporating any Open Source Tool. To study Performance Testing, Load Testing, Security Testing, Stress Testing, Demonstrate on link Test expectation.
15. To perform Software Audit (Checklist and Template-based) for the software developed and improve the Code Quality.
Project Based Learning 1. Every Student should select different websites/Applications and perform the each phase of STLC.

Syllabus for Unit Tests:	
Unit Test -1	Unit – I, Unit – II, Unit - III
Unit Test -2	Unit – IV, Unit – V, Unit - VI

Big Data Analytics					
Teaching Scheme		**Examination Scheme**		**Credit Scheme**	
	Hours/Week		**Marks**		**Credits**
Lecture:	**04 Hours/Week**	**University Examination:**	**60 Marks**		
Practical:	**00 Hours/Week**	**Internal Assessment:**	**40 Marks**	**Lecture**	**04**
		Term Work &Practical	**0 Marks**	**Practical**	**00**
		Total	**100 Marks**	**Total**	**04**

Course Objective:

To know the fundamental concepts of big data and analytics.
To explore tools and practices for working with big data
To learn about stream computing.
To know about the research that requires the integration of large amounts of data.

Prerequisite:

a Big Data Analyst needs to be very comfortable with coding, Data Warehousing, Data Visualisation, Business Knowledge etc.

Course Outcomes: On completion of the course, students will have the ability to:

1. Understand how to leverage the insights from big data analytics
2. Analyze data by utilizing various statistical and data mining approaches
3. Perform analytics on real-time streaming data
4. Understand the various NoSql alternative database models
5. Understand the Stream Data Model and Real Time Sentiment Analysis.
6. Understand the pig Data Model and Aggregated data model.

Unit I INTRODUCTION TO BIG DATA	**08 Hours**
Big Data – Definition, Characteristic Features – Big Data Applications - Big Data vs Traditional Data - Risks of Big Data - Structure of Big Data -	

Challenges of Conventional Systems - Web Data – Evolution of Analytic Scalability - Evolution of Analytic Processes, Tools and methods - Analysis vs Reporting - Modern Data Analytic Tools.	
Unit II HADOOP FRAMEWORK	**08 Hours**
Distributed File Systems - Large-Scale FileSystem Organization – HDFS concepts - MapReduce Execution, Algorithms using MapReduce, Matrix-Vector Multiplication – Hadoop YARN	
Unit III DATA ANALYSIS	**08 Hours**
Statistical Methods:Regression modelling, Multivariate Analysis - Classification: SVM & Kernel Methods - Rule Mining - Cluster Analysis, Types of Data in Cluster Analysis, Partitioning Methods,Hierarchical Methods, Density Based Methods, Grid Based Methods, Model Based Clustering Methods, Clustering High Dimensional Data - Predictive Analytics – Data analysis using R.	
Unit IV MINING DATA STREAMS	**08 Hours**
Streams: Concepts – Stream Data Model and Architecture - Sampling data in a stream - Mining Data Streams and Mining Time-series data - Real Time Analytics Platform (RTAP) Applications - Case Studies - Real Time Sentiment Analysis, Stock Market Predictions.	
Unit V CLUSTERING AND CLASSIFICATION	**08 Hours**
Advanced Analytical Theory and Methods: Overview of Clustering – K-means – Use Cases – Overview of the Method – Determining the Number of Clusters – Diagnostics – Reasons to Choose and Cautions .- Classification: Decision Trees – Overview of a Decision Tree – The General Algorithm – Decision Tree Algorithms – Evaluating a Decision Tree – Decision Trees in R – Naïve Bayes – Bayes‘ Theorem – Naïve Bayes Classifier.	
Unit VI BIG DATA FRAMEWORKS	**08 Hours**
Introduction to NoSQL – Aggregate Data Models – Hbase: Data Model and Implementations – Hbase Clients – Examples – .Cassandra: Data Model – Examples – Cassandra Clients – Hadoop Integration. Pig – Grunt – Pig Data Model – Pig Latin – developing and testing Pig Latin scripts. Hive – Data Types and File Formats – HiveQL Data Definition – HiveQL Data Manipulation – HiveQL Queries	
Textbooks	
1. Anand Rajaraman and Jeffrey David Ullman, “Mining of Massive Datasets”, Cambridge University Press, 2012.	
Reference Books	

1. .Bill Franks, ―Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics‖, Wiley and SAS Business Series, 2012.
2. David Loshin, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph", 2013.

List of Assignments

16. List the main characteristics of big data architecture with a neat schematic diagram.
17. Explain in detail about the challenges of conventional system
18. How would you show your understanding of the tools, trends and technology in big data
19. What are the best practices in Big Data analytics? Explain the techniques used in Big Data Analytics
20. Discuss the following features of Apache Hadoop in detail with diagram as necessary.
21. Describe briefly about Hadoop input and output and write a note on data integrity
22. Explain clustering and classifications in detail.

Project Based Learning:

1. Market Basket Analysis
2. Airline Dataset Analysis
3. Data Analysis using Clustering

Syllabus for Unit Tests:

Unit Test -1	Unit – I, Unit – II, Unit - III
Unit Test -2	Unit – IV, Unit – V, Unit - VI

HUMAN MACHINE INTERACTION

Teaching Scheme		Examination Scheme		Credit Scheme	
	Hours/Week		Marks		Credits
Lecture:	04 Hours/Week	University Examination:	60 Marks		
Practical:	00 Hours/Week	Internal Assessment:	40 Marks	Lecture	04
		Term Work&Practical	00 Marks	Practical	00
		Total	100 Marks	Total	04

Course Objective:

1. To introduce the need for human- Machine -interaction study or human-entered software design.
2. To gain an understanding of the human part of human- Machine -interactions.
3. Develop meaningful user interface.
4. Design and implement useful, usable, and engaging graphical Machine interfaces.
5. To apply HMI to real life use cases.
6. To familiarize information, interaction and GUI design process for enhancing user-

experience	
Prerequisite:	
Basic knowledge of designing tools and languages like HTML, Java, etc	
Course Outcomes: On completion of the course, students will have the ability to:	
1. Identify User Interface (UI) design principles.	
2. Apply Interactive Design process in real world applications	
3. To develop understanding of human factors in HMI design.	
4. To design effective user-interfaces	
5. To apply cognitive models for predicting human-Machine-interactions.	
6. To develop understanding of models, paradigms and context of interactions	
Unit I	**08 Hours**
INTRODUCTION: Introduction to HMI, Importance of user Interface - definition, importance of good design. Benefits of good design. A brief history of Screen design, The graphical user interface - popularity of graphics, the concept of direct manipulation, graphical system, Web user - Interface popularity, characteristics- Principles of user interface.	
Unit II	**08 Hours**
INTERACTIVE DESIGN: Basics – process – scenarios – navigation – screen design Iteration and prototyping. HMI in software process: Software life cycle – usability engineering – Prototyping in practice – design rationale. Design rules: principles, standards, guidelines, rules. Evaluation Techniques – Universal Design.	
Unit III	**08 Hours**
SCREEN DESIGNING: Design goals, Screen planning and purpose, organizing screen elements, ordering of screen data and content, screen navigation and flow, visually pleasing composition, amount of information, focus and emphasis, presentation information simply and meaningfully, information retrieval on web, statistical graphics, Technological consideration in interface design.	
Unit IV	**08 Hours**
INTERFACE DESIGN FOR MOBILE DEVICES: Mobile Ecosystem: Platforms, Application frameworks: Types of Mobile Applications: Widgets, Applications, Games, Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools	
Unit V	**08 Hours**
HMI MODELS: Goal and task hierarchy model, Linguistic model, Physical and device models, Cognitive models: Socio-Organizational issues and stakeholder requirements –Communication and collaboration models-Hypertext, Multimedia and WWW. Cognitive architectures,	

Hierarchical task analysis (HTA), Uses of task analysis, Diagrammatic dialog design notations, Computer mediated communication, Ubiquitous Computing, Finding things on web Future of HMI	
Unit VI	**08 Hours**
INTERACTION DEVICES: Keyboard and Function Keys - Pointing Devices - Speech Recognition Digitization and Generation -Image and Video Displays -Drivers.	

Textbooks

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, Human Computer Interaction, 3rdEdition, Pearson Education, 2004.
5. Wilbert O. Galitz , The Essential Guide to User Interface Design, Wiley publication.
6. Alan Cooper, Robert Reimann, David Cronin, About Face3: Essentials of Interaction design, Wiley publication.
7. Jeff Johnson, Designing with the mind in mind, Morgan Kaufmann Publication.
8. Donald A. Normann, Design of everyday things, Basic Books; Reprint edition 2002.
9. Brian Fling, Mobile Design and Development, First Edition , OReilly Media Inc., 2009

Reference Books

3. Rogers Sharp Preece Interaction Design: Beyond Human Computer Interaction, Wiley.
4. Guy A. Boy the Handbook of Human Machine Interaction, Ashgate publishing Ltd
5. Kalbande, Kanade, Iyer , Galitzs Human Machine Interaction, Wiley Publications.

List of Assignments

23. Explain the characteristics of GUI.
24. Compare and contrast GUI and web interface design.
25. Explain contrast between printed pages versus web pages.
26. Explain the general principles of UID.
27. Mention the advantages & disadvantages of GUI in detail
28. Explain the concept of direct and indirect manipulation and when it leads to infeasible situation?
29. Write short notes on human characteristics in interface design
30. Explain the direct and indirect methods for determining business requirements analysis on user interface design

Project Based Learning

1. Project Web Site and Brainstorming
2. UI Critique
3. Ethnography
4. Protoyping
5. Heuristic Evaluation

Syllabus for Unit Tests:

Unit Test -1	Unit – I, Unit – II, Unit - III
Unit Test -2	Unit – IV, Unit – V, Unit - VI

COMPUTER NETWORKS					
Teaching Scheme		**Examination Scheme**		**Credit Scheme**	
	Hours/Week		**Marks**		**Credits**
Lecture:	**04 Hours/Week**	**University Examination:**	**60 Marks**		
Practical:	**02 Hours/Week**	**Internal Assessment:**	**40 Marks**	**Lecture**	**04**
		Term Work	**25 Marks**	**Practical**	**01**
		Practical	**25 Marks**		
		Total	**150 Marks**	**Total**	**05**

Course Objective:

1. To understand the fundamental concepts of networking and technologies
2. To learn different techniques for framing, error control, flow control and routing
3. To learn different layer protocols in the Network layer
4. To understand modern network architectures with respect to design and performance.

Prerequisite:

Computer Systems Workshop Technology

Course Outcomes: On completion of the course, students will have the ability to:

1. Summarize fundamental concepts of Computer Networks, architectures, protocols and technologies
2. Illustrate the working and functions of data link layer
3. Analyze the working of different routing protocols and mechanisms
4. Implement client-server applications using sockets
5. Illustrate role of application layer with its protocols, client-server architectures
6. Illustrate the different multiplexing techniques

Unit I : Basics of Computer Networks	**08 Hours**
Introduction to computer network, Types of computer network,Ad-hoc Network, Network Architectures: Client-Server; Peer To Peer; Distributed and SDN, OSI Model, TCP/IP Model, Topologies: Star and Hierarchical; Design issues for Layers, Transmission Mediums: CAT5, 5e, 6, OFC and Radio Spectrum, Network Devices: Bridge, Switch, Router, Brouter and Access Point.	
Unit II : Data Link Layer	**08 Hours**
Design issues, error detection and correction, elementary data link protocols, sliding window protocols, example data link protocols - HDLC, the data link layer in the internet. THE MEDIUM ACCESS SUBLAYER: Channel allocations problem, multiple access protocols, Ethernet, Data Link Layer switching, Wireless LAN, Broadband Wireless, Bluetooth	
Unit III : Network Layer	**08 Hours**
Switching techniques, IP Protocol, IPv4 and IPv6 addressing schemes, Subnetting, Address mapping – ARP, RARP, BOOTP and DHCP–Delivery ,Routing Protocols: Distance Vector, Link State, Path Vector, Routing in Internet: RIP ,OSPF, BGP.	
Unit IV : Transport Layer	**08 Hours**
Transport Service, transport layer protocols for flow control, Elements of Transport Protocols, Multiplexing, Congestion Control, Example protocols: UDP, TCP.	
Unit V : Application Layer	**08 Hours**
Domain Name System (DNS), Hyper Text Transfer Protocol (HTTP), Email: SMTP, MIME, POP3, Webmail, FTP, TELNET, Dynamic Host Control Protocol (DHCP), WWW, HTTP, SNMP, Bluetooth, Firewalls.	
Unit VI: Network Security	**08 Hours**
Network Security: Electronic mail, directory services and network management, Basic concepts of Cryptography.	
Textbooks	
1. Fourauzan B.,"Data Communications and Networking", 5 th Edition, Tata McGraw-Hill, Publications, ISBN:0–07 – 058408 – 7	
2. Andrew S. Tanenbaum, Computer Networks, 5th Edition, Pearson India, 2012.	
Reference Books	
1. Kurose, Ross, “Computer Networking a Top Down Approach Featuring the Internet”, Pearson, ISBN-10: 0132856204	
2. L. Peterson and B. Davie, “Computer Networks: A Systems Approach”, 5th Edition, Morgan-Kaufmann, 2012.	

3. Douglas E. Comer & M.S Narayanan,"Computer Network & Internet", Pearson Education

List of Assignments

31. Study of LAN environment.
32. Explain OSI Model in detail.
33. Explain error detection and correction methods with example.
34. Study the concept of subnetting at network layer.
35. Discuss switching techniques in detail.
36. Explain multiplexing methods in detail.
37. Assignment on Application Layer
38. Assignment on Bandwidth utilization techniques.

List of Laboratory Exercises

1. Setup a wired LAN using Switch, Router and then IP switch of minimum four computers, configuration machine using IP addresses, testing using PING utility using Network Simulation tool Cisco Packet Tracer.
2. Write a program for error detection and correction for 7/8 bits ASCII codes using Hamming Codes and CRC.
3. Write a program to simulate Go back N and Selective Repeat Modes of Sliding Window Protocol in peer to peer mode.
4. Write a program to demonstrate subnetting and find the subnet masks
5. Configure RIP/OSPF/BGP using packet Tracer
6. Write a program for DNS lookup. Given an IP address input, it should return URL and vice-versa
7. Write a program using TCP socket for wired network.
8. Write a program using UDP Sockets to enable file transfer (Script, Text, Audio and Video one file each) between two machines
9. Use network simulator NS2 to implement: Monitoring traffic for the given topology
10. Study of Installation and configuration of DHCP server

Project Based Learning

1. Chat Application
2. Multiuser Chat Application
3. Network monitoring System
4. Intruder Detection System
5. Computing shortest path between nodes
6. Client-Server based Instant Messenger
7. File Transfer Protocol
8. Network Security Protocol with Cryptography
9. Peer to peer resource monitoring system
10. Distance-Vector-Routing-and-Flow-Control-Simulator
11. Link state routing protocol to find suitable path for transmission.
12. analyse following packet formats captured through Wireshark for wired network

Syllabus for Unit Tests:

Unit Test -1	Unit – I, Unit – II, Unit - III
Unit Test -2	Unit – IV, Unit – V, Unit - VI

ARTIFICIAL INTELLIGENCE

Teaching Scheme		Examination Scheme		Credit Scheme	
	Hours/Week		**Marks**		**Credits**
Lecture:	**04 Hours/Week**	**University Examination:**	**60 Marks**		
Practical:	**02 Hours/Week**	**Internal Assessment:**	**40 Marks**	**Lecture**	**04**
		Term Work	**25 Marks**	**Practical**	**01**
		Practical	**25 Marks**		
		Total	**150 Marks**	**Total**	**05**

Course Objective:

1 To impart artificial intelligence principles, techniques, and it's history

2. To assess the applicability, strengths, and weaknesses of the basic knowledge representation, problem solving, and learning methods in solving engineering

3. To develop intelligent systems by assembling solutions to concrete computational problems

Prerequisite:

Discrete mathematics, Data structures

Course Outcomes: On completion of the course, students will have the ability to:

1. Describe the concept of Artificial Intelligence, Intelligent agents and Learning agents
2. Identify issues in problem solving and apply the appropriate search methods
3. Use the appropriate search method and identify the constraints
4. Describe and select the different knowledge representation methods
5. Identify the components of planning for a particular System
6. Use appropriate domain knowledge and develop an Expert system

Unit I	**08 Hours**
Introduction to Artificial intelligence and Agents: Introduction–Human Intelligence, comparison between Man and Machine, Definition -The Turing Test, Definitions - Importance of AI, Evolution of AI - Applications of AI, Problems of AI, AI technique, Tic - Tac - Toe problem. Intelligent Agents, Agents & environment, nature of environment, structure of agents, goal-based agents, utility-based agents, learning agents. Introduction to Basic concept of Machine Learning (ML), Deep Learning (DL)and Data Science. (DS). AI vs ML vs DL vs DS, Case Study- 1 : AI for everyone/ Building AI Projects Case Study- 2 : AI and Society / Ethics for AI	
Unit II	**08 Hours**

