ESTD. 1939

KARNATAK LAW SOCIETY'S
GOGTE INSTITUTE OF TECHNOLOGY
"JNANA GANGA" UDYAMBAG, BELAGAVI-590008,
KARNATAKA, INDIA.
Approved by AICTE & UGC
Permanently Affiliated and Autonomous Institution Under
Visvesvaraya Technological University, Belagavi
www.git.edu

ESTD. 1979

2018-19 Scheme

Department: Computer Science and Engineering

Programme: B.E. in Computer Science and Engineering

3rd to 8th Semester Scheme of Teaching and Examination

Detailed Syllabi of 3rd to 8th Semesters

INSTITUTION VISION

Gogte Institute of Technology shall stand out as an institution of excellence in technical education and in training individuals for outstanding caliber, character coupled with creativity and entrepreneurial skills.

MISSION

To train the students to become Quality Engineers with High Standards of Professionalism and Ethics who have Positive Attitude, a Perfect blend of Techno-Managerial Skills and Problem solving ability with an analytical and innovative mindset.

QUALITY POLICY

- Imparting value added technical education with state-of-the-art technology in a congenial, disciplined and a research oriented environment.
- Fostering cultural, ethical, moral and social values in the human resources of the institution.
- Reinforcing our bonds with the Parents, Industry, Alumni, and to seek their suggestions for innovating and excelling in every sphere of quality education.

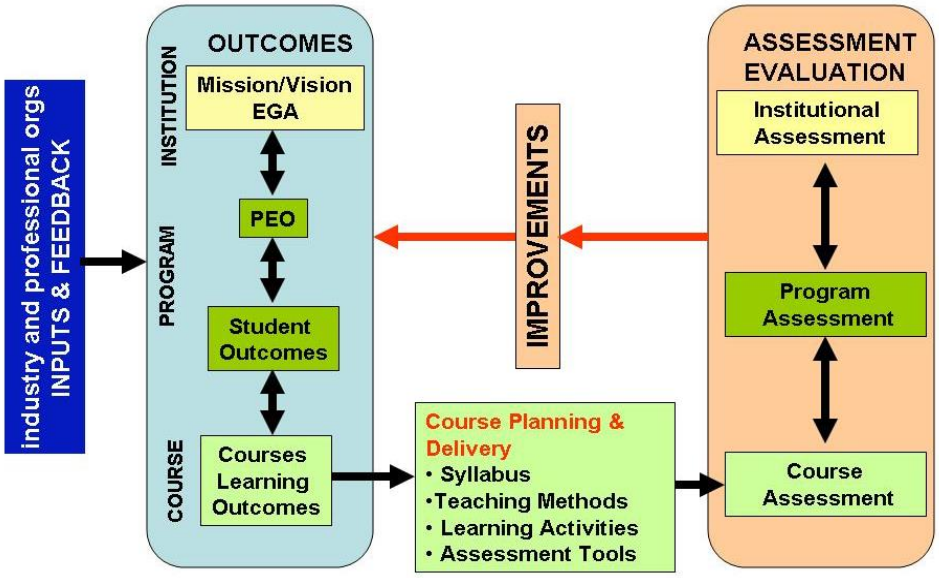
DEPARTMENT VISION

To be a center of excellence for education, research and entrepreneurship in Computer Science and Engineering in creating professionals who are competent to meet emerging challenges to benefit society.

MISSION

To impart and strengthen fundamental knowledge of students, enabling them to cultivate professional skills, entrepreneurial and research mindset with right attitude and aptitude.

OUTCOME BASED EDUCATION (OBE)



PROGRAM OUTCOMES (POs):

National Board of Accreditation (NBA) has framed the Program Outcomes (PO) based on twelve Graduate Attributes (GA). These POs are generic to engineering education and applies to all branches of Engineering.