Problem Solving, Problems, Problem Space & search: Defining the problem as state space search, production system, problem characteristics, issues in the design of search programs. **Search techniques:** Problem solving agents, searching for solutions; uniform search strategies: breadth first search, depth first search, depth limited search, bidirectional search, comparing uniform search strategies. Heuristic search strategies Greedy best-first search, A* search, AO* search, memory bounded heuristic search: local search algorithms & optimization problems: Hill climbing search, simulated annealing search, local beam search	
Unit III	**08 Hours**
Constraint satisfaction problems: Local search for constraints Satisfaction problems. Adversarial search, Games, optimal decisions & strategies in games, the minimax search procedure, alpha-beta pruning, additional refinements, iterative deepening. Case Study - 3 : State of Art Game Programs and Analysis	
Unit IV	**08 Hours**
Knowledge & reasoning: Knowledge representation issues, representation & mapping, approaches to knowledge representation. Using predicate logic, representing simple fact in logic, representing instant & ISA relationship, computable functions & predicates, resolution, natural deduction. Representing knowledge using rules, Procedural verses declarative knowledge, logic programming, forward verses backward reasoning, matching, control knowledge.	
Unit V	**08 Hours**
Knowledge Inference and Planning: Production based system; Frame based system. Inference - Backward chaining, Forward chaining, Rule value approach, Fuzzy reasoning - Certainty factors, Bayesian Theory-Bayesian Network-Dempster – Shafer theory. **Planning** – Block world problem, components of a planning systems, Goal stack planning, Non-linear planning, Hierarchical planning, least commitment strategy	
Unit VI	**08 Hours**
Learning And Expert System: Definition of learning, Forms of learning, Rote learning, learning by taking advice, learning in problem solving, Induction leaning, Explanation based learning, Formal learning theory. Connectionist models- learning in Neural network **Expert systems** - Intelligent System Vs Expert system, Architecture of expert systems, Roles of expert systems - Knowledge Acquisition –Meta Expert systems shells, Typical expert systems - MYCIN, DART, XOON, RI,.	
Textbooks	
1. Artificial Intelligence: A Modern Approach by Peter and Norvig, Reference Books: 2. Artificial Intelligence by Elaine Rich, Kevin Knight and Nair, TMH 3. Artificial Intelligence by Patrick Henry Winston, Addison-Wesley Publishing Company	
Reference Books	
1. Prolog Programming for A.I. by Bratko, TMH 3. Artificial Intelligence by Saroj Kausik	
2. Artificial Intelligence and Intelligent Systems by Padhy, Oxforfd University Press	

3. Deepak Khemani, "A First Course in Artificial Intelligence", McGraw Hill Education(India)
4. Expert Systems, Giarranto, VIKAS

List of Assignments

39. What is AI and what are the problems associated with AI
40. Describe in detail Techniques of AI
41. What is Agent and Intelligent Agent. Also explain the Agent and environment in detail.
42. Discuss the concept of AO* algorithm with suitable example
43. Define Memory bound search? Explain working of IDA* and SMA* algorithm with suitable example.
44. Define the Constraint Satisfaction Problems. Describe the elements in the Definition
45. Explain Iterative Deeping search method with suitable example
46. . Prove given examples using natural deduction rules
    1. $p \rightarrow q \vdash (q \rightarrow r) \rightarrow ((r \rightarrow s) \rightarrow (\neg s \rightarrow \neg p))$
    2. $p \wedge q \vdash (p \rightarrow q) \wedge (q \rightarrow p)$
47. Describe Dempster-Shafer theory using suitable example
48. Describe Goal stack planning with example.
49. Explain Architecture of Expert system? Give its 3 application areas.
50. Discuss the expert system in domain of medicine using suitable case study.

List of Laboratory Exercises

1.Implement Tic-Tac-Toe game for 3×3 grid.

1. Implement Water jug problem
2. Implement concept of Breadth First Search Technique
3. Implement concept of Depth First Search Technique
4. Implement Best first search for given Problem
5. Implementation of A* algorithm (Always gives optimal solution) for solving Puzzle problems
6. To solve Travelling Salesman Problem (TSP) using Hill climbing Algorithm
7. To implement graph colouring algorithm using Constraint Satisfaction problem.
   OR
   Implementation of Constraint Satisfaction Problem for solving Crypt-arithmetic Problem
8. Implementation of MinMax Search Procedure with alpha beta pruning for finding the solutions of games.
9. To design a simple expert system using decision trees.

Project Based Learning

1. Expert system
2. Game development
3. NLP
4. Solving problem with AI
5. Voice-based Virtual Assistant for Windows
6. Heart Disease Prediction Project
7. Stock Price Prediction
8. Predict Housing Price
9. Facial Emotion Recognition and Detection
10. Banking Bot

Syllabus for Unit Tests:	
Unit Test -1	Unit – I, Unit – II, Unit - III
Unit Test -2	Unit – IV, Unit – V, Unit - VI

CSE Skill Lab –II					
Teaching Scheme		**Examination Scheme**		**Credit Scheme**	
	Hours/Week		**Marks**		**Credits**
Lecture:	**00 Hours/Week**	**University Examination:**	**-**		
Practical:	**04 Hours/Week**	**Internal Assessment:**	**-**	**Lecture**	**00**
		Term Work	**25 Marks**	**Practical**	**02**
		Practical	**25 Marks**		
		Total	**50 Marks**	**Total**	**02**

Course Objective:

1. To learn basics, features and future of Python programming.
2. To acquaint with data types, input output statements, decision making, looping and functions in Python
3. To learn features of Object Oriented Programming using Python
4. To acquaint with the use and benefits of files handling in Python

Prerequisite:

Students are expected to have a good understanding of basic computer programming.

Course Outcomes: On completion of the course, students will have the ability to:

1. Exhibit the programming skills for the problems those require the writing of well documented programs including use of the logical constructs of language, Python	
2. Demonstrate experience with the Python program development environment by implementing various functions and libraries	
3. Understand file handling in Python.	
4. Understand Introductory R language fundamentals, basic syntax and how to use R; what R is and how it's used to perform data analysis.	
5. Understand and practically demonstrate the working in Data using R.	
6. Understand file handling in R.	
Unit I: Python Programming Basics	**08 Hours**
Introduction: Features of Python, history, writing and executing Python program, literal constants, variables and identifiers, data types (set, tuple, dictionary and list) operators and expressions Decision Control Statement: branching statements, loops, break, continue, pass.	
Unit II: Functions and Libraries in Python	**08 Hours**
Functions and Libraries: definition, call, variable scope and lifetime, the return statement. Defining functions, Lambda or anonymous function. Libraries: Various useful libraries (Pandas, Numpy, Pytorch, Matplotlib, Scipy etc)	
Unit III: File Handling in Python	**08 Hours**
Files: Introduction, File path, Types of files, Opening and Closing files, Reading and Writing files	
Unit IV: Basics of R programming	**08 Hours**
Introduction: advantages of R over other programming language, handling and installing packages, R variables, R data types, R decision making, R loops	
Unit V: Working with Data using R	**08 Hours**
Working with Data: R Vectors, R matrices, R factors, R Lists, R Datasets	
Unit VI: File handling in R	**08 Hours**
File handling: Loading and handling Data in R: Getting and Setting the Working Directory – getwd(), setwd(), dir() - R-CSV Files - Input as a CSV file, Reading a CSV File, Analyzing the CSV File: summary(), min(), max(), range(), mean(), median(), apply() - Writing into a CSV File – R -Excel File – Reading the Excel file.	
Textbooks	
1. Reema Thareja, "Python Programming Using Problem Solving Approach", Oxford University Press, ISBN 13: 978-0-19-948017-6	
2. Sandip Rakshit, R Programming for Beginners, McGraw Hill Education (India), 2017, ISBN: 978-93-5260-455-5.	
Reference Books	

1. Martin C. Brown, "Python: The Complete Reference", McGraw Hill Education, ISBN-10: 9789387572942, ISBN-13: 978-9387572942, ASIN: 9387572943	
2. Python 3 for Absolute Beginners, Tim Hall and J-P Stacey.	
3. Hands-on Programming with R - Garrett Grolemund	
4. Seema Acharya, Data Analytics using R, McGraw Hill Education (India), 2018, ISBN: 978-93-5260-524-8	
List of Laboratory Exercises	
1. Study and implement data structures in Python	
2. Write a Python program to implement decision control statements: if, if-else, nested if, if-elif-else statements	
3. Write Python Program to implement various looping structures.	
4. Write Python program to demonstrate implementation of functions.	
5. Demonstrate data visualization using various packages and libraries in Python.	
6. Implement various conditional statements in R.	
7. Write a R program to implement looping structures	
8. Write a R program to demonstrate use of vectors and matrices in R.	
9. Demonstrate reading of a file in R and implement various functions on a file.	
Project Based Learning	
1. Implement rock paper scissors game.	
2. Develop an email slicer	
3. Implement an Alarm clock	
4. Develop a tic tac toe game	
5. Develop a Phonebook.	
6. Design a Sentiment Analysis System	
7. Develop a system to detect credit card fraud	
8. Design a Music recommendation system	
Syllabus for Unit Tests:	
Unit Test -1	Unit – I, Unit – II, Unit - III
Unit Test -2	Unit – IV, Unit – V, Unit - VI

Semester-VI

Business Intelligence System					
Teaching Scheme		**Examination Scheme**		**Credit Scheme**	
	Hours/Week		**Marks**		**Credits**
Lecture:	**03 Hours/Week**	**University Examination:**	**60 Marks**		
Practical:	**02 Hours/Week**	**Internal Assessment:**	**40 Marks**	**Lecture**	**03**
		Term Work **Practical**	**25 Marks** **25 Marks**	**Practical**	**01**
		Total	**150 Marks**	**Total**	**04**

Course Objective:

1. Learn Business Intelligence.

Prerequisite:

Basic information about the business, its model and structure of business administrative policies

Course Outcomes: On completion of the course, students will have the ability to:

1. To gain knowledge of Business Intelligence
2. To do BI Deployment, Administration & Security.
3. To analyse the BI building process
4. To generate and manage BI reports
5. To build business projects
6. To deploy and administer BI in the real-life scenario

Unit I: Introduction to Business Intelligence	**06 Hours**
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.	
Unit II: Elements of Business Intelligence Solutions	**04 Hours**
Reports & ad hoc queries; Analyse 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.	
Unit III: Building the BI Project	**06 Hours**
Planning the BI project, Project Resources; Project Tasks, Risk Management and Mitigation, Cost-justifying BI solutions and measuring success	
Unit IV: BI building Process	**06 Hours**
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	
Unit V Reporting authoring	**06 Hours**

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.	
Unit VI Deployment, Administration & Security	**06 Hours**
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.	
Textbooks	
1. Business Intelligence (IBM ICE Publication).	
Reference Books	
1. Business Management "Derrick Foresight · Tom Hendrix · Gerard Howles · Nathan Sides 2. Dec 2020 · Efalon Acies · Narrated by Aaron Miller, Doug Greene, Chloe Jacobson and Wes Grant"	
List of Assignments	
51. Define the structure, scope and importance of BI in the business.	
52. Explain the different elements of BI and prepare an authenticate model of the same.	
53. Elaborate the importance of BI modelling and prepare one in the real time scenario.	
54. What are different types of reports? State the importance of each of them.	
55. Explain the different requirements of BI and how do they help in preparing a model.	
56. State the significance of the decentralized structure of the BI.	
List of Laboratory Exercises	
1. Introduction to BI tools, their pros and cons and limitations.	
2. Demonstration of BI techniques ETL on Application Financial Analysis.	
3. Demonstration of BI techniques ETL on Application Student result pattern and ranking analysis	
4. Demonstration of BI modelling preparation and its analysis	
5. Demonstration of measuring techniques and their analysis	
6. Demonstration of BI various BI reports	
7. Demonstration of Sorting and modelling techniques	
8. Demonstration of Exploring Excel Modelling capabilities to solve business problems	
9. Demonstration of decision tree	
10. Demonstration of BI authentication, mail server and portal integration	
Project Based Learning 1. Problem definition, identifying which data sorting task is needed. 2. Identify and use a standard methods of data sorting and measuring available for the problem. 3. Prepare a case study on the significance of the BI in light of any business organization. 4. Prepare a case study on the process of building a BI	

5. Prepare a case study on the requirement of BI 6. Prepare a case study on the authorising different reports in the Business setting	
Syllabus for Unit Tests:	
Unit Test -1	Unit – I, Unit – II, Unit - III
Unit Test -2	Unit – IV, Unit – V, Unit - VI

CRYPTOGRAPHY AND NETWORK SECURITY

Teaching Scheme		Examination Scheme		Credit Scheme	
	Hours/Week		Marks		Credits
Lecture:	04 Hours/Week	University Examination:	60 Marks		
Practical:	02 Hours/Week	Internal Assessment:	40 Marks	Lecture	04
		Term Work	25 Marks	Practical	02
		Oral	25 Marks		
		Total	150 Marks	Total	06

Course Objective:

1. To understand basics of cryptography, how it has evolved, and some key encryption techniques.
2. To understand necessary Approaches and Techniques to build protection mechanisms in order to secure computer networks.

Prerequisite:

Basic knowledge of computer network.

Course Outcomes: On completion of the course, students will have the ability to:

1. To understand basics of Cryptography and Network Security
2. Use symmetric and asymmetric key algorithms for cryptography
3. To learn about how to maintain the Confidentiality, Integrity and Availability of a data.
4. To understand various protocols for network security to protect against the threats in the networks.
5. Be able to configure simple firewall architectures
6. Apply knowledge of network security and cryptography in real life

Unit I	**08 Hours**
Security Concepts: Introduction, The need for security, Security approaches, Principles of security, Types of Security attacks, Security services, Security Mechanisms, A model for Network Security. **Cryptography Concepts and Techniques:** Introduction, plain text and cipher text, substitution techniques, transposition techniques, encryption and decryption, symmetric and asymmetric key cryptography, steganography, key range and key size, possible types of attacks.	
Unit II	**08 Hours**
Symmetric and Asymmetric key Ciphers: Block Cipher principles & Algorithms(DES, AES, Blowfish), Block cipher modes of operation, Stream ciphers, RC4, Location and placement of encryption function, Key distribution. Principles of public key cryptosystems, Algorithms (RSA, Diffie-Hellman, ECC), Key Distribution.	
Unit III	**08 Hours**
Hash and MAC Algorithms : Authentication Requirement, Functions, Message Authentication Code, Hash Functions, Security Of Hash Functions And Macs, MD5 Message Digest Algorithm, Secure Hash Algorithm, Digital Signatures	

Unit IV	**08 Hours**
System Security: Secure Socket Layer, Secure Electronic Transaction, 3-D Secure protocol, Secure HTTP, Time stamping protocol, Email Security, SMTP, PEM, PGP, Wireless Application protocol, Authentication applications- X.509, Kerberos. Key Distribution Centre, Single Sign ON approaches, Security in GSM and 3G.	
Unit V	**08 Hours**
Web Security: Requirements, Secure Socket Layer (SSL) and Transport Layer Security (TLS), Secure Electronic Transaction (SET), Intruders, Viruses and related threats. FIREWALL: Firewall Design principles, Trusted Systems.	
Unit VI	**08 Hours**
Case Studies on Cryptography and Security: Internet Key Exchange Case Studies on Cryptography and security: Secure Multiparty Calculation, Virtual Elections, Single sign On, Secure Inter-branch Payment Transactions, Cross site Scripting Vulnerability.	

Textbooks

1. Atul Kahate, "Cryptography and Network Security", 2nd Edition, Tata McGrawHill
2. William Stallings, "Cryptography and Network Security", Pearson Education.

Reference Books

1. Bruce Schneier ,"Applied Cryptography-Protocols, Algorithms, and Source Code in C".
2. William R. Cheswick. Steven M. Bellovin, Aviel D. Rubin, Addison-Wesley. "Firewalls and Internet Security, Repelling the Wily Hacker".
3. J.W. Rittiaghouse and William M.Hancok – Elseviers. "Cyber Security Operations Handbook".
4. Menezes, van Oorschot and Vanstone, "Handbook of Applied Cryptography".

List of Assignments

1. Introduction to security and types of attacks.
2. Discuss Security approaches and policies.
3. Study of any one Symmetric key cryptography algorithm.
4. Explain any one Asymmetric key cryptography algorithm.
5. Explain the concept of digital certificates.
6. Explain email security and it's security protocols.
7. Study of Key agreement protocols
8. Discuss system level security
9. Study of various protocols in network security
10. Study of network security practices

List of Laboratory Exercises

1. Introduction to Cryptography based Security Tools Key Distribution and Authentication
2. Write a Program in C/Java to implement symmetric encryption.
3. Write a Program in C/Java to implement asymmetric encryption.

4. Introduction to GnuPG encryption system.
5. Implementation of Decryption techniques using secret key in GnuPG.
6. Implementation of various cryptographic algorithms using HashCalc.
7. Study of how Firewall works in computing.
8. Study of how Antivirus works according to offline or online mode.
9. Implement mini project to develop antivirus application.
10. Case study on cyber security.
Project Based Learning 1. Keylogger projects 2. Build your own encryption software 3. Network traffic analysis 4. Caesar Cipher Decoder 5. Antivirus
Syllabus for Unit Tests:

Unit Test -1	Unit – I, Unit – II, Unit - III
Unit Test -2	Unit – IV, Unit – V, Unit - VI

NATURAL LANGUAGE PROCESSING

Teaching Scheme		Examination Scheme		Credit Scheme	
	Hours/Week		Marks		Credits
Lecture:	04 Hours/Week	University Examination:	60 Marks		
Practical:	02 Hours/Week	Internal Assessment:	40 Marks	Lecture	04
		Term Work	25 Marks	Practical	01
		Oral	25 Marks		
		Total	150 Marks	Total	05

Course Objective:

1. To understand the concepts of morphology, syntax, semantics and pragmatics of the language
2. To give introduction of knowledge acquisition, information retrieval and machine translation.
3. To relate mathematical foundations, Probability theory with Linguistic essentials such as syntactic and semantic analysis of text.

Prerequisite:

Students should have knowledge of:
Probabilities and statistics, Algorithms and programming experience.

Course Outcomes: On completion of the course, students will have the ability to:

1. Understand the models, methods, and algorithms of statistical Natural Language Processing (NLP)
2. Understand the basic NLP techniques, including syntactic parsing, semantic interpretation, lexical and morphological analysis.
3. Apply machine learning techniques used in NLP, including hidden Markov models and probabilistic context-free grammars.
4. Choose appropriate solutions for solving typical NLP sub problems (tokenizing, tagging, parsing)
5. Understand basics of knowledge representation.
6. Understand resources of natural language data – corpora.

Unit I	**08 Hours**
Introduction of NLP: Knowledge in Speech and Language processing, Various stages of NLP-ambiguity, and models and algorithm, language and understanding, brief history, Why NLP Is Difficult Parts of Speech: Nouns and Pronouns, Words: Determiners and adjectives, verbs, Phrase Structure. Statistics Essential Information Theory: Entropy, perplexity, The relation to language, Cross Entropy NLP-Language and Grammar-Processing: Origins and challenges, Language models: Uni-gram, N-gram –Statistical Language Model, NLP Applications.	
Unit II	**08 Hours**
Natural Language and Formal Language: Text Pre-processing, Regular Expressions, patterns, FA, Formal Language, NFSA, Regular Language and FSAs, Raw Text Extraction and Tokenization, Extracting Terms from Tokens, Vector Space Representation and Normalization, Similarity Computation in Text, lexicon. Phrases and idioms, word order, agreement, tense, aspect and mood and agreement, Context Free Grammar, spoken language syntax.	
Unit III	**08 Hours**

Part-of-Speech Tagging, Speech recognition and Hidden Markov Models: Speech Recognition Architecture The concept of parts-of-speech, Tagging, Tagsets, and Morphology, The Penn Treebank and Brown Corpus. Probabilistic (weighted) finite state automata. Overview of Hidden Markov models (HMMs). The Viterbi Algorithms Revisited, Advanced Methods for Decoding, Acoustic Processing of Speech, Computing Acoustic Probabilities, Training a Speech Recognizer, Waveform Generation for Speech Synthesis, Human Speech Recognition	
Unit IV	**08 Hours**
Grammars & Parsing Algorithms: Context-free Grammars, Context-Free Rules and Trees, Sentence-Level Constructions, The Noun Phrase, Coordination, Agreement and The Verb Phrase and Subcategorization, Auxiliaries, Spoken Language Syntax, Parsing Regular Grammars, Parsing Context Free Grammars, Example Toy NL Grammar, Shift-Reduce Parsers, Probabilistic Parsing: Introduction, Grammars & Human Processing	
Unit V	**08 Hours**
Matrix Factorization and Topic Modeling: Vector space model, Matrix factorization, Singular Value Decomposition, Nonnegative Matrix Factorization, Probabilistic Latent Semantic Analysis, Latent Dirichlet Allocation, Word2Vec and Doc2Vec, Word-character and sentence embedding, Topic modelling term weighting, homonymy, polysemy, synonymy, Improving user queries. Machine Translation– Overview, Applications of NLP- Spell-checking, Summarization.	
Unit VI	**08 Hours**
Linguistics resources: Introduction to corpus, elements in balanced corpus, TreeBank, PropBank, WordNet, VerbNet etc. Resource management with XML, Management of linguistic data with the help of GATE, The Semantic Web technologies, ontologies, OWL, NLTK.	

Textbooks

1. Allen, J. "Natural Language Understanding", The Benajmins/Cummings Publishing Company ,Inc. 1994. ISBN 0-8053-0334-0.
2. Daniel Jurafsky and James H Martin. "Speech and Language Processing", 2e, Pearson Education, 2009

Reference Books

1. James A, "Natural language Understanding" 2e, Pearson Education, 1994
2. Bharati A., Sangal R., Chaitanya V."Natural language processing: a Paninian perspective", PHI, 2000.
3. Siddiqui T., Tiwary U. S. "Natural language processing and Information retrieval", OUP, 2008 NLTK – Natural Language Tool Kit - http://www.nltk.org/
4. Journals: Computational Linguistics, Natural Language Engineering, Machine Learning, Machine Translation, Artificial Intelligence.

List of Assignments

57. Write note on word normalization and stemming. Explain case folding with suitable example.
58. What is significance of decision tree in sentence segmentation also give implementation of decision tree for suitable example.

59. Discuss challenges of Machine translation. What are classical approaches of machine translation?
60. Case study on IBM translation model.
61. Case study on WordVET and VerbNet
62. Study of Hidden Markov Model and POS tagging
63. Study assignment on Python—Analysing Text with the Natural Language.
64. Research paper reading, analysing and demonstrating.
65. Research paper reading, analysing and demonstrating.
66. Describe different techniques for removal of ambiguity.

List of Laboratory Exercises

1. Implement bottom-up parser for any given grammar.
2. Analysis of natural language using lexical analysis.
3. Case study of any parsing algorithm.
4. Study of clustering algorithm in NLP.
5. Case study: NLP in web mining or text mining
6. Case study of Viterbi Algorithm.
7. Study of Python features used in NLP
8. Study assignment of information retrieval techniques
9. Installation of NTLK Toolkit.
10. Implement program in Python to calculate frequency distribution.

Project Based Learning

1. Question Answering
2. Text Classification
3. Text Summarization
4. Sentiment Analysis
5. Sentence Similarity
6. Speech Recognition
7. Neural Machine Translation
8. Document Summarization
9. Conversational Bots: ChatBots
10. Grammar Autocorrector
11. Summary Writer
12. Image-Caption Generator

Syllabus for Unit Tests:

Unit Test -1	Unit – I, Unit – II, Unit - III
Unit Test -2	Unit – IV, Unit – V, Unit - VI

COURSE: Quantitative Techniques, Communication and Values

TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS:**
Theory: 04Hours / Week Tutorial: 00Hour / Week	Semester End Examination: 60 Marks Internal Assessment: 40 Marks	Credits:4

Course Pre-requisites: The students should have knowledge of

1	Basic math's and reasoning, and comprehensive ability
2	Basic knowledge of communication process, soft skills
3	Basic knowledge and idea about leaders and leadership qualities, ethics, etiquettes and values

Course Objective:

The **Quantitative Techniques, Communication and Value s**aims to augment students to face the campus recruitment test and train them on applying short techniques/ tricks to solve questions of Maths, reasoning and English in very less amount of time. The communication and values section focuses on the aspects of communication and soft skills such as grooming personality for leading team, presentation, business communication which would enable graduates to project themselves as a professionals in the corporate sector and/or otherwise.

Course Outcomes: The student will be able to

1	Solve the aptitude test in the recruitment and competitive exam by applying short techniques and solve the question in less amount of time
2	Apply the short mnemonics and techniques to solve the questions of logical reasoning in the placement and competitive exam in lesser time.
3	Develop the verbal ability to communicate effectively using suitable vocabulary and proper sentence pattern
4	Understand the concept of soft skills and its implication at workplace
5	Build up the ability to study employment business correspondences and its proper implications
6	Understand business ethics, etiquettes and values and apply them in the professional ventures.

Course Content:

Unit-I	**QUANTITATIVE APTITUDE** :Number system, Percentage, profit and loss, Simple Interest and Compound Interest, Ratio, Proportion and Average, Mixture and Allegation, Time, Speed & Distance, Time & Work , Permutation & Combination, Probability, Pipes and Cisterns	**(8 Hrs)**
Unit-II	**NON-VERBAL REASONING :** Coding, Decoding, Number series, Blood relation Directions, cubes & dices , Data Interpretation, Data Sufficiency, Set Theory & Syllogisms, Matching, Selection & Arrangement, Clocks & Calendars, Visual Reasoning, Input, Output & Flow Chart.	**(8 Hrs)**
Unit-III	**VERBAL REASONING:** Sentence Patterns, Sentence correction and spotting errors, Vocabulary, antonyms and synonyms and analogy, Phrasal Verbs, idiomatic expressions, reading comprehension, closest, sentence rearrangement and theme detection	**(8 Hrs)**
Unit-IV	**SELF AWARENESS AND SOFT SKILLS DEVELOPMENT:** Concept of SWOT, Importance of SWOT, Individual & Organizational SWOT Analysis, Soft skills, meaning, need and importance, difference between soft skills and hard skills, life skills and personal skills, Leadership skills,- Importance ,Types, Attributes of good leader Motivational theories and	**(8 Hrs)**

	leadership ,Emotional intelligence in personal and professional lives its importance need and application, Team Building and conflict resolution Skills ,Problem solving skills, Time Management and Stress Management Skills Pareto Principle(80/20) Rule in time management, Time management matrix, creativity and result orientation, working under pressure, stress management	
Unit-V	**COMMUNICATION AND HONING EMPLOYMENT SKILLS:** Communication process, Non-verbal codes in communication, importance of LSRW in communication, Barriers to communication, Principles of effective Technical writing, Email writing and Netiquettes, **Letter writing** – formal letters, job application letter, cover letter, structure of technical report writing, Building Resume and CV, Tips to build an effective Resume Group discussion, Skills required for Group Discussion Interview skills, Ways of handling telephonic interviews, Importance of body language, grooming &etiquettes for getting right impression in PI&GD , Extempore, Introduction to PowerPoint presentation, ,Structure & flow of presentation,	**(8 Hrs)**
Unit-VI	**BUSINESS ETHICS ,ETIQUETTES AND VALUES:** The Importance of Ethics and Values in Business World, Respect for Individuality and diversity at workplace values of a good manager Key features of corporate etiquette, Corporate grooming & dressing, etiquettes in social & office Setting-Understand the importanceof professional behaviour at the work place, Corporate social responsibility (CSR) its importance and need.	**(8 Hrs)**
Reference Books:		

1	Quantitative Aptitude by R. S. Agarwal published by S. Chand
2	The Book of Numbers by Shakuntala Devi
3	A Modern Approach To Logical Reasoning by R. S. Agarwal published by S. Chand
4	A New Approach to Reasoning Verbal & Non-Verbal by Indu Sijwali
5	Business Communication by Meenakshi Raman, Prakash Singh published by Oxford University press, second edition
6	Communication Skills by Sanjay Kumar, Pushp Lata, published by Oxford University press, second edition
7	Technical Communication by Meenakshi Raman, Sangeeta Sharma published by Oxford University press
8	Developing Communication Skills by Krishna Mohan, Meera Banerji published by Macmillan India Pvt Ltd
9	Soft Skills by Meenkashi Raman, published by Cengage publishers
10	Soft Skills by Dr. K Alex published by Oxford University press
11	Soft skills for Managers by Dr. T. Kalyana Chakravarthi and Dr. T. Latha Chakravarthi published by biztantra
Project Based Learning Topics:	
1	Prepare mock Tests on Unit –I and solve it in given time(use of PSD lab manual)
2	Prepare mock Tests on Unit –I and solve it in given time(use of PSD lab manual)
3	Prepare online model test based on Unit-II and solve it in specific time(use of PSD lab manual)
4	Prepare online model test based on Unit-II and solve it in specific time(use of PSD lab manual)

5	Form a model for spoken and written communication skills which avoid grammar mistakes and common errors
6	Develop various activity models for enriching and developing vocabulary
7	Preparing strategies by using SWOT and TWOS analysis
8	Analysing differences between Soft Skills, Hard skills, and Personal skills
9	Develop Bruce Tuchman's Team Building Models with classmates/Teammates
10	To study different personalities of Leaders from various sectors and find out their attributes and success stories
11	Preparing a model for Time Management Skills and Stress Management and conduct activities for effective implementation of it.
12	Form a model to develop LSRW and communication Skills
13	Conduct mock interview and practice GD activities to build competencies for actual selection process
14	Preparing a model for evaluating Values and Ethics of Good Managers
15	Preparing a model of dress codes and attire for different professional situations Corporate etiquettes and its implications
16	Develop some good activities to understand the importance and need of Corporate social responsibility (CSR)

Syllabus for Unit Tests:	
Unit Test -1	Unit – I, Unit – II, Unit - III
Unit Test -2	Unit – IV, Unit – V, Unit - VI

Design Thinking

Teaching Scheme		Examination Scheme		Credit Scheme	
	Hours/Week		Marks		Credits
Lecture:	04 Hours/Week	University Examination:	60 Marks		
Practical:	-	Internal Assessment:	40 Marks	Lecture	04
			-		
		Total	100 Marks	Total	04

Course Objective:

1. Recognize the importance of DT
2. Explain the phases in the DT process
3. Apply each phase in the DT process
4. Create value proposition statements as part of their presentations

Prerequisite: Students should be well versed Completion of all units from Semesters 1, 2, 3 and 4

Course Outcomes: On completion of the course, students will have the ability to:

1. Implement the Phases in the DT process
2. Identify the steps required to conduct an immersion activity
3. Design personas to create problem statements in the define phase of DT
4. Apply the steps in the ideate phase of DT
5. Design a prototype to create a value proposition statement
6. Test a prototype created through a DT process

Unit I	**08 Hours**
Introduction: Recognize the importance of Design Thinking why is Design Thinking important for business, Why is Design Thinking important for you, Identify the steps in the DT process What is DT? Empathize (search for rich stories and find some love), Define (user need and insights – their POV), Ideate (ideas, ideas, ideas), Prototype (build to learn), Test (show, don't tell)	
Unit II	**08 Hours**
Empathy Phase: Recognize the steps in the empathize phase of DT, What is empathy? Ask What? How? Why? Different types to developing Empathy towards People Identify the steps required to conduct an immersion activity, How to empathize?, Intro to Immersion Activity, Conduct an immersion activity and fill up the DT question template, Immersion activity	
Unit III	**08 Hours**
Define Phase: Creating personas: Recognize the steps to create personas in the define phase of DT, What is a persona and how do I create one? Four Different Perspectives on Personas 1) Goal-directed Personas 2) Role-Based Personas 3) Engaging Personas 4) Fictional Personas, 10 steps to Creating Your Engaging Personas and Scenarios Recognize the steps to create problem statements in the define phase of DT, Problem statements, Defining problem statements, Define the problem statements in the define phase of DT	
Unit IV	**08 Hours**
Ideate Phase: How to Ideate?, Recognize the steps in the ideate phase of DT, Apply the steps in the ideate phase of DT, Ideation games: Game 1: Six Thinking Hats, Game	

2: Million-dollar idea, Ideate to find solutions, Characteristics Required for Successful Ideation, Recognize how doodling can help to express ideas, Recognize the importance storytelling in presenting ideas and prototypes, What is Storytelling in DT?	
Unit V	**08 Hours**
Prototype Phase: Recognize the importance of the prototype phase in DT, Prototype your idea, Create a prototype: Types of Prototyping 1)Low-Fidelity Prototyping 2) High-Fidelity Prototyping , Guidelines for Prototyping, Recognize the importance of service value proposition, Create a value proposition statement	
Unit VI	**08 Hours**
Testing Phase: Testing in Design Thinking, Test the Prototype, Role of DT in your work, discuss How DT can help me to become a better coder?, Agile and DT complement each other to deliver customer satisfaction, Share your Satori.	

Textbooks

1. "Designing for growth: A design thinking tool kit for managers", by Jeanne Liedtka and Tim Ogilvie., 2011, ISBN 978-0-231-15838-1
2. "Design Thinking: New Product Development Essentials from the PDMA", by Abbie Griffin, Michael G. Luchs, Scott Swan, Wiley Publications

Reference Books

1. Hooked by Nir Eyal
2. The Art of Creative Thinking by Rod Judkins
3. Start Up nation by Dan Senor and Saul singer
4. Start with Why by Simon Sinek

List of Assignments

67. Identify problem using DT.
68. Use thinking tool for development of the idea.
69. Use DT to develop the solution.
70. Develop a prototype using DT
71. Study the challenges faced during implementing DT in an Organization

Project Based Learning

1. Use of DT to improve classroom education.
2. Use of DT to improve cab services.
3. Use of DT to improve banking system.
4. Use of DT to identify and give solution to a society related problem
5. Use of DT to improve medical services

Syllabus for Unit Tests:

Unit Test -1	Unit – I, Unit – II, Unit - III
Unit Test -2	Unit – IV, Unit – V, Unit - VI

CSE Skill Lab –III

Teaching Scheme		Examination Scheme		Credit Scheme	
	Hours/Week		Marks		Credits
Lecture:	00 Hours/Week	University Examination:	-		
Practical:	04 Hours/Week	Internal Assessment:	-	Lecture	00
		Term Work	25 Marks	Practical	02
		Practical	25 Marks		
		Total	50 Marks	Total	02

Course Objective:

To develop analytical skills among the students using data analysis methods and Python.

Prerequisite:

The Students should have knowledge of basics of statistics and python programming.

Course Outcomes: On completion of the course, students will have the ability to:

1. Understand and demonstrate fundaments of Python programming
2. Demonstrate visualization in Python.
3. Understand basics of normal distribution and linear regression model
4. Design various clusters.
5. Understand basics H plots.
6. Understand basics clustering and segmentations.