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

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

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

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

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

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

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

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

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

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

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

12. Life-long learning: Recognize the need for and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs):

1. The graduates will acquire core competence in basic-science and engineering fundamentals necessary to identify, formulate, analyze, and solve complex engineering problems.
2. The graduates will acquire capabilities to succeed as Computer Science and Engineering professionals with an aptitude for higher education and entrepreneurship.
3. The graduates will have the curiosity and desire for lifelong learning, self-confidence and ability to adapt to changes.
4. The graduates will maintain high professionalism and ethical standards, effective oral and written communication skills and work as part of teams on multidisciplinary projects.

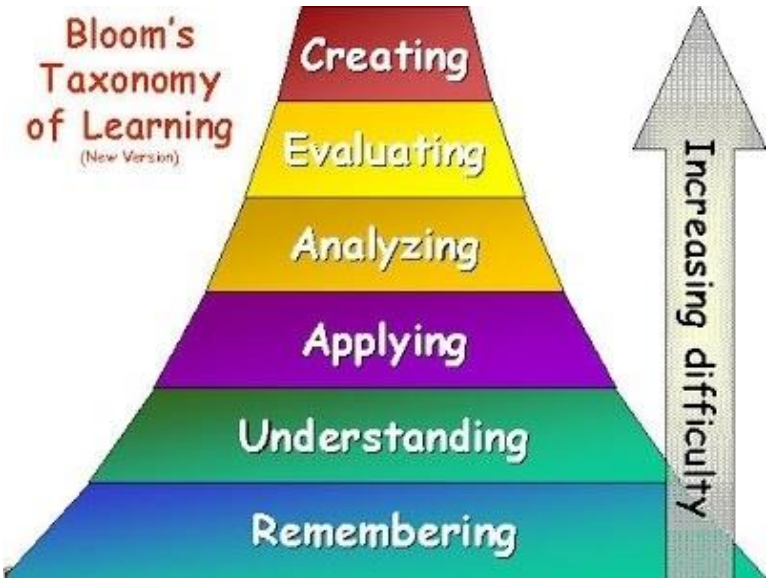
PROGRAM SPECIFIC OUTCOMES (PSOs):

1. **Problem solving skills:** Ability to identify and analyze problems of varying complexity and propose solutions by applying fundamental knowledge acquired in the field of Computer Science and Engineering.
2. **Project development skills:** Ability to apply design principles and demonstrate best practices of software development processes to solve real life problems.
3. **Carrier advancement:** Ability to demonstrate professional and leadership qualities required to pursue opportunities in Information Technology/self-employment/ higher studies.

BLOOM'S TAXONOMY OF LEARNING OBJECTIVES

Bloom's Taxonomy in its various forms represents the process of learning. It was developed in 1956 by Benjamin Bloom and modified during the 1990's by a new group of cognitive psychologists, led by Lorin Anderson (a former student of Bloom's) to make it relevant to the 21st century. The **revised taxonomy** given below emphasizes what a learner "Can Do".

Lower order thinking skills(LOTS)		
L1	Remembering	Retrieve relevant knowledge from memory.
L2	Understanding	Construct meaning from instructional material, including oral, written, and graphic communication.
L3	Applying	Carry out or use a procedure in a given situation – using learned knowledge.
Higher order thinking skills(HOTS)		
L4	Analyzing	Break down knowledge into its components and determine the relationships of the components to one another and then how they relate to an overall structure or task.
L5	Evaluating	Make judgments based on criteria and standards, using previously learned knowledge.
L6	Creating	Combining or reorganizing elements to form a coherent or functional whole or into a new pattern, structure or idea.



Scheme of Teaching and Examination- 3rd to 8th Semester B.E.

As per the guidelines of UGC CBCS the courses can be classified into:

(i) Core Courses (PC): This is the course which is to be compulsorily studied by a student as a core requirement to complete the requirements of a program in a said discipline of study. These courses will have 4 credits per course.

(ii) Foundation Courses: The Foundation Courses are of two kinds:

Compulsory Foundation: These courses are the courses based upon the content that leads to Knowledge enhancement. These courses provide opportunities to improve technological knowledge before entering industry as well as preparing students for higher degrees in technological subjects. They are mandatory for all disciplines. These courses will have 4 credits per course.

The courses are: **Basic Science Courses (BS), Engineering Science Courses (ES)**.

Foundation Electives: These are value based courses aimed at man making education. The course is related to **Humanities and Social Science Courses (HS).**

(iii) Elective Courses: This is course, which can be chosen from the pool of papers. It may be supportive to the discipline/ providing extended scope/enabling an exposure to some other discipline / domain / nurturing student proficiency skills.

An elective may be **Discipline Centric (PE)** or **Open Elective (OE).**

(iv) Mandatory Non-Credit Courses (MNC): These courses are mandatory for students joining B.E Program and students have to successfully complete these courses before the completion of degree.

Semester wise distribution of credits for B.E program

Total credits for B.E Program: 175 credits

		Regular batch		Dip. Lateral entry	
	Semester	**Credits per Sem**	**Total credits**	**Credits per Sem**	**Total credits**
1st year	1	20	40	----	----
	2	20		----	
2nd year	3	24	48	24	48
	4	24		24	
3rd year	5	24	48	24	48
	6	24		24	
4th year	7	23	39	23	39
	8	16		16	
	Total	**175**	**175**	**135**	**135**

Credit definition:

Lecture (L):One Hour /week – 1 credit
Tutorial (T): Two hour /week – 1 credit
Practicals (P): Two hours /week – 1 credit;

Scheme of Teaching and Examination- 3rd to 8th Semester B.E.

Third Semester (Regular)									
S.No.	**Course Code**	**Course**		**Contact Hours**	**Total Contact Hours/ week**	**Total credits**	**Marks**		
				L – T – P			**CIE**	**SEE**	**Total**
1	18MATCS31	Statistical- Numerical – Fourier Techniques	BS	4 – 0 – 0	4	4	50	50	100
2	18CS32	Data Structures with C	PC	4 – 0 – 0	4	4	50	50	100
3	18CS33	Digital Electronics	PC	3 – 2 – 0	5	4	50	50	100
4	18CS34	Object Oriented Programming with Java	PC	3 – 0 – 0	3	3	50	50	100
5	18CS35	Computer Organization	PC	3 – 0 – 0	3	3	50	50	100
6	18CSL36	Web Programming (Integrated)	PC	2 – 0 – 2	4	3	25	25	50
7	18CSL37	Data Structures with C Laboratory	LAB	**0 – 0 – 2**	3	**1**	25	25	50
8	18CSL38	Object Oriented Programming with Java Laboratory	LAB	**0 – 0 – 2**	3	**1**	25	25	50
9	18CS39	Kannada	HS	2 – 0 – 0	2	**1**	25	**25**	**50**
		Total			**31**	**24**	**350**	**350**	**700**

Third Semester (Diploma)									
S.No.	**Course Code**	**Course**		**Contact Hours**	**Total Contact Hours/ week**	**Total credits**	**Marks**		
				L – T – P			**CIE**	**SEE**	**Total**
1	18DMATCS31	Calculus, Fourier Analysis and Linear Algebra	BS	4 – 0 – 0	4	4	50	50	100
2	18CS32	Data Structures with C	PC	4 – 0 – 0	4	4	50	50	100
3	18CS33	Digital Electronics	PC	3 – 2 – 0	5	4	50	50	100
4	18CS34	Object Oriented Programming with Java	PC	3 – 0 – 0	3	3	50	50	100
5	18CS35	Computer Organization	PC	3 – 0 – 0	3	3	50	50	100
6	18CSL36	Web Programming (Integrated)	PC	2 – 0 – 2	4	3	25	25	50
7	18CSL37	Data Structures with C Laboratory	LAB	**0 – 0 – 2**	3	**1**	25	25	50
8	18CSL38	Object Oriented Programming with Java Laboratory	LAB	**0 – 0 – 2**	3	**1**	25	25	50
9	18CS39	Kannada	HS	2 – 0 – 0	2	**1**	25	**25**	**50**
		Total			**31**	**24**	**350**	**350**	**700**