Unit I : Introduction to Python Programming	**08 Hours**
Python programming environment, statements, Expressions, Flow Controls, Functions, Numeric Types, Sequences and Class Definition, Constructors, Text & Binary Files- Reading and Writing. **Visualization in Python:** Matplotlib package, Plotting Graphs, Controlling Graph, Adding Text, More Graph Types, Getting and setting values, Patches.	
Unit II : Descriptive Statistics:	**08 Hours**
Type of data- univariate bivariate and multivariate. Descriptive measures - central tendency and dispersion. Bivariate data-Summarization, marginal and conditional frequency distribution. Regression and correlation. Least squares method. Rank correlation. Graphical representation, Frequency curves, Scatter diagram.	
Unit III: Probability Theory	**08 Hours**
Probability Theory: concept of experiments, sample space, event. Definition of Combinatorial Probability. Conditional Probability, Bayes Theorem. **Probability distribution:** Type of data, Bernoulli Distribution, Uniform Distribution, Binomial Distribution, Normal Distribution, Poisson Distribution, Exponential Distribution. Visualization of distribution	
Unit IV: Regression	**08 Hours**
Linear regression: Linear regression model, Model assumptions, Validation of model and model assumptions. **Multiple regression:** Multiple linear regression model, Model assumptions, Validation of model and model assumptions	
Unit V : Principal Component Analysis:	

Principal Component Analysis: Principal components, Algorithm for conducting principal component analysis, deciding on how many principal components to retain, H-plot.	**08 Hours**
Unit VI: Clustering and Segmentation Analysis:	**08 Hours**
Clustering and Segmentation Analysis: Introduction, Types of clustering, Correlations and distances, clustering by partitioning methods, hierarchical clustering, overlapping clustering, K-Means Clustering, Profiling and Interpreting Cluster	

Textbooks

1. Tim Hall and J-P Stacey "Python 3 for Absolute Beginners", A press.
2. Wes Mc Kinney. "Python for Data Analysis",O'Reilly Media, Inc.

Reference Books

1. Jake Vander Plas, "Python Data Science Handbook: Essential Tools for Working with Data"O'Reilly Media
2. David Spiegel halter "The Art of Statistics"Pelican

List of Laboratory Exercises

72. Introduction to python programming (String operation, Mathematical operation, loops, branching)
73. Write a program to perform basic operations using Python Functions.
74. Write a program to perform to read, write and modify text file data using OO Python.
75. . Implement various pre-defined libraries in Python like Panda, NumPy, Cbor (Drawing of statistical graph)
76. Exercise different functionalities of Matplotlib package.
77. Write a program to measure central tendency and dispersion of given data.
78. Write a program to visualize different types of distributions.
79. Write a program to develop linear and multiple regression model.
80. Implementation of clustering and segmentation

Project Based Learning:

Syllabus for Unit Tests:

Unit Test -1	Unit – I, Unit – II, Unit - III
Unit Test -2	Unit – IV, Unit – V, Unit - VI

Program: B.TECH. (Computer Science and Engineering) Semester – VII CBCS 2021 Course

Sr. No.	Course Code	Name of Course	Teaching Scheme (Hrs./Week)			Examination Scheme (Marks)						Credits			
			L	P	T	ESE	IA	TW	OR	PR	Total	L	P	T	Total
1		Machine Learning	3	2	-	60	40	25	-	25	150	3	1	-	4
2		Internet of Things *	4	2	-	60	40	25	25	-	150	4	1	-	5
3		Optimization Techniques	4	-	-	60	40	-	-	-	100	4	-	-	4
4		Elective I	3	2	-	60	40	25	25	-	150	3	1	-	4
5		CSE Skill Lab–IV	-	4	-	-	-	25	-	25	50	-	2	-	2
6		Project Stage-I	-	2	-	-	-	50	50	-	100	-	3	-	3
7		Internship	-	-	-	-	-	25	25	-	50	-	3	-	3
		Total	**14**	**12**	**-**	**240**	**160**	**175**	**125**	**50**	**750**	**14**	**11**	**-**	**25**

***Industry Taught Course- V**

Elective I	Deep learning	Game Theory	Semantic Web	Text Mining

Program: B.TECH. (Computer Science and Engineering) Semester – VIII CBCS 2021 Course

Sr. No.	Course Code	Name of Course	Teaching Scheme (Hrs./Week)			Examination Scheme (Marks)						Credits			
			L	P	T	ESE	IA	TW	OR	PR	Total	L	P	T	Total
1		Data Visualization & Reporting	3	-	1	60	40	25	-	-	125	3	-	1	4
2		Augmented and Virtual Reality	4	2	-	60	40	-	25	-	125	4	1	-	5
3		Block Chain and Digital Currency*	3	2	-	60	40	-	-	25	125	3	1	-	4
4		Elective –II	3	2	-	60	40	-	25	-	125	3	1	-	4
5		CSE Skill Lab–V	-	4	-	-	-	25	-	25	50	-	2	-	2
6		Project Stage-II	-	4	-	-	-	100	100	-	200	-	6	-	6
		Total	**13**	**14**	**1**	**240**	**160**	**150**	**150**	**50**	**750**	**13**	**11**	**1**	**25**
		Research Paper Publication#	-	-	-	-	-	-	-	-	-	-	-	-	2

***Industry Taught Course- VI**

 # Add-on Course

Elective -II	Pattern Recognition	Industrial IOT	Knowledge Management System	Information Retrieval

Machine Learning

Teaching Scheme		Examination Scheme		Credit Scheme	
	Hours/Week		Marks		Credits
Lecture:	03 Hours/Week	University Examination:	60 Marks		
Practical:	02 Hours/Week	Internal Assessment:	40 Marks	Lecture	03
		Term Work	25 Marks	Practical	01
		Practical	25 Marks		
		Total	150 Marks	Total	04

Course Objective:

1. To provide a strong formal foundation of Machine Learning concepts and technique

Prerequisite:

Artificial intelligence, Discrete Mathematics, Database Management System, Engineering Mathematics, Programming Languages.

Course Outcomes: On completion of the course, students will have the ability to:

1. To understand the need for Machine learning
2. To explore various data pre-processing methods.
3. To study and understand classification methods
4. To understand the need for multi-class classifiers.
5. To learn the working of clustering algorithms
6. To learn fundamental neural network algorithms

Unit I	**06 Hours**
Introduction To ML: Introduction to statistics, Comparison of Machine learning with traditional programming, ML vs AI vs Data Science. Introduction to Learning Systems, Structure of Learning System, Testing vs Training, learning vs Designing, Elements of Machine Learning- Data formats, Learnability, Statistical learning approaches, Elements of information theory	
Unit II:	**06 Hours**
Machine Learning Techniques: Introduction to Machine Learning Techniques: Supervised Learning(SL) Vs Semi-Supervised Learning(SSL) vs Unsupervised Learning(USL), Reinforcement Learning, Examples of SL, SS, and US Learning, how to choose Machine Learning Technique, Machine Learning Models, and Types, Examples: Linear based Models, Logic Based and Algebraic Models, Probabilistic Models	
Unit-III- Regression:	**06 Hours**
What is Regression? Types: Linear Regression, Logistic Regression, Classification vs Regression, Issues Regarding Classification, and Regression, Assessing performance of Regression, Predictor error measures, Applications of Supervised Learning	
Unit-IV- Classification:	**06 Hours**
What is Classification?, Types: Naive Bayes Classifier, Decision Trees, Support Vector Machines, Rule based Classification, Backpropagation, Associative Classification, Classifier Accuracy Measures, Precision and Recall Measure	

Unit-V- Unsupervised Learning	**06 Hours**
Introduction to Clustering, Types: K Means Clustering Algorithm, Mixture Models, Hierarchical Clustering, Anomaly Detection, Neural Networks, Self- Organizing Map(SOM), Applications of Unsupervised Learning.	
Unit VI- Trends in Machine Learning:	**06 Hours**
Ensemble methods for increasing accuracy: Bagging and Boosting, multitask learning, online learning and Sequence Prediction, Data Streams and Active Learning, Introduction to Deep Learning and Reinforcement Learning, Case Study: Latest Machine Learning Tools.	

Textbooks

1. K.P. Soman, R. Loganathan, V. Ajay, "Machine Learning with SVM and Other Kernel Methods"
2. C. M. Bishop ," Pattern Recognition and Machine Learning", Springer 1st Edition-2013.
3. Ethem Alpaydin, "Introduction to Machine Learning"

Reference Books

1. Tom Mitchell, ―Machine learning‖, McGraw-Hill series in Computer Science, 1997
2. Shalev-Shwartz, Shai, and Shai Ben-David, ―Understanding machine learning: From theory to algorithms‖, Cambridge university press, 2014.
3. Jiawei Han, Micheline Kamber, and Jian Pie, ―Data Mining: Concepts and Techniques‖, Elsevier Publishers Third Edition, ISBN: 9780123814791, 9780123814807
4. Hastie, Trevor, et al., ―The elements of statistical learning: data mining, inference, and prediction‖, Vol. 2. New York: springer, 2009.
5. McKinney, ―Python for Data Analysis ―,O' Reilly media, ISBN : 978-1-449- 31979-3
6. Trent hauk, ―Scikit-learn‖, Cookbook , Packt Publishing, ISBN: 9781787286382

List of Practical

1. Predict the price of the Uber ride from a given pickup point to the agreed drop-off location.

   Perform following tasks:
   1. Pre-process the dataset.
   2. Identify outliers.
   3. Check the correlation.
   4. Implement linear regression and random forest regression models.
   5. Evaluate the models and compare their respective scores like R2, RMSE, etc.

   Dataset link: https://www.kaggle.com/datasets/yasserh/uber-fares-dataset

2. Classify the email using the binary classification method. Email Spam detection has two states: a) Normal State – Not Spam, b) Abnormal State – Spam. Use K-Nearest Neighbors and Support Vector Machine for classification. Analyze their performance.

   Dataset link: The emails.csv dataset on the Kaggle
   https://www.kaggle.com/datasets/balaka18/email-spam-classification-dataset-csv

3. Given a bank customer, build a neural network-based classifier that can determine whether they will leave or not in the next 6 months.

   Dataset Description: The case study is from an open-source dataset from Kaggle. The dataset contains 10,000 sample points with 14 distinct features such as
   CustomerId, CreditScore, Geography, Gender, Age, Tenure, Balance, etc.
   Link to the Kaggle project:

https://www.kaggle.com/barelydedicated/bank-customer-churn-modeling

Perform following steps:

1. Read the dataset.
2. Distinguish the feature and target set and divide the data set into training and test sets.
3. Normalize the train and test data.
4. Initialize and build the model. Identify the points of improvement and implement the same.
5. Print the accuracy score and confusion matrix (5 points).

4. Implement Gradient Descent Algorithm to find the local minima of a function.

For example, find the local minima of the function $y=(x+3)^2$ starting from the point x=2.

5. Implement K-Nearest Neighbors algorithm on diabetes.csv dataset. Compute confusion matrix, accuracy, error rate, precision and recall on the given dataset.
   Dataset link : https://www.kaggle.com/datasets/abdallamahgoub/diabetes

6. Implement K-Means clustering/ hierarchical clustering on sales_data_sample.csv dataset. Determine the number of clusters using the elbow method.
   Dataset link : https://www.kaggle.com/datasets/kyanyoga/sample-sales-data

Project Based Learning

1. Zillow Home Value Prediction ML Project ...
2. BigMart Sales Prediction ML Project – Learn about Unsupervised Machine Learning Algorithms
3. Music Recommendation System ML Project
4. Iris Flowers Classification ML Project
5. Stock Prices Predictor using TimeSeries
6. Predicting Wine Quality using Wine Quality Dataset
7. MNIST Handwritten Digit Classification
8. Build a Movie Recommender System Movielens Dataset

Syllabus for Unit Tests:

Unit Test -1	Unit – I, Unit – II, Unit - III
Unit Test -2	Unit – IV, Unit – V, Unit - VI

Internet Of Things

Teaching Scheme		Examination Scheme		Credit Scheme	
	Hours/Week		**Marks**		**Credits**
Lecture:	**04 Hours/Week**	**University Examination:**	**60 Marks**		
Practical:	**02 Hours/Week**	**Internal Assessment:**	**40 Marks**	**Lecture**	**04**
		Term Work	**25 Marks**	**Practical**	**01**
		Oral	**25 Marks**		
		Total	**150 Marks**	**Total**	**05**

Course Objective: Students will try:

1. To understand fundamentals of Internet of Things (IoT)
2. To learn methodologies for IoT application development
3. To learn the IoT protocols, cloud platforms and security issues in IoT
4. To learn real world application scenarios of IoT along with its societal and economic impact using case studies and real time examples

Prerequisite:

Data structures and algorithms

Course Outcomes: On completion of the course, students will have the ability to:

1: Understand the fundamentals and need of Embedded Systems for the Internet of Things

2: Apply IoT enabling technologies for developing IoT systems

3: Apply design methodology for designing and implementing IoT applications

4: Analyze IoT protocols for making IoT devices communication

5: Design cloud based IoT systems

6: Design and Develop secured IoT applications

Unit I : Introduction to Internet of and Things (IoT)	**08 Hours**
Introduction: Enabling Technologies of IoT, Logical Design of IoT, IoT communication Models, IoT Communication API‟s Cloud Services: IAAS, PAAS, SAAS, IoT Specific Cloud Services RFID: Introduction to RFID and its Applications in IoT.	
Unit II: PHY/MAC Layer	**08 Hours**
PHY/MAC Layer: Wireless HART, ZWave, Bluetooth Low Energy, Zigbee Smart Energy Network Layer: IPv4, IPv6, 6LoWPAN, ICMP, RPL,COAP	
Unit III: IoT Design Methodology	**08 Hours**
Transport Layer: (TCP, UDP, DCCP, SCTP)-(TLS, DTLS) Session Layer: HTTP, CoAP, XMPP, AMQP, MQTT	
Unit IV: IoT Protocols	**08 Hours**
Protocol Standardization for IoT, M2M and WSN Protocols, RFID Protocol, Modbus Protocol, Zigbee Architecture. IP-based Protocols: MQTT (Secure), 6LoWPAN, LoRa.	
Unit V: IoT Security	**08 Hours**
Vulnerabilities Security Requirements and Threat Analysis, Misuse Cases, IoT Security Tomography, and Layered Attacker Model, Identity Management and Establishment,	

Access Control, and Secure Message Communication, Security Models, IoT Security Protocols.	
Unit VI: System Software for IoT	**08 Hours**
Software for IoT Development Boards like Arduino, Raspberry Pi, Beagle Bone, Intel Galileo: IDE, Simulator, Emulator, Debugger, OS , Software Libraries for Internet connectivity Devices, Gateways, Internet, and Web/Cloud Services Software Development Prototyping Online Component API and Web APIs	

Textbooks

1. Vijay Madisetti and ArshdeepBahga, "Internet of Things (A Hands-on Approach)", University Press 1st Edition, 2014
2. Jeeva Jose, "Internet of Things", ISBN-10 : 938617359X, Khanna Book Publishing, 2018 3. Raj Kamal, Internet of Things: Architecture and Design Principle" , ISBN-13: 978-93-5260- 522-4, McGraw Hill Education (India) 2017

Reference Books

1. The Internet of Things: From RFID to the Next-Generation Pervasive Networked Lu Yan, Yan Zhang, Laurence T. Yang, Huansheng Ning
2. Designing the Internet of Things , Adrian McEwen (Author), Hakim Cassimally
3. HakimaChouchi, "The Internet of Things Connecting Objects to the Web", ISBN 078 -1-84821-140-7, Wiley Publications Asoke K Talukder and Roopa R Yavagal, "Mobile Computing," Tata McGraw Hill, 2010.
4. Computer Networks; By: Tanenbaum, Andrew S; Pearson Education Pte. Ltd., Delhi, 4th Edition 5. Data and Computer Communications; By: Stallings, William; Pearson Education Pte.Ltd., Delhi, 6th Edition

List of Laboratory Exercises:

1. Case Studt on IOT Smart Cities,
2. Agriculture,
3. Health and Lifestyle,
4. Industry,
5. Home Automation,
6. Telecom/5G.