Fourth Semester (Regular)									
S.No.	**Course Code**	**Course**		**Contact Hours**	**Total Contact Hours/ week**	**Total credits**	**Marks**		
				L – T – P			**CIE**	**SEE**	**Total**
1	18MATCS41	Discrete Mathematical Structures and Graph Theory	BS	4 – 0 – 0	4	4	50	50	100
2	18CS42	Operating System	PC	4 – 0 – 0	4	4	50	50	100
3	18CS43	Database Management System	PC	4 – 0 – 0	4	4	50	50	100
4	18CS44	Design and Analysis of Algorithm	PC	3 – 0 – 0	3	3	50	50	100
5	18CS45	Software Engineering	PC	3 – 0 – 0	3	3	50	50	100
6	18CSL46	Python Programming (Integrated)	PC	2 – 0 – 2	4	3	25	25	50
7	18CSL47	Algorithms Laboratory	LAB	0 – 0 – 3	3	1.5	25	25	50
8	18CSL48	Database Applications Laboratory	LAB	0 – 0 – 3	3	1.5	25	25	50
9	18CS49	Environmental Science	HS	2 – 0 – 0	2	MNC	25	-	25
		Total			**30**	**24**	**350**	**325**	**675**

 # MNC: Mandatory Non-credit course. Pass in this course is mandatory for the award of degree.

Fourth Semester (Diploma)									
S.No.	**Course Code**	**Course**		**Contact Hours**	**Total Contact Hours/ week**	**Total credits**	**Marks**		
				L – T – P			**CIE**	**SEE**	**Total**
1	18DMATCS41	Graph Theory and Discrete Mathematical Structures	BS	4 – 0 – 0	4	4	50	50	100
2	18CS42	Operating System	PC	4 – 0 – 0	4	4	50	50	100
3	18CS43	Database Management System	PC	4 – 0 – 0	4	4	50	50	100
4	18CS44	Design and Analysis of Algorithm	PC	3 – 0 – 0	3	3	50	50	100
5	18CS45	Software Engineering	PC	3 – 0 – 0	3	3	50	50	100
6	18CSL46	Python Programming (Integrated)	PC	2 – 0 – 2	4	3	25	25	50
7	18CSL47	Algorithms Laboratory	LAB	0 – 0 – 3	3	1.5	25	25	50
8	18CSL48	Database Applications Laboratory	LAB	0 – 0 – 3	3	1.5	25	25	50
9	18CS49	Environmental Science	HS	2 – 0 – 0	2	MNC	25	-	25
		Total			**30**	**24**	**350**	**325**	**675**

 # MNC: Mandatory Non-credit course. Pass in this course is mandatory for the award of degree.

Fifth Semester (Regular)									
S.No.	**Course Code**	**Course**		**Contact Hours**	**Total Contact Hours/week**	**Total credits**	**Marks**		
				L – T - P			**CIE**	**SEE**	**Total**
1	18CS51	Computer Networks	PC	3 – 2 – 0	5	4	50	50	100
2	18CS52	Object Oriented Modeling and Design	PC	3 – 0 – 0	3	3	50	50	100
3	18CS53	Unix System Programming	PC	4 – 0 – 0	4	4	50	50	100
4	18CS54	Formal Languages and Automata Theory	PC	3 – 2 – 0	5	4	50	50	100
5	18CS55X	**Professional Elective-I**	PE	3 – 0 – 0	3	3	50	50	100
6	18CS56X	**Open Elective – I (only for other branches)**	OE	3 – 0 – 0	3	3	50	50	100
7	18CSL57	Unix System Programming Laboratory	LAB	0 – 0 – 3	3	1.5	25	25	50
8	18CSL58	Software Design And Modeling Laboratory	LAB	0 – 0 – 3	3	1.5	25	25	50
9		Employability Skills-I	HS	3 – 0 – 0	3	MNC	50	-	50
		Total			**32**	**24**	**400**	**350**	**750**

Fifth semester (Regular)			
Course Code	**Professional Elective I**	**Course Code**	**Open Elective I (only for other branches)**
18CS551	Advanced Web Programming	18CS561	NoSQL
18CS552	Advanced JAVA 2-0-2 Scheme	18CS562	Enterprise Resource Planning
18CS553	Advanced Algorithms	18CS563	Project Management
18CS554	Data Warehousing and Data Mining	18CS564	Principles of Cyber Security