Syllabus for Unit Tests:

Unit Test -1	Unit – I, Unit – II, Unit - III
Unit Test -2	Unit – IV, Unit – V, Unit - VI

Optimization Techniques

Teaching Scheme		Examination Scheme		Credit Scheme	
	Hours/Week		Marks		Credits
Lecture:	04 Hours/Week	University Examination:	60 Marks	Lecture	04
		Internal Assessment:	40 Marks		
		Total	100 Marks	Total	04

Course Objective:

5. To recognize the importance of applications of Optimization Techniques
6. To understand the framework of optimization problem
7. To inculcate modelling skills necessary to describe and formulate optimization problems in design
8. To train the students to solve optimization problems using software tools

Prerequisite: Students should be well versed with concepts of Linear Algebra, Probability and Statistics and Artificial Intelligence, Completion of all semesters 1 to 6

Course Outcomes: On completion of the course, students will have the ability to:

1. To understand the basic principle of optimization.
2. To apply linear programming to real world problem.
3. To analyze constrained and unconstrained optimization techniques.
4. To evaluate optimization using dynamic programming
5. To build problems using integer programming
6. To make student aware about modern optimization techniques

Unit I	**08 Hours**
Introduction to Optimization: What are optimization techniques, the Importance of Optimization, Mathematical problem formulation, engineering applications of optimization, classification of optimization problems	
Unit II	**08 Hours**
Linear Programming: Standard form of Linear Programming, Graphical Method, Simplex Algorithm, Simplex Criterion, Duality in Linear Programming, Transportation Problem, Assignment Problem. Case study.	
Unit III	**08 Hours**
Non-Linear Programming Introduction to Non-Linear Programming, Examples of Non-Linear Programming, Constrained and Unconstrained Optimization, Gradient Based and Steepest Descent Methods, Methods of Non-Linear Programming. Case Study.	
Unit IV	**08 Hours**
Dynamic Programming: Introduction to Dynamic Programming, Sequential Optimization, Computational Procedure, Discrete Dynamic Programming, Continuous Dynamic Programming. Case Study.	
Unit V	**08 Hours**
Integer Programming: Introduction to Integer Programming, Examples of Linear and Non-Linear Programming, Methods for Integer Programming. Case Study.	
Unit VI	**08 Hours**
Modern Optimization: Genetic Algorithm, Particle Swarm Optimization, Ant Colony Optimization, Neural Network based Optimization, Fuzzy Optimization Techniques	

Textbooks	
1. S. S. Rao, Engineering Optimization: Theory and Practice, New Age International	
2. K. Deb, Optimization for Engineering Design, Prentice Hall of India	
3. Hillier & Lieberman, Introduction to Operations Research, TMH	
Reference Books	
1. Practical Optimization Algorithms and Engineering Applications Andreas Antoniou	
2. An introduction to Optimization by Edwin P K Chong, Stainslaw Zak	
3. Nonlinear Programming by Dimitri Bertsekas	
4. Start with Why by Simon Sinek	
Project Based Learning	
1. Project optimization plan for business	
2. Project on Supply Chain Management	
3. Applications of diet or nutrition-based problems	
4. Linear Programming in a restaurant style	
5. Maximize discount at a bookstore	
6. Student project allocation	
Syllabus for Unit Tests:	
Unit Test -1	Unit – I, Unit – II, Unit - III
Unit Test -2	Unit – IV, Unit – V, Unit - VI

Elective-I Deep Learning

Teaching Scheme		Examination Scheme		Credit Scheme	
	Hours/Week		**Marks**		**Credits**
Lecture:	**03Hours/Week**	**University Examination:**	**60 Marks**		
Practical:	**02 Hours/Week**	**Internal Assessment:**	**40 Marks**	**Lecture**	**03**
		Term Work	**25 Marks**	**Practical**	**01**
		Oral	**25 Marks**		
		Total	**150 Marks**	**Total**	**04**

Course Objective:

1. To acquire knowledge of Deep Learning Concepts
2. To learn various types of Artificial Neural Networks
3. To gain knowledge to apply optimization strategies

Prerequisite:

Knowledge of Programming, Engineering Mathematics, Artificial Intelligence

Course Outcomes: On completion of the course, students will have the ability to:

1. Understand basic concepts of Deep Learning.
2. Learn concept of Gradient Decent and Regularization
3. Understand different methodologies to create applications using deep nets.
4. Understanding of RNN to model for real-world applications.
5. Design the test procedures to assess the efficacy of the developed model.
6. Examine the case studies of Deep Learning techniques

Unit I	**06 Hours**
Introduction To Deep Learning: Introduction to Deep Learning: Basics: Biological Neuron, Idea of computational units, History of Deep Learning McCulloch Pitts Neuron, Thresholding Logic, Perceptron's, Perceptron Learning Algorithm, Multilayer Perceptron's (MLPs), Representation Power of MLPs, Sigmoid Neurons, Gradient Descent, Feedforward Neural Networks, Representation Power of Feedforward Neural Networks.	
Unit II	**06 Hours**
Gradient Descent and Regularization **Gradient Descent** -Gradient Descent (GD), Momentum Based GD, Nesterov Accelerated GD, Stochastic GD, AdaGrad, RMSProp **Regularization-** Concept of Hyper parameters their purpose in training deep learning models, types and examples L1 regularization, L2 regularization and difference between L1, L2 and dropout, Early stopping, Dataset augmentation, Parameter sharing and tying, Injecting noise at the input.	
Unit III	**06 Hours**
Convolutional Neural Networks **Convolutional Neural Networks-** Convolutional Neural Networks, Architectures, convolution/pooling layers, LeNet, AlexNet, ZF-Net, VGGNet, GoogLeNet, ResNet, Width and Depth of Neural Networks, Activation Functions: RELU, LRELU, ERELU, Unsupervised Training of Neural Networks, Visualizing Convolutional Neural Networks, Guided Backpropagation.	
Unit IV	**06 Hours**
Recurrent Neural Networks- Recurrent Neural Networks, Backpropagation through time (BPTT), Vanishing and Exploding Gradients, Truncated BPTT, GRU, LSTMs. Encoder, decoder architecture, recursive neural network and difference between feed forward neural network and recurrent neural.	

Unit V	**06 Hours**
Optimization for Train Deep Models: Challenges in Neural Network Optimization, Basic Algorithms, Parameter Initialization Strategies, Algorithms with Adaptive Learning Rates, Approximate Second-Order Methods, Optimization Strategies, and Meta-Algorithms, Representation Learning and transfer learning.	
Unit VI	**06 Hours**
Recent Trends in Deep Learning: Pre-trained models: VGG-16 or ResNet-5, Image net-Detection-Audio Wave Net-Natural Language Processing Word2Vec - Joint Detection-Bioinformatics- Face Recognition- Scene Understanding- Gathering Image Captions, Computer Vision, ChatGPT learning using both supervised and reinforcement learning techniques.	

Textbooks

1. Deng & Yu, Deep Learning: Methods and Applications, Now Publishers, 2013.
2. Deep Learning: An MIT Press Book By Ian Goodfellow and Yoshua Bengio and Aaron Courville
3. Nikhil Buduma, "Fundamentals of Deep Learning: Designing Next-Generation Machine
4. Intelligence Algorithms", O'Reilly publications.

Reference Books

1. Josh Patterson, Adam Gibson, "Deep Learning: A Practitioners Approach",
2. O"REILLY, SPD, ISBN: 978-93-5213-604-9, 2017 Edition 1st.
3. Michael Nielsen, Neural Networks and Deep Learning, Determination Press, 2015.
4. Giancarlo Zaccone, Md. RezaulKarim, Ahmed Menshawy "Deep Learning with TensorFlow:
5. Explore neural networks with Python", Packt Publisher, 2017.
6. Antonio Gulli, Sujit Pal "Deep Learning with Keras", Packt Publishers, 2017.
7. Francois Chollet "Deep Learning with Python", Manning Publications, 2017

List of Laboratory Exercises

1. Implement Simple Programs like vector addition in TensorFlow
2. Implement a simple problem like regression model in Keras.
3. Implement an Image Classifier using CNN in TensorFlow/Keras
4. Implement a Transfer Learning concept in Image Classification.
5. Implement an Autoencoder in TensorFlow/Keras
6. Object detection using Convolution Neural Network
7. Recommendation system from sales data using Deep Learning
8. Perform Sentiment Analysis in the network graph using RNN

Project-Based Learning:

1. Image Classification
2. Visual tracking system
3. Face detection system
4. Digit Recognition System
5. Music genre classification system
6. Drowsiness detection system
7. Image caption generator
8. Detecting Gender and Age:
9. Traffic Sign Classification
10. News Aggregation and Fraud News Detection
11. Language Translations
12. Automatic Handwriting Generation

Syllabus for Unit Tests:

Unit Test -1	Unit – I, Unit – II, Unit - III
Unit Test -2	Unit – IV, Unit – V, Unit - VI

Elective-I Game Theory					
Teaching Scheme		**Examination Scheme**		**Credit Scheme**	
	Hours/Week		**Marks**		**Credits**
Lecture:	**03 Hours/Week**	**University Examination:**	**60 Marks**		
Practical:	**02 Hours/Week**	**Internal Assessment:**	**40 Marks**	**Lecture**	**03**
		Term Work	**25 Marks**	**Practical**	**01**
		Oral	**25 Marks**		
		Total	**150 Marks**	**Total**	**04**

Course Objective:

1. Knowledge and understanding of game theory at a level required to read current research in economics in applied theory
2. The ability to develop game theory models

Prerequisite: Students should be well versed with concepts of Programming Language, good understanding of Algorithms, Artificial Intelligence

Course Outcomes: On completion of the course, students will have the ability to:

1. To understand game theory strategies.
2. To apply the extended form of games.
3. To analyze how to use bargaining in real life.
4. To evaluate the working of repeated games.
5. To create real time static game.
6. To understand dynamic games of incomplete information.

Unit I	**06 Hours**
Games in Strategic Form: Decision Theory versus Game Theory, Equilibrium Analysis, Nash Equilibrium, Finding Nash Equilibria in 3 x 3 Games, Games with Infinity Strategy Sets.	
Unit II	**06 Hours**
Games in extension form: Dynamic Games, Game Theory and Experiments, Self-Confirming, Backward Induction, Subgame -Perfect Equilibrium	
Unit III	**06 Hours**
Applications of multistage games with observed actions: Bargaining, Political Economy of Institutional Reform.	
Unit IV	**06 Hours**
Introduction to repeated games: Repeated Games, Folk Theorem for Supportable Equilibrium Payoffs, Minimax Payoffs.	
Unit V	**06 Hours**
Static games of incomplete information: Bayesian Games, The role of Uncertainty, Baye's Rule, Bayesian Nash Equilibrium	
Unit VI	**06 Hours**
Dynamic games of incomplete information: Sequential Equilibrium and Perfect Bayesian Equilibrium. Signaling Games, Social Learning, Reputation Effects and the Chain Store Game.	

Textbooks	
1. Fudenberg, D. and J. Tirole: Game Theory	
2. “Game theory for applied economists,” by Robert Gibbons	
3. “Games of strategy” by Dixit, Skeath, and Reily	
Reference Books	
6. Game Theory: An Introduction by Steven Tadelis	
7. A Course in game Theory by Osborne M. and A. Rubinstein	
8. The Theory of Learning in games by Fudenberg, D. and D. Levine	
List of Laboratory Exercises	
Subject teacher can give any suitable laboratory experiments.	
Project Based Learning	
1. Rock Paper Scissor	
2. Gambit Play	
3. Prisoner’s Dilemma	
4. The Battle of Sexes	
5. The k-server problem	
Syllabus for Unit Tests:	
Unit Test -1	Unit – I, Unit – II, Unit - III
Unit Test -2	Unit – IV, Unit – V, Unit - VI

Elective-I Semantic Web

Teaching Scheme		Examination Scheme		Credit Scheme	
	Hours/Week		Marks		Credits
Lecture:	03 Hours/Week	University Examination:	60 Marks	Lecture	03
Practical:	02 Hours/Week	Internal Assessment:	40 Marks	Practical	01
		Term work:	25 Marks		
		Oral:	25 Marks		
		Total	150 Marks	Total	04

Course Objective:

1.To Introduce Semantic Web Vision

2. Understanding about XML,RDF,RDFS,OWL

Prerequisite: Students should be well versed with concepts of Web Technology and HTML.

Course Outcomes: On completion of the course, students will have the ability to:

1. Understand the semantic web Vision and technologies
2. To analyse the descriptive logic with language extension
3. To understand the XML queries in detail
4. To understand and reflect on the principles of Ontology Engineering
5. To analyse query ontologies using SPARQL
6. Understanding about Data Web (Linked open data Cloud)

Unit I	**06 Hours**
Foundation of Semantic Web Technologies Introduction, Current web vs Semantic Web, Semantic Web Technologies, A layered approach.	
Unit II	**06 Hours**
Descriptive Logic Introduction, Definition of the basic formalism, Reasoning algorithms, Language extensions	
Unit III	**06 Hours**
Structured Web Documents in XML Introduction, XML, Structuring, Namespaces, Addressing and querying XML document, Processing	
Unit IV	**06 Hours**
Web Ontology Language: OWL Introduction, OWL and RDF/RDFS, Three Sublanguages of OWL, Description of the OWL Language, Layering of OWL, Examples OWL in OWL	
Unit V	**06 Hours**

SPARQL SPARQL simple Graph Patterns, Complex Graph Patterns, Group Patterns, Queries with Data Values, Filters OWL Formal Semantics,	
Unit VI	**06 Hours**
Linked Open data Introduction, Principles of Linked Data, Web of Data, LOD Cloud, Linked Data Source : Dbpedia, Freebase	

Textbooks

1. A Semantic Web Primer by Grigoris Antoniou Frank van Harmelen, The MIT Press Cambridge
2. Foundation of Semantic Web Technologies, Pascal Hitzler, Markus and Sebastian
3. Linked Data : Evolving the Web into a Global Data space by Tom Heath, Christian Bizer , Morgan & Claypool publication

Reference Books

1. Basic Description Logic by Franz Baader, Warner Nutt

List of Assignments

1. Working with XML,
2. Working with XML Schema, DTD
3. Design Of Ontology using RDF
4. Design RDF document with different Serialization format (e.g. tutle,N-triple)
5. Design Of Ontology using RDFS
6. Design Of Ontology using OWL

Project Base Learning:

1. Case study : Pizza Ontology
2. Querying Ontology using SPARQL
3. Design of any domain specific Ontology in Protégé
4. Case Study : Dbpedia
5. Case study : LOD Cloud

Syllabus for Unit Tests:

Unit Test -1	Unit – I, Unit – II, Unit - III
Unit Test -2	Unit – IV, Unit – V, Unit - VI

Elective -I Text Mining					
Teaching Scheme		**Examination Scheme**		**Credit Scheme**	
	Hours/Week		**Marks**	**Credits**	
Theory:	**03 Hours/Week**	**End Semester Examination**	**60 Marks**	**Theory**	**03**
Practical:	**02 Hours/Week**	**Internal Assessment**	**40 Marks**		
		Term work	**25 Marks**	**Practical**	**01**
		Oral	**25 Marks**		
		Total	**150 Marks**	**Total**	**04**

Course Objectives:

1. To provide an overview of common text mining and social media data analytic activities.
2. To understand the complexities of processing text and network data from different data sources.
3. To enable students to solve complex real-world problems for sentiment analysis and Recommendation systems.

Prerequisite:

Mathematical analysis; Linear Algebra; Probability and Statistics; Machine Learning; Basic programming.

Course Outcomes: On completion of the course, students will have the ability to:

1. To examine the types of the data to be mined and present a general classification of tasks and primitives to integrate a data mining system
2. To explore DWH and OLAP, and devise efficient and cost-effective methods for maintaining DWHs.
3. To discover interesting patterns from large amounts of data to analyze and extract patterns to solve problems, make predictions of outcomes
4. To comprehend the roles that data mining plays in various fields and manipulate different data mining techniques
5. To evaluate systematically supervised and unsupervised models and algorithms with respect to their accuracy.

Unit I	**06 Hours**
Introduction to Text Mining: Text Data and Where to Find Them? unstructured vs. (semi-)structured data, Data File Types, Metadata, Steps to Create Quality Metadata, Digital Data Creation, Different Ways of Getting Data, Web Scraping/Screen Scraping, What is text mining- benefits and limitations.	
Unit II	**06 Hours**
Text Pre-Processing: Level of Text Representation, Text Transformation, Dictionary Creation, Text Pre-Processing, Tokenization, Stemming, Stopwords, Lemmatization, Object Standardization, Semantic Parsing, Bag of Words (BOW), N-Grams, Term Frequency-Inverse Document Frequency (TF-IDF), Syntactical Parsing, Parts-of-Speech Tagging (POS), Named Entity Recognition (NER), Word Embedding	
Unit III	**06 Hours**
Topic Modeling: Topic Evolution, Application and Visualization, Available Tools and Packages, When to Use Topic Modeling, When *Not* to Use Topic Modeling, Methods and Algorithms, Topic Modeling and Libraries mixture models and how they work, Expectation-Maximization (EM) algorithm and how it can be used to estimate parameters of a mixture model, the basic topic model, Probabilistic Latent Semantic Analysis (PLSA), and how Latent Dirichlet Allocation (LDA) extends PLSA.	
Unit IV	**06 Hours**
Mining Textual Data: Text Clustering, Clustering techniques, Text Classification	
Unit V	**06 Hours**
Network Text Analysis: Two-Mode, Networks, Centrality, Measures, Graph Algorithms, Comparison of Network Text Analysis with Others, Available Tools and Packages, Applications ,	

Advantages, Limitations , Topic Maps , Constructs of Topic Maps, Topic Map Software Architecture ,Typical	
Unit VI	**06 Hours**
Sentiment Analysis: Levels of Granularity, analyzing topics in text, Approaches for Sentiment Analysis, How to Perform Sentiment Analysis, Available Tools and Packages, Latent Aspect Rating Analysis (LARA)	

Textbooks:

1. Michael Geatz and Richard Roiger, Data Mining: A Tutorial Based Primer, Pearson Education
2. Thomas W. Miller, Data and Text Mining: A Business Applications Approach, Pearson Education
3. Markus Hofmann, Andrew Chisholm, Text Mining and Visualization: Case Studies Using Open-source tools, CRC press, Taylor & Francis,2016

Reference Books:

1. Murugan Anandarajan, Practical Text Analytics: Maximizing the Value of Text Data, Springer; 2018
2. Pang-Ning Tan, Michael Steinbach, Vipin Kumar, Introduction to Data Mining, Pearson Education
3. R. Baeza-Yates and B. Ribeiro-Neto, Modern Information Retrieval, Pearson Education, 1999

List of Assignments :

1. Demonstrate advantages and disadvantages of Text Mining.
2. different terms used in text pre-processing.
3. Explain different algorithms used in topic modeling.
4. Explain text clustering and text classification?

List of Laboratory Exercises:

1. Interpret the contribution of text mining to generate new knowledge from natural language text
2. Extract useful information from the textual data using various classifiers and Predictors
3. Identify the various components of a web that can be used for mining process
4. Analyse social media data using appropriate web mining techniques
5. Discover interesting patterns from Social Media Networks using linear methods and models
6. Provide solutions to the emerging problems of social media analytics with sentiment analysis and opinion mining

Project Based Learning:

1. systems to find promising targets for drug discovery,
2. Application to match CVs to job profiles,
3. System to carry out business news analysis for competitive intelligence,
4. System to aid discovery of disease-gene associations,
5. System to monitor reports of terrorist activity,
6. System to help generate hypotheses for scientific research,
7. System to direct customer queries to appropriate support staff,
8. System to discover positive and negative opinions on topics of interest,
9. System to discover hot topics and trends.

(Note:- *Students in a group of 3 to 4 shall complete any one project from the above list)

Syllabus for Unit Tests:	
Unit Test -1	Unit – I, Unit – II, Unit - III
Unit Test -2	Unit – IV, Unit – V, Unit – VI

CSE Skill Lab IV					
Teaching Scheme		**Examination Scheme**		**Credit Scheme**	
			Marks		**Credits**
Lecture:	**00 Hours/Week**	**University Examination:**	**00 Marks**		
Practical:	**04 Hours/Week**	**Internal Assessment:**	**00 Marks**	**Lecture**	**00**
		Term Work	**25 Marks**	**Practical**	**02**
		Practical	**25 Marks**		
		Total	**50 Marks**	**Total**	**02**

Course Objective:

The objective of this course is to teach the learner how to use Object Oriented paradigm to develop code and understand the concepts of Core Java and to cover-up with the pre-requisites of Core java.

Prerequisite:

Object Oriented Programming and C++,java

Course Outcomes: On completion of the course, students will have the ability to:

1. Object oriented programming concepts using Java.
2. Knowledge of input, its processing and getting suitable output.
3. Understand, design, implement and evaluate classes and applets.
4. Knowledge and implementation of AWT package.
5. Use Java APIs for program development.
6. Handle abnormal termination of a program using exception handling

Unit I	**08 Hours**
Introduction: History, architecture and its components, Java Class File, Java Runtime Environment, The Java Virtual Machine, JVM Components, The Java API, java platform, java development kit, Lambda Expressions, Methods References, Type Annotations, Method Parameter Reflection, setting the path environment variable, Java Compiler And Interpreter, java programs, java applications, main(), public, static, void, string[] args, statements, white space, case sensitivity, identifiers, keywords, comments, braces and code blocks, variables, variable name **Data types:** primitive data types, Object Reference Types, Strings, Auto boxing, operators and properties of operators,Arithmetic operators, assignment operators, increment and decrement operator, relational operator, logical operator, bitwise operator, conditional operator.	

Unit II	**08 Hours**
Control Flow Statements: The If…Else If…Else Statement, The Switch…Case Statement **Iterations:** The While Loop, The Do … While Loop, The For Loop, The Foreach Loop, Labeled Statements, The Break And Continue Statements, The Return Statement **Classes:** Types of Classes, Scope Rules, Access Modifier, Instantiating Objects From A Class, Initializing The Class Object And Its Attributes, Class Methods, Accessing A Method, Method Returning A Value, Method's Arguments, Method Overloading, Variable Arguments [Varargs], Constructors, this Instance, super Instance, Characteristics Of Members Of A Class, constants, this instance, static fields of a class, static methods of a class, garbage collection.	

Unit III	**08 Hours**
Inheritance: Derived Class Objects, Inheritance and Access Control, Default Base Class Constructors, this and super keywords. Abstract Classes And Interfaces, Abstract Classes,	

Abstract Methods, Interfaces, What Is An Interface? How Is An Interface Different From An Abstract Class?, Multiple Inheritance, Default Implementation, Adding New Functionality, Method Implementation, Classes V/s Interfaces, Defining An Interface, Implementing Interfaces. **Packages:** Creating Packages, Default Package, Importing Packages, Using Package.	
Unit IV	**08 Hours**
Enumerations, Arrays: Two Dimensional Arrays, Multi- Dimensional Arrays, Vectors, Adding Elements To A Vector, Accessing Vector Elements, Searching For Elements In A Vector, Working With The Size of The Vector. **Multithreading:** the thread control methods, thread life cycle, the main thread, creating a thread, extending the thread class. Exceptions: Catching Java Exceptions, Catching Run-Time Exceptions, Handling Multiple Exceptions, The finally Clause, The throws Clause **Byte streams:** reading console input, writing console output, reading file, writing file, writing binary data, reading binary data, getting started with character streams, writing file, reading file	
Unit V	**08 Hours**
Event Handling: Delegation Event Model, Events, Event classes, Event listener interfaces, Using delegation event model, adapter classes and inner classes. Abstract Window Toolkit: Window Fundamentals, Component, Container, Panel, Window, Frame, Canvas. Components – Labels, Buttons, Check Boxes, Radio Buttons, Choice Menus, Text Fields, Text, Scrolling List, Scrollbars, Panels, Frames **Layouts:** Flow Layout, Grid Layout, Border Layout, Card Layout.	
Unit VI	**08 Hours**
Inner Classes: Introduction, Member inner class, Static inner class, Local inner class, Anonymous inner class **AWT:** Introduction, Components, Event-Delegation-Model, Listeners, Layouts, Individual components Label, Button, Checkbox, Radio Button, Choice, List, Menu, Text Field, Text Area	
Textbooks	
1. Herbert Schildt, Java The Complete Reference, Ninth Edition, McGraw-Hill Education, 2014	
Reference Books	
1) E. Balagurusamy, Programming with Java, Tata McGraw-Hill Education India, 2014	
2) Programming in JAVA, 2nd Ed, Sachin Malhotra & Saurabh Choudhary, Oxford Press	
3) Core Java Volume I - Fundamentals By Cay S. Horstmann, 11th Edition, Prentice Hall	
4) The Complete Reference By Herbert Shildt, 11th Edition, McGraw Hill Education	
5) Java Beginners Guide By Herbert Shildt, 8 th Edition, McGraw-Hill Education	
List of Laboratory Exercises	
1. WAP to find the average and sum of the N numbers Using Command line argument.	
2. WAP to Demonstrate Type Casting.	

3. WAP to find the factorial of a given number using Recursion
4. WAP to handle the Exception using try and multiple catch block.
5. WAP to design a class using abstract Methods and Classes
6. WAP to Create a package that access the member of external class as well as same package
7. WAP that show the partial implementation of Interface.
8. WAP to Handle the user defined Exception using throw keyword.
9. WAP to calculate the Simple Interest and Input by the user.
10. WAP to Test the Prime number.
Project Based Learning:
1. Online bank management system.
2. Smart city project.
3. Online survey system.
4. Supply chain management system.
5. e-healthcare management system.
6. Data visualization software.

Project Stage -I

TEACHING SCHEME		EXAMINATION SCHEME		CREDIT SCHEME	
					Credits
Lecture:	Hrs/Week	**End Semester Examination:0**0 Marks		**Theory**	
Practical:	2 Hrs/Week	**Continuous Assessment:** 00 Marks			
Tutorials:	Hrs/Week				
		Oral:	Marks 50	**Oral:**	03
		Term Work :	Marks 50		
		Total	Marks 100	**Total**	**03**

Course Pre-requisites:

Basics of Software engineering, Software testing and knowledge of core computer engineering subjects.

Course Objectives:

To develop problem solving abilities using mathematics.
• To apply algorithmic strategies while solving problems.
• To develop time and space efficient algorithms.
• To develop software engineering documents and testing plans.
• To use algorithmic solutions using distributed, Embedded, concurrent and parallel environments.

Course Outcomes: On completion of the course, students will have the ability to:

7. Review and understand how previous experiences had an impact on affective states and intellectual performance
8. Identify and define the problem.
9. Decide critically to solve the problem.
10. Demonstrate the ability to synthesize complex information from a variety of sources in decision-making.
11. Predict and develop a group process and desired outcomes.
12. Plan and perform collaboratively towards a common purpose.

1. The project will be undertaken preferably by a group of at least3- 4 students who will jointly work and implement the project over the academic year. The work will involve the design of a system or subsystem in the area of Computer Engineering.
2. If the project is chosen a hardware project it will involve the designing a system or subsystem or upgrading an existing system. The design must be implemented into a working model with necessary software interfacing and a user manual.
3. If the project is chosen in the pure Software Application it must involve the detail Software Design Specifications, Data Structure Layout, File Design, Testing with complete documentation and user interface, with life cycle testing and as an executable package.
4. The group will select a project with the approval of the guide (Staff members assigned) and submit the name of the project with a synopsis of 2 or 3 pages in the month of August in the academic year. A preliminary study report by the group must be submitted and certified at the end of seventh Semester.
5. It is expected that at least one research paper is published by each group with guide.

The project report stage-I will contain the details.

Problem definition and requirement specification, acceptance test procedure (ATP).

a) System definition, requirement analysis.

b) System design with UML.

c) Documentation and references.

Documentation will use UML approach with Presentation, Category, Use Case, Class Diagrams, etc

INTERNSHIP

TEACHING SCHEME		EXAMINATION SCHEME			CREDIT SCHEME	
						Credits
Lecture:	Hrs/Week	**End Semester Examination:**		00 Marks	**Theory**	
Practical:	Hrs/Week	**Continuous Assessment:**		00 Marks		
Tutorials:	Hrs/Week					
		Oral:	Marks	25	**Oral:**	03
		Term Work	Marks	25		
		Total	Marks	50	**Total**	**03**

Course Pre-requisites:
Professional Skills, Knowledge of core computer engineering subjects.

Course Objectives:

- To provide exposure for the students on practical engineering fields
- To have better understanding of engineering practice in general and a sense of frequent
  possible problems.
- To develop problem Identification abilities in real world
- To experience use of technology /tools for software development.
- To Identify their skills, values, beliefs, interests and personal abilities to develop the skills.
- To prepare and present a report.

Course Outcomes: On completion of the course, students will have the ability to:

- Propose a solution to solve real world problems with the help of technology.
- Apply software engineering principles.
- Evaluate and compare the various methodologies to solve a real-world problem.
- Report hands on experience of using modern software development tools.
- Assess their skills, values, beliefs, interests and personal abilities and act in congruence with them.
- Identify social and ethical responsibilities and develop skills to compete for lifelong learning.

As a part of the B. Tech Computer Science Engineering curriculum, Industrial Training is a Practical course, which the students B. Tech Computer Science Engineering should undergo in reputed Private / Public Sector / Government organization / companies as industrial training of 60 days weeks to be undergone by the student in the summer vacation after the semester VI. Examination and Oral examination will be conducted at the end of the semester VI

The Industrial Training Report:

An Industrial Training report should be prepared by each student. The report is expected to demonstrate development of practical and professional skills in Engineering through technical experience and application of theoretical knowledge. Development of skills in dealing with people, and communication skills form part of the training experience. Students should seek advice from their employers to ensure that no confidential material is included into the report. The student should be able to present the report to prospective employers,

The following should be observed:

- Length of training
- Preliminary information
- Technical report/diary References should be made in the text to books, technical papers, standards etc., used during the training period and should be listed.
- Finally, a conclusion should include comprehensive comments on the type and value of experience gained, and how this relates to your professional career.
- A copy of the report should be submitted to his/her employer, another copy to the Department (through the respective Adviser).
- Students should also retain a personal copy of the report.

Program: B.TECH. (Computer Science and Engineering) Semester – VIII CBCS 2021 Course

Sr. No.	Course Code	Name of Course	Teaching Scheme (Hrs./Week)			Examination Scheme (Marks)						Credits			
			L	P	T	ESE	IA	TW	OR	PR	Total	L	P	T	Total
1		Data Visualization & Reporting	3	-	1	60	40	25	-	-	125	3	-	1	4
2		Augmented and Virtual Reality	4	2	-	60	40	-	25	-	125	4	1	-	5
3		Block Chain and Digital Currency*	3	2	-	60	40	-	-	25	125	3	1	-	4
4		Elective –II	3	2	-	60	40	-	25	-	125	3	1	-	4
5		CSE Skill Lab–V	-	4	-	-	-	25	-	25	50	-	2	-	2
6		Project Stage-II	-	4	-	-	-	100	100	-	200	-	6	-	6
		Total	**13**	**14**	**1**	**240**	**160**	**150**	**150**	**50**	**750**	**13**	**11**	**1**	**25**
		Research Paper Publication#	-	-	-	-	-	-	-	-	-	-	-	-	2

***Industry Taught Course- VI**

 # Add-on Course

Elective -II	Pattern Recognition	Industrial IOT	Knowledge Management System	Information Retrieval

Data Visualization and Reporting					
Teaching Scheme		**Examination Scheme**		**Credit Scheme**	
	Hours/Week		**Marks**		**Credits**
Lecture:	**03 Hours/Week**	**University Examination:**	**60 Marks**	**Theory**	**03**
Tutorial	**01 Hour/Week**	**Internal Assessment:**	**40 Marks**	**Tutorial**	**01**
		Term Work	**25 Marks**		
		Total	**125 Marks**	**Total**	**04**

Course Objective:

1. To understand the mechanism of Data visualization and Reporting.
2. To understand the functionality of current implementation of Data Visualization and Reporting.
3. To design virtual reality of current trends.

Prerequisite:

Business Intelligence System, Data Mining, Machine learning

Course Outcomes: On completion of the course, students will have the ability to:

1. Understand fundamentals of data visualization concepts.
2. Understand and Apply data visualization stages on chosen data.
3. Develop a toolkit for exploring and communicating complex data using visualization
4. Describe how effectively a visualization conveys target data
5. Understand data customization parameters in Tableau.
6. Design various Virtual Reality Applications.

Unit I	**06 Hours**
Introduction to Visualization: Relationship between Visualization and Other Fields -The Visualization Process - Pseudo code Conventions - The Scatter plot. Data Foundation - Types of Data - Structure within and between Records - Data Preprocessing - Data Sets	
Unit II	**06 Hours**
Foundations for Visualization: Visualization stages - Semiology of Graphical Symbols - The Eight Visual Variables - Historical Perspective - Taxonomies - Experimental Semiotics based on Perception Gibson ‘s Affordance theory – A Model of Perceptual Processing.	
Unit III	**06 Hours**
Visualization Techniques: Spatial Data: One-Dimensional Data - Two-Dimensional Data – Three-Dimensional Data - Dynamic Data - Combining Techniques. Geospatial Data: Visualizing Spatial Data - Visualization of Point Data -Visualization of Line Data - Visualization of Area Data - Other Issues in Geospatial Data Visualization	

Multivariate Data: Point-Based Techniques - Line Based Techniques - Region-Based Techniques - Combinations of Techniques – Trees Displaying Hierarchical Structures – Graphics and Networks- Displaying Arbitrary Graphs/Networks	
Unit IV	**06 Hours**
Introduction to Tableau: Dive into Tableau, Connecting Data Sources, Tableau Generated Fields, Data Manipulation in Tableau, Working with Dates in Tableau Data Customization with Calculations: Adding Dynamism to a View with Parameters, Geographical Analysis & Maps, Creating Visualizations, Adding Statistics to Data, Formatting & Annotation, Dashboards & Stories Introduction to Zohosheet: Import data from a variety of data sources for in-depth analysis.	
Unit V	**06 Hours**
Interaction Concepts and Techniques: Text and Document Visualization: Introduction - Levels of Text Representations - The Vector Space Model - Single Document Visualizations -Document Collection Visualizations - Extended Text Visualizations Interaction Concepts: Interaction Operators - Interaction Operands and Spaces - A Unified Framework. Interaction Techniques: Screen Space - Object-Space -Data Space -Attribute Space- Data Structure Space - Visualization Structure - Animating Transformations -Interaction Control	
Unit VI	**06 Hours**
Current Trends Design – Virtual Reality: Tools used for Creation of Virtual Reality, Interactive Medical Application – Tactile Maps for visually challenged People – Animation Design for Simulation – Integrating Spatial and Nonspatial Data – Innovating the Interaction	
Textbooks and Reference Books	
1. Matthew Ward, Georges Grinstein and Daniel Keim, “Interactive Data Visualization Foundations, Techniques, Applications”, 2010.	
2. Colin Ware, “Information Visualization Perception for Design”, 2nd edition, Margon Kaufmann Publishers, 2004.	
3. Robert Spence “Information visualization – Design for interaction”, Pearson Education, 2 nd Edition, 2007.	
4. Alexandru C. Telea, “Data Visualization: Principles and Practice,” A. K. Peters Ltd, 2008	
5. Joerg Osarek, “Virtual Reality Analytics”, Gordon”s Arcade, 2016.	
6. https://www.tableau.com/products/techspecs	
7. https://www.tableau.com/tft/activation	
8. Visualization Analysis & Design by Tamara Munzner (2014) (ISBN 9781466508910)	
List of Assignments	
1. Explain the process which you use to transform raw data into visualization.	
2. Explain the stages in data visualization.	
3. List and explain most common problems in data visualization.	

4. Explain characteristics of data visualization.
5. Describe interaction concepts in data visualization.
List of Laboratory Exercises: (Practicing below mentioned lab exercises will help students in Project based learning)
1. Demonstrate Tableau Desktop by connecting to the dataset.
2. Filter and sort data by using Tableau.
3. Create common visualizations like bar chart, line chart.
4. Assemble dashboard layout by using dashboard filters
5. Create simple calculations in Tableau.
6. Demonstrate interactivity with text and visual tooltips.
7. Create more advanced chart types
8. Create a data story in Tableau.
Project-Based Learning:
1. Develop a system to apply data customization with calculations.
2. Collect data source and connect it with the existing data through Tableau to show various fields.
3. Apply geographical analysis for any data set.
4. Design dashboard for given data set.
5. Design stories by using data visualization.
6. Design – Virtual Reality: Interactive Medical Application.
7. Design – Virtual Reality: – Tactile Maps for visually challenged People
Syllabus for Unit Tests:

Unit Test -1	Unit – I, Unit – II, Unit - III
Unit Test -2	Unit – IV, Unit – V, Unit - VI

Augmented and Virtual Reality

Teaching Scheme		Examination Scheme		Credit Scheme	
	Hours/Week		**Marks**		**Credits**
Lecture:	**04 Hours/Week**	**University Examination:**	**60 Marks**		
Practical :	**02 Hours/Week**	**Internal Assessment:**	**40 Marks**	**Lecture**	**04**
		Term Work		**Oral**	**01**
		Oral	**25 Marks**		
		Total	**125 Marks**	**Total**	**05**

Course Objective:

4. To gain knowledge of historical and modern overviews and perspectives on virtual reality.
5. TO Learn the fundamental Computer Vision, Computer Graphics and Human-Computer interaction Techniques related to VR/AR
6. Discuss and Examine VR/AR Technologies

Prerequisite:

Mathematics, Physics, Programming and Problem Solving, Engineering Graphics, Solid Modelling and Drafting, Numerical & Statistical Methods, Mechatronics, Artificial Intelligence &Machine Learning, Computer-Aided Engineering

Course Outcomes: On completion of the course, students will have the ability to:

1. Understand fundamental Computer Vision, Computer Graphics and Human-Computer Interaction Techniques related to VR/AR
2. Understand Geometric Modeling Techniques
3. Understand the Virtual Environment
4. Analyze and Evaluate VR/AR Technologies
5. Apply various types of Hardware and Software in Virtual Reality systems
6. Design and Formulate Virtual/Augmented Reality Applications

Unit I	**08 Hours**
Introduction to Augmented and Virtual Reality: Introduction to Augmented-Virtual and Mixed Reality, Taxonomy, technology and features of augmented reality, difference between AR,VR, and MR, Challenges with AR, AR systems and functionality, Augmented reality methods, visualization techniques for augmented reality.	
Unit II	**08 Hours**
VR Systems: VR as a discipline, Basic features of VR systems, Architecture of VR systems, **VR hardware:** VR input hardware: tracking systems, motion capture systems, data gloves, VR output hardware: visual displays.	
Unit III	**08 Hours**
Computer Graphics and Geometric Modelling: The Virtual world space, positioning the virtual observer, the perspective projection, human vision, stereo perspective projection, Color theory, Conversion From 2D to 3D, 3D space curves, 3D boundary representation, Simple 3D modeling, 3D clipping, Illumination models, Reflection models, Shading algorithms, Geometrical Transformations: Introduction, Frames of reference, Modelling transformations, Instances, Picking, Flying, Scaling the VE, Collision detection	

Unit IV	**08 Hours**
Virtual Environment Input/Output Devices: Input (Tracker, Sensor, Digital Gloves, Movement Capture, Video based Input, 3D Menus & 3D Scanner, etc.), Output (Visual/Auditory/Haptic Devices) Generic VR system: Introduction, Virtual environment, Computer environment, VR technology, Model of interaction, VR Systems, Animating the Virtual Environment: Introduction, The dynamics of numbers, Linear and Nonlinear interpolation, the animation of objects, linear and non-linear translation, shape & object in between, free from deformation, particle system	
Unit V	**08 Hours**
Augmented Reality (AR) Taxonomy, Technology, and Features of Augmented Reality, AR Vs VR, Challenges with AR, AR systems and functionality, Augmented Reality Methods, Visualization Techniques for Augmented Reality, enhancing interactivity in AR Environments, Evaluating AR systems	
Unit VI	**08 Hours**
Development Tools, Frameworks, and AR / VR Applications **Human factors:** Introduction, the eye, the ear, the somatic senses **Hardware:** Introduction, sensor hardware, Head-coupled displays, Acoustic hardware, Integrated VR systems **Software:** Introduction, Modelling virtual world, Physical simulation, VR toolkits, Introduction to VRML **AR / VR Applications**: Introduction, Engineering, Entertainment, Science, Training, Game Development, VR Technology in Film & TV Production. VR Technology in Physical Exercises	

Textbooks

1. Coiffet, P., Burdea, G. C., (2003), "Virtual Reality Technology," Wiley-IEEE Press, ISBN: 9780471360896
2. Schmalstieg, D., Höllerer, T., (2016), "Augmented Reality: Principles & Practice," Pearson, ISBN: 9789332578494
3. Hassanien, A. E., Gupta, D., Khanna, A., Slowik, A., (2022), "Virtual and Augmented Reality for Automobile Industry: Innovation Vision and Applications," Springer, ISBN: 9783030941017

Reference Books

1. Craig, A. B., (2013), "Understanding Augmented Reality, Concepts and Applications," Morgan Kaufmann, ISBN: 9780240824086
2. Craig, A. B., Sherman, W. R., Will, J. D., (2009), "Developing Virtual Reality Applications, Foundations of Effective Design," Morgan Kaufmann, ISBN: 9780123749437
3. John Vince, J., (2002), "Virtual Reality Systems, " Pearson, ISBN: 9788131708446

Anand, R., "Augmented and Virtual Reality," Khanna Publishing House

List of Laboratory Exercises

1. Study of different game engines
2. Implementation of Video/ Feature Viewing
3. Implementation of Virtual tour

4. Implementation of material animation
5. Implementation to show portal planets
6. Explore projects in Unity 2D and 3D

Project-Based Learning:

1. Modern Apartment Walk Simulation using Virtual Reality
2. Farming in Village Simulation Using VR Tractor
3. Large Warehouse Simulation with Forklift Virtual Reality
4. Industry safety training simulation virtual reality
5. Control and monitoring of IoT devices using mixed reality in unity engine using Arduino
6. Factory machine simulation using virtual reality.
7. Augmented Reality in Education
8. Product video promotion app using augmented reality.
9. AR in the automotive industry
10. Graphics processor unit using virtual reality.

Syllabus for Unit Tests:

Unit Test -1	Unit – I, Unit – II, Unit - III
Unit Test -2	Unit – IV, Unit – V, Unit - VI

Block Chain and Digital Currency*					
Teaching Scheme		**Examination Scheme**		**Credit Scheme**	
	Hours/Week		**Marks**		**Credits**
Lecture:	**03 Hours/Week**	**University Examination:**	**60 Marks**		
Practical:	**02 Hours/Week**	**Internal Assessment:**	**40 Marks**	**Lecture**	**03**
		Term Work	**-**	**Practical**	**01**
		Practical	**25 Marks**		
		Total	**125 Marks**	**Total**	**04**

Course Objective:

To understand the mechanism of Blockchain and Cryptocurrency.

To understand the functionality of current implementation of blockchain technology.

To understand the required cryptographic background.

To explore the applications of Blockchain to cryptocurrencies and understanding limitations of current Blockchain.

An exposure towards recent research

Prerequisite:

Computer Networks; Operating Systems; Cryptography and Network Security.

Course Outcomes: On completion of the course, students will have the ability to:

1. Identify the importance of Blockchain technology
2. Interpret the fundamentals and basic concepts in Blockchain
3. Interpret the need and working of crypto currency
4. Recall about Bitcoin and Ethereum
5. Summarize the different technologies and latest trends in Blockchain
6. Analyze the importance of blockchain in finding the solution to the real-world problems.

Unit I - INTRODUCTION TO BLOCKCHAIN	**06 Hours**
Distributed DBMS – Limitations of Distributed DBMS, Introduction to Block chain – History, Definition, Distributed Ledger, Blockchain Categories – Public, Private, Consortium, Blockchain Network and Nodes, Peer-to-Peer Network, Mining Mechanism, Generic elements of Blockchain, Features of Blockchain, and Types of Blockchain	
Unit II - COMPONENTS OF BLOCKCHAIN	**06 Hours**
Components of Blockchain: Core components of Blockchain, Types of Block chains; Blockchain Protocol, Permission & Permission less Block chains	

Unit-III- CRYPTOCURRENCIES AND BITCOIN	**06 Hours**
Introduction to Cryptocurrencies, Tokens – Cryptosecurities, Players involved - Cryptocurrency Users, Miners, Cryptocurrency exchanges, Trading platforms, Wallet providers, Coin inventors, Coin offerors. Distributed Ledger Technology (DLT), Bitcoin (BTC) – Genesis Block, Buy Bitcoin, Transactions, Unspent Transaction Output (UTXO), Bitcoin Mining, Value of Bitcoin, Advantages and Disadvantages,	
Unit-IV- ETHEREUM CRYPTOCURRENCY	**06 Hours**
Ethereum (ETH) – Smart Contracts, UTXO, Types of Accounts - Externally controlled accounts and Contract account, Merkley Tree, Ether, Components of Ethereum Transaction, DApps, Hard & Soft Fork, Bitcoin Stack versus Ethereum Stack.	
Unit-V- ALTERNATIVE BLOCKCHAINS AND NEXT EMERGING TRENDS	**06 Hours**
Cloud-based block chain, Multi chain, Geth , Stellar , Ripple, R3 Corda, Blockchain API, Blockchain Sandboxes	
Unit VI- BLOCK CHAIN USE CASES	**06 Hours**
Block Chain Use Cases: Supply Chain Management, Finance, Health Care, Internet of Things (IoT), Remittance, Land Records, Voting and election, Loyalty Programs, Go Green (Renewable Energy)	

Textbooks

1. Artemis Caro, "Blockchain: The Beginners Guide to Understanding the Technology Behind Bitcoin & Crypto currency".
2. Ambadas, Arshad Sarfarz Ariff, Sham "Blockchain for Enterprise Application Developers", Wiley
3. Andreas M. Antonpoulos, "Mastering Bitcoin: Programming the Open Blockchain" , O'Reilly

Reference Books

1. Blockchain: A Practical Guide to Developing Business, Law, and Technology Solutions, Joseph Bambara, Paul R. Allen, Mc Graw Hill.
2. Blockchain: Blueprint for a New Economy, Melanie Swan, O'Reilly

List of Practical

1. Installation of MetaMask and study spending Ether per transaction.
2. Create your own wallet using Metamask for crypto transactions
3. Write a smart contract on a test network, for Bank account of a customer for following operations:
   - Deposit money
   - Withdraw Money

   Show balance
4. Write a program in solidity to create Student data. Use the following constructs:
   - Structures
   - Arrays

• Fallback Deploy this as smart contract on Ethereum and Observe the transaction fee and Gas values
5. Write a survey report on types of Blockchains and its real time use cases
6. Write a program to create a Business Network using Hyperledger
7. **Mini Project -** Develop a Blockchain based application dApp (de-centralized app) for e-voting system.
Project Based Learning
1. Trusted Crowdfunding Platform Using a Smart Contract. 2. Exact Shipment Location Data. 3. Peer To Peer Ridesharing. 4. A Fake Product Identification System. 5. Transparent and Genuine Charity Application. 6. Blockchain-Based Voting System. 7. Anti-Money Laundering System using Blockchain
Syllabus for Unit Tests:

Unit Test -1	Unit – I, Unit – II, Unit - III
Unit Test -2	Unit – IV, Unit – V, Unit - VI

Elective-II PATTRN RECOGNITION

Teaching Scheme		Examination Scheme		Credit Scheme	
	Hours/Week		Marks		Credits
Lecture:	03 Hours/Week	University Examination:	60 Marks		
Practical:	02 Hours/Week	Internal Assessment:	40 Marks	Lecture	03
		Term Work &Practical		Oral	01
		Oral	25 Marks		
		Total	125 Marks	Total	04

Course Objective:

To develop the mathematical tools required for the pattern recognition.

Prerequisite:

It is assumed the students have a working knowledge of calculus, linear algebra, and probability theory. It is also assumed the students have some experience programming in a scientific computing environment.

Course Outcomes: On completion of the course, students will have the ability to:

1. To explain the digital image processing and digital image formation.
2. To illustrate different mathematical preliminaries to deal with digital image processing
3. To apply the concept of pattern recognition and its different phases.
4. To develop understanding of models, paradigms and context of interactions
5. To apply knowledge/ skills for solving real world problems
6. To learn about applications of pattern recognition

Unit I	**06 Hours**
Background: Fundamental steps and Components of Digital Image Processing**,** Image Sampling and Quantization**:** Basic concepts in Sampling and Quantization, Representing Digital images, Spatial and intensity resolution, Relationship between Pixels**,** Histogram Processing: Definition, Histogram Equalization,	
Unit II	**06 Hours**
Image Enhancement: Fundamentals of Spatial Filtering- The Mechanics of Spatial Filtering, Generating Spatial, Filter Masks, Noise Model, Smoothing Spatial Filters: Linear filters – Mean filters Non-linear (Order Statistic filters): Median, Mode, Max, Min filters, Image Enhancement by Frequency Domain Methods: Basic steps for Filtering in Frequency Domain, Frequency Domain low pass (Smoothing), High pass (Sharpening)	
Unit III	**06 Hours**
Basics of Pattern Recognition: Introduction and examples, Clustering vs. Classification; Supervised vs. unsupervised, Decision Boundaries, Decision region/ Metric spaces/ distances, Object detection.	
Unit IV	**06 Hours**
Different Paradigms of Pattern Recognition:	

Bayes' theorem; Random Processes: Stationary and nonstationary processes, Expectation, Autocorrelation, Cross-Correlation, spectra; Linear Algebra: Inner product, outer product, inverses, eigen values, eigen vectors; Bayes Decision Theory	
Unit V	**06 Hours**
Clustering and Classification: Clustering: Basics of Clustering; similarity / dissimilarity measures; clustering criteria. Minimum within cluster distance criterion. K-means algorithm, DBSCAN-Density-based Spatial clustering of application with Noise.	
Unit VI	**06 Hours**
Applications and Linear discriminant functions: Gradient descent procedures; Perceptron; Support vector machines	

Textbooks

1. R.O.Duda, P.E.Hart and D.G.Stork, Pattern Classification, John Wiley, 2001
2. S.Theodoridis and K.Koutroumbas, Pattern Recognition, 4th Ed., Academic Press, 2009 3. C.M.Bishop, Pattern Recognition and Machine Learning, Springer, 2006

Reference Books

1. Devi V.S.; Murty, M.N. (2011) Pattern Recognition: An Introduction, Universities Press, Hyderabad.
2. R. O. Duda, P. E. Hart and D. G. Stork, Pattern Classification, Wiley, 2000.

List of Assignments

1. To enhance contrast using Histogram Equalization
2. Write and explain K-means algorithm.
3. Write and explain DBSCAN.
4. Case study on radiographic images to reduce noise in image.
5. Case study on pattern recognition.

List of Laboratory Exercises

1. Display of Grayscale Images.
2. Write a MATLAB code that reads a gray scale image and generates the flipped image of original image.
3. To enhance contrast using Histogram Equalization
4. Write a program for image enhancement.
5. Write a program for image compression
6. Write a program for Edge detection
7. Write a program for image segmentation
8. Write a program for image morphology
9. Illustrate and discuss use of various method of pattern recognition.

Project Based Learning

1. Iris Flowers Classification
2. Face Recognition
3. Digit Recognition
4. Wine Quality Analysis
5. Speech Emotion Recognition

Syllabus for Unit Tests:	
Unit Test -1	Unit – I, Unit – II, Unit - III
Unit Test -2	Unit – IV, Unit – V, Unit - VI

Elective-II Industrial IOT					
Teaching Scheme		**Examination Scheme**		**Credit Scheme**	
	Hours/Week		**Marks**		**Credit**
Lecture:	**03Hours/Week**	**University**	**60 Marks**		
Practical	**02Hours/Week**	**Internal Assessment:**	**40 Marks**	**Lecture**	**03**
				Oral	**01**
		Oral	**25 Marks**		
		Total	**125 Marks**	**Tota**	**04**

Course Objective:

To understand fundamentals of Internet of Things (IoT)

Prerequisite:

Digital Electronics, DC, MPMC, CN, Python programming

Course Outcomes:

1. Identify the components of IOT
2. Analyses networking protocols in IOT
3. Evaluate the connectivity technologies in in IOT
4. Understand Wireless Sensor networks
5. Understand applications of IOT
6. Comprehend Architecture of Raspberry Pie

Unit I Introduction to IOT	**06 Hours**
Technologies involved in IoT development, Infrastructure, Overview of IoT supported Hardware platforms such as: Raspberry pi, ARM Cortex Processors, Arduino and Intel Galileo boards, Types of Sensors and Actuators.	
Unit II Networking in IOT	**06 Hours**
Internet web and Networking technologies, Functional components of IOT, IOT gateways, IP V4 and IPV6, IOT protocols- MQTT , Components and methods, CoAP, XMPP,AMQP.	
Unit III Connectivity Technologies	**06 Hours**
Communication protocols like 802.15.4, Zigbee, 6LOWPAN, Bluetooth, Wireless HART, RFID, Z Wave. Remote monitoring and sensing, remote controlling, and performance analysis	
Unit IV Sensor Networks	**06 Hours**
Wireless sensor networks, Sensor nodes, Sensor web, social sensing in WSN, Target Tracking, WSN coverage, Stationary and mobile WSN, Mobile nodes, Role of M2M in IoT, SCADA (Supervisory control and data acquisition)	
Unit V Smart cities and Smart Homes	**06 Hours**

Privacy and Trust in IoT-Data-Platforms for Smart Cities, Smart Economy, Data Aggregation for the IoT in Smart Cities, Data fusion, Smart parking, smart home infrastructure, HAN network standards and architecture	
Unit VI Introduction to Raspberry Pie	**06 Hours**

pecifications, Architecture, Basic set up, Integration of sensors and actuators, Capturing Image with Raspberry Pi, Implementation of IOT with with Raspberry Pi	

Textbooks

1. Vijay Madisetti and ArshdeepBahga, "Internet of Things (A Hands-on-Approach)", 1 st
    a. Edition, VPT, 2014
2. Adrian McEwen, Hakim Cassimally, "Designing the Internet of Things", November 2013,
    a. John Wiley and Sons
3. Simon Monk, "Programming the Raspberry Pi: Getting Started with Python", January 2012, McGraw Hill Professional

Reference Books

1. Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1 st Edition, Apress Publications, 2013
2. CunoPfister, Getting Started with the Internet of Things, O"Reilly Media, 2011, ISBN: 978- 1-4493- 9357

List of Laboratory Exercises

1. Identify different types of sensors and Actuators
2. To Install Raspian on SD card
3. Use Python-based IDE (integrated development environments) for the
4. LED Interfacing with Raspberry Pi
5. To interface push button with Raspberry Pi
6. To interface Bluetooth Raspberry Pi
7. To interface temperature sensor with Raspberry Pi
8. To interface camera with Raspberry Pi to capture image
9. Study MQTT protocol

10. Project
Project Based Learning 1. Home Automation System. 2. Car Parking Management System. 3. Health Monitoring System. 4. Air & Noise Pollution Monitoring System. 5. Smart Street Light Monitoring System.
Syllabus for Unit Tests:

Unit Test -1	Unit – I, Unit – II, Unit - III
Unit Test -2	Unit – IV, Unit – V, Unit - VI

Elective-II Information Retrieval

Teaching Scheme		Examination Scheme		Credit Scheme	
	Hours/Week		Marks		Credits
Lecture:	03 Hours/Week	University Examination:	60 Marks		
Practical:	02 Hours/Week	Internal Assessment:	40 Marks	Lecture	03
				Oral	01
		Oral	25 Marks		
		Total	125 Marks	Total	04

Course Objective: Students will try:

1. To learn the fundamentals of information retrieval system.
2. To classify various Information retrieval models.
3. To demonstrate the query processing techniques and operations
4. To compare the relevance of query languages for text and multimedia data
5. To evaluate the significance of various indexing and searching techniques for information retrieval.
6. To develop an effective user interface for information retrieval.

Prerequisite:

Data structures and algorithms

Course Outcomes: On completion of the course, students will have the ability to:

1. define and describe the objectives the basic concepts of Information retrieval system.
2. evaluate the taxonomy of different information retrieval models.
3. solve and process text and multimedia retrieval queries and their operations
4. compare the relevance of query languages for text and multimedia data
5. evaluate the significance of various indexing and searching techniques for information retrieval
6. develop an effective user interface for information retrieval.

Unit I: Introduction	**06 Hours**
Motivation, Basic Concepts, The retrieval Process, Information System: Components, parts and types on information system; Definition and objectives on information retrieval system	
Unit I: IR Models	**06 Hours**
Modelling: Taxonomy of Information Retrieval Models, Retrieval: Ad-hoc and filtering, Formal Characteristics of IR models, Classic Information Retrieval, Alternative Set Theoretic models, Probabilistic Models, Structured text retrieval Models, models for Browsing; Multimedia IR models: Data Modelling	
Unit III: Query Processing and Operations	**06 Hours**
Query Languages: Keyword based Querying, Pattern Matching, Structural Queries, Query Protocols; Query Operations: User relevance feedback, Automatic local analysis, Automatic global analysis, Multimedia IR Query Languages	

Unit IV: Text Processing	**06 Hours**
Text and Multimedia languages and properties: Metadata, Markup Languages, Multimedia; Text Operations: Document Pre-processing, Document Clustering, Text Compression, Comparing Text Comparison Technique.	
Unit V: Indexing and searching	**06 Hours**
Inverted files, other indices for text, Boolean Queries, Sequential Searching, Pattern Matching, Structural Queries, Compression; Multimedia IR: Indexing and Searching: - Spatial Access Methods, A Generic Multimedia indexing approach, one dimensional time series, two-dimensional color images, Automatic Feature extraction; Searching Web: Challenges, Characterizing the web, Search Engines. Browsing, Meta searches, searching needle in haystack, Searching using Hyperlinks	
Unit VI: User Interface and Visualization	**06 Hours**
Human Computer interaction, the information access process, starting points, query specifications, context, using relevance judgments, interface support for the search process	
Textbooks	
1. Modern Information Retrieval, Ricardo Baeza-Yates, Berthier Ribeiro- Neto, ACM Press- Addison Wesley 2. Information Retrieval Systems: Theory and Implementation, Gerald Kowaski, Kluwer Academic Publisher 3. Storage Network Management and Retrieval by Dr. Vaishali Khairnar, Nilima Dongre, Wiley India	
Reference Books	
1. Introduction to Information Retrieval by Christopher D. Manning and Prabhakar Raghavan, Cambridge University Press 2. Information Storage & Retrieval by Robert Korfhage – John Wiley & Sons 3. Introduction to Modern Information Retrieval. G.G. Chowdhury. Neal Schuman	
List of Laboratory Exercises:	
1. Write a program to demonstrate bitwise operation.	
2. Implement Page Rank Algorithm.	
3.Implement Dynamic programming algorithm for computing the edit distance between strings s1 and s2. (Hint. Levenstein Distance)	
4. Write a program to Compute Similarity between two text documents.	
5. Write a map-reduce program to count the number of occurrences of each alphabetic character in the given dataset. The count for each letter should be case-insensitive (i.e., include both upper-case and lower-case versions of the letter; Ignore non-alphabetic characters).	
6. Implement a basic IR system using Lucene.	
8. Write a program for mining Twitter to identify tweets for a specific period and identify trends and named entities	
9.Write a program to implement simple web crawler	

10.Write a program to parse XML test, generate web graph and compute topic specific page rank

Project Based Learning:

1. Information retrieval of documents using user generated query
2. Processing, Retrieving, and Ranking Documents in a Wikipedia collection
3. Sentiment analysis for Twitter
4. Chemistry community analysis
5. Email processing utilities for smartphones/email client

Syllabus for Unit Tests:

Unit Test -1	Unit – I, Unit – II, Unit - III
Unit Test -2	Unit – IV, Unit – V, Unit - VI

Elective-II Knowledge Management System					
Teaching Scheme		**Examination Scheme**		**Credit Scheme**	
	Hours/Week		**Marks**	**Credits**	
Theory:	**03 Hours/Week**	**End Semester Examination**	**60 Marks**	**Theory**	**03**
Practical:	**02 Hours/Week**	**Internal Assessment**	**40 Marks**		
		Oral	**25 Marks**	**Oral**	**01**
		Total	**125 Marks**	**Total**	**04**

Course Objective:

- The objective of this course is to prepare students to understand the current theories, practices, tools and techniques in knowledge management (KM) to deal with the challenges with the organization and management of knowledge.

Prerequisite:

System Testing, Data Mining

Course Outcomes: On completion of the course, students will have the ability to:

13. Understand a knowledge management system.
14. Create a knowledge management plan to leverage opportunities to create, capture, represent and share knowledge.
15. Analyze the role of knowledge management in attainment of financial objectives, quality and process improvement, and innovation.
16. Apply knowledge management models and technologies to situations.
17. Understand a knowledge management system tools.
18. Understand a knowledge management system ethical.

Unit I	**06 Hours**
Introduction to KM: History of KM, Importance of KM, Information Management to Knowledge Management, K M Cycle, Industrial Economy to Knowledge Economy	
Unit II	**06Hours**
KM Cycle: Knowledge creation, capturing tacit knowledge, Types of knowledge and its implications for KM	
Unit III	**06 Hours**
Knowledge codification and system development: codification, system testing and deployment, Knowledge transfer and knowledge sharing- the role of culture and structure	
Unit IV	**06 Hours**
KM system: Analysis design and development: Knowledge infrastructure, Knowledge audit, and knowledge team	
Unit V	**06 Hours**
KM tools and Portals: inferences from data, data mining and knowledge portals	
Unit VI	**06Hours**
Evaluation of KM effectiveness: Tools and metrics Ethical, legal and managerial issues	

Textbooks

5. Dalkir, K. (2011). Knowledge Management in Theory and Practice (2nd edition). Cambridge, Massachusetts: The MIT Press.
6. We will use Knowledge Management in Theory and Practice - 2nd edition by Kimiz Dalkir

Reference Books

1. Awad, E.M (2007). Knowledge Management. Pearson India, Delhi.
2. Fernandez I. B. and Sabherwal, R. (2010). Knowledge Management: System and Resources. PHI Delhi.
3. Kimiz Dalkir (2005). Knowledge Management in Theory and Practice. Elsevier.
4. Tiwana Amrit (1999). The Knowledge Management Toolkit. Prentice Hall PTR.

Project Based Learning:

Students are expected prepare report on any one topic, write its definition, applications and illustrate with few examples. Also, write pseudo code for it, wherever applicable.

1. Impact of knowledge management on organizational competitiveness (a case study)
2. knowledge management on organization continuity
3. impact of knowledge management on organizational performance (a case study of selected it firms and logos)

(Note:- *Students in a group of 3 to 4 shall complete any one project from the above list)

Syllabus for Unit Tests:

Unit Test -1	Unit – I, Unit – II, Unit - III
Unit Test -2	Unit – IV, Unit – V, Unit - VI

CSE Skill Lab V					
Teaching Scheme		**Examination Scheme**		**Credit Scheme**	
	Hours/Week		**Marks**		**Credits**
Lecture:	**Hours/Week**	**University Examination:**	**00 Marks**		
Practical:	**04 Hours/Week**	**Internal Assessment:**	**00 Marks**	**Lecture**	**00**
		Term Work	**25Marks**	**Practical**	**02**
		Practical	**25Marks**		
		Total	**50 Marks**	**Total**	**02**

Course Objective:

1. To Prepare Students to Excel and Succeed In Industry / Technical Profession Through Global, Rigorous Education.
2. Excellence Through Application Development.
3. To Provide Students with A Solid Foundation on Tools, Technology and Framework
4. To Learn Server-Side Programming Using Servlets and Java Server Pages.

Prerequisite:

1. Understanding Of the Java Language
2. Understanding Of Software Development
3. Understanding Of the Software Development Life Cycle

Course Outcomes: On Completion of The Course, Students Will Have The Ability To:

1. Understand The Concepts Related to Java Technology
2. Explore And Understand Use of Java Server Programming
3. Manipulate Window Interfaces Using Swing Objects
4. Understand The Concepts of Hypertext Markup Language
5. Implement Web Based Applications Using Features of HTML And XML
6. Apply The Concepts of Server-Side Technologies For Dynamic Web Applications

Unit I	**06 Hours**
Swing Components – I: Introduction to JFC and Swing, Features of the Java Foundation Classes, Swing API Components, JComponent Class, Windows, Dialog Boxes, and Panels, Labels, Buttons, Check Boxes, Menus, Pane, JScrollPane, Desktop pane, Scrollbars, Lists and Combo Boxes, Text-Entry Components.	
Unit II	**06 Hours**
Swing Components – II: Toolbars, Implementing Action interface, Colors and File Choosers, Tables and Trees, Printing with 2D API and Java Print Service API. Schedules Tasks using JVM, Thread-safe variables, Communication between threads.	
Unit III	**06 Hours**
Servlets: Introduction, Web Application Architecture, Http Protocol & Http Methods, Web Server & Web Container, Servlet Interface, Genericservlet, Httpservlet, Servlet Life Cycle, Servletconfig, Servletcontext, Servlet	

Communication, Session Tracking Mechanisms JSP: Introduction, JSP Lifecycle, JSP Implicit Objects & Scopes, JSP Directives, JSP Scripting Elements, JSP Actions: Standard Actions And Customized Actions,	
Unit IV	**06 Hours**
Java Beans: Introduction, Javabeans Properties, Examples Struts 2: Basic MVC Architecture, Struts 2 Framework Features, Struts 2 MVC Pattern, Request Life Cycle, Examples, Configuration Files, Actions, Interceptors, Results & Result Types, Value Stack/OGNL JSON: Overview, Syntax, Datatypes, Objects, Schema, Comparison With XML, JSON With Javainterfaces. **Packages:** Creating Packages, Default Package, Importing Packages, Using Package.	
Unit V	**06 Hours**
JDBC: JDBC Introduction, JDBC Architecture, Types of JDBC Drivers, The Connectivity Model, The java.sql package, Navigating the ResultSet object's contents, Manipulating records of a ResultSet object through User Interface , The JDBC Exception classes, Database Connectivity, Data Manipulation (using Prepared Statements, Joins, Transactions, Stored Procedures), Data navigation.	
Unit VI	**06 Hours**
Networking With JAVA: Overview Of Networking, Working With URL, Connecting To A Server, Implementing Servers, Serving Multiple Clients, Sending E-Mail, Socket Programming, Internet Addresses, URL Connections. Accessing Network Interface Parameters, Posting Form Data, Cookies, Overview Of Understanding The Sockets Direct Protocol. Introduction To Distributed Object System, Distributed Object Technologies, RMI For Distributed Computing, RMI Architecture, RMI Registry Service, Parameter Passing In Remote Methods, Creating RMI Application, Steps Involved In Running The RMI Application, Using RMI With Applets.	
Textbooks	
1. Advanced Java Programming, Uttam K. Roy, Oxford University Press.	
2. JDBC, Servlets, And JSP, New Edition, Santhosh Kumar K , Kogent Learning Solutions Inc, Dreamtech Press	
Reference Books	
1. Cay S. Horstmann, Gary Cornell, Core Java™ 2: Volume II–Advanced Features Prentice Hall PTR,9th Edition	
2. Herbert Schildt, Java2: The Complete Reference, Tata Mcgraw-Hill,5th Edition	
3. Joe Wigglesworth And Paula Mcmillan, Java Programming: Advanced Topics, Thomson Course Technology (SPD) ,3rd Edition	
4. Core Servlets And Java Server Pages Volume 1 Core Technologies , Marty Hall And Larry Brown Pearson	
List of Laboratory Exercises	
10. Write A Database Application That Uses Any JDBC Driver	
11. Write A Simple JSP Program for User Login Form With Static & Dynamic Database	
12. Write A Program to Demonstrate the Use of AWT Components.	

13. Write A Program Using Swing to Display a Scrollpane And Jcombobox In An Japplet With The Items- English, Marathi, Hindi, Sanskrit.	
14. Write A Program to Create a Jtree	
15. Develop A Program Which Will Implement Special Keys Such as Function Keys and Arrow Keys.	
16. Write A Program to Change The Background Color Of Applet When User Performs Events Using Mouse.	
17. Write A Program Using Jtextfield to Perform The Addition Of Two Numbers	
18. Write A Program to Implement Chat Server Using Server Socket And Socket Class.	
Project Based Learning	
1. Food Ordering System	
2. Media Player Application	
3. Quizzing app	
4. Temperature Converter	
Syllabus for Unit Tests:	

Project Stage -II

TEACHING SCHEME		EXAMINATION SCHEME		CREDIT SCHEME	
					Credits
Lecture:	Hrs/Week	**End Semester Examination:**	00 Marks	**Theory**	
Practical:	4 Hrs/Week	**Continuous Assessment:**	00Marks		
Tutorials:	Hrs/Week				
		Oral:	Marks 100	**Oral:**	06
		Term Work	Marks 100		
		Total	Marks 200	**Total**	**06**

Course Pre-requisites:

Basics of Software engineering, Software testing and knowledge of core computer engineering subjects.

Course Objectives:

- To develop problem solving abilities using mathematics.
- To apply algorithmic strategies while solving problems.
- To prepare software engineering documents and design test cases.
- To demonstrate use of algorithmic solutions in real time problem.
- To encourage and expose students for participation in National/ International paper.
- presentation activities.
- Exposure to Learning and knowledge access techniques using Conferences, Journal
- papers and participation in research activities.

Course Outcomes: On completion of the course, students will have the ability to:

- Understand how to solve the problem.
- Demonstrate the ability to synthesize complex information from a variety of sources in decision-making
- Plan and perform collaboratively towards a common purpose.
- Demonstrate self-advocacy skills and self-reliant behaviour.
- Demonstrate the ability to develop and maintain satisfying interpersonal. relationships.
- Evaluate and conclude the results with documentation.

1 The project will be undertaken preferably by a group of at least 3- 4 students who will jointly work and implement the project over the academic year. The work will involve the design of a system or subsystem in the area of Computer Engineering.

2. If the project is chosen a hardware project it will involve the designing a system –subsystem or upgrading an existing system. The design must be implemented into a working model with necessary software interfacing and a user manual.

3. If the project is chosen in the pure Software Application it must involve the detail Software Design Specifications, Data Structure Layout, File Design, Testing with complete documentation and user interface. With life cycle testing and as an executable package.

The group will submit at the end of Semester-VIII,

i) The workable project.

ii) The details of Research paper published in National/International paper conferences/journals for the project work carried out.

iii) Project Report in the form of bound journal complete in all aspects, 3 copies for the institute and 1 copy of each student in the group for certification.

The examiner in consultation with the guide will assess the term work.

Oral examination will be based on the project work completed by the candidate.

The project report will contain the following details:

1. Problem definition and requirement specification, acceptance tests procedure (ATP).
2. System definition, requirement analysis.
3. System design.
4. System implementation-code documentation –dataflow diagram / algorithm.
5. Test results and procedure, test report as per ATP.
6. Platform choice, use.
7. Appendix tools used, references.
8. Documentation will use UML approach with Presentation, Category, Use Case, Class Diagrams, etc.