Fifth Semester (Diploma)									
S.No.	**Course Code**	**Course**		**Contact Hours**	**Total Contact Hours/week**	**Total credits**	**Marks**		
				L – T – P			**CIE**	**SEE**	**Total**
1	18DMATCS51	Numerical Methods and Probability	BS	4 – 0 – 0	4	4	50	50	100
2	18CS52	Object Oriented Modeling and Design	PC	3 – 0 – 0	3	3	50	50	100
3	18CS53	Unix System Programming	PC	4 – 0 – 0	4	4	50	50	100
4	18CS54	Formal Languages and Automata Theory	PC	3 – 2 – 0	5	4	50	50	100
5	18CS55X	**Professional Elective-I**	PE	3 – 0 – 0	3	3	50	50	100
6	18CS56X	**Open Elective – I (only for other branches)**	OE	3 – 0 – 0	3	3	50	50	100
7	18CSL57	Unix System Programming Laboratory	LAB	0 – 0 – 3	3	1.5	25	25	50
8	18CSL58	Software Design and Modeling Laboratory	LAB	0 – 0 – 3	3	1.5	25	25	50
9	18CS59	Communicative English	HS	2 – 0 – 0	2	MNC	**25**	-	25
10		Employability Skills-I	HS	3 – 0 – 0	3	MNC	50	-	50
		Total			**33**	**24**	**425**	**350**	**775**

**** One Course exemption in 5th semester for Diploma lateral entry students to maintain the same credits as regular. (Computer Networks – exempted for Diploma students)**

Fifth Semester (Diploma)			
Course Code	**Professional Elective I**	**Course Code**	**Open Elective I (only for other branches)**
18CS551	Advanced Web Programming	18CS561	NoSQL
18CS552	Advanced JAVA 2-0-2 Scheme	18CS562	Enterprise Resource Planning
18CS553	Advanced Algorithms	18CS563	Project Management
18CS554	Data Warehousing and Data Mining	18CS564	Principles of Cyber Security

Sixth Semester									
S.No.	**Course Code**	**Course**		**Contact Hours**	**Total Contact Hours/week**	**Total credits**	**Marks**		
				L – T – P			**CIE**	**SEE**	**Total**
1	18CS61	Artificial Intelligence and Machine Learning	PC	3 – 2 – 0	5	4	50	50	100
2	18CS62	Compiler Design	PC	3 – 2 – 0	5	4	50	50	100
3	18CS63	Embedded Systems and IoT	PC	3 – 0 – 0	3	3	50	50	100
4	18CS64X	**Professional Elective-II**	PE	3 – 0 – 0	3	3	50	50	100
5	18CS65X	**Professional Elective-III**	PE	3 – 0 – 0	3	3	50	50	100
6	18CS66X	**Open Elective – II (only for other branches)**	OE	3 – 0 – 0	3	3	50	50	100
7	18CSL67	Machine Learning Laboratory	LAB	0 – 0 – 3	3	1.5	25	25	50
8	18CSL68	Embedded Systems and IoT Laboratory	LAB	0 – 0 – 3	3	1.5	25	25	50
9	18CS69	Constitution of India, PE and HV	HS	1 – 0 – 0	1	1	25	25	50
10.		Employability Skills-II	HS	3 – 0 – 0	3	MNC	50	-	50
		Total			**32**	**24**	**425**	**375**	**800**

Sixth Semester					
Course Code	**Professional Elective II**	**Course Code**	**Professional Elective III**	**Course Code**	**Open Elective II (only for other branches)**
18CS641	Computer Graphics	18CS651	Digital Image Processing	18CS661	Python Programming
18CS642	Big Data Management	18CS652	Information and Network Security	18CS662	Database Management System
18CS643	System Software	18CS653	Introduction to Salesforce (Industry Supported Elective) 2-0-2 scheme	18CS663	Data Structures
18CS644	Software Testing	18CS654	Mobile Computing	18CS664	Object Oriented Programming with JAVA
18CS645	Robotic Process Automation (Industry Supported Elective)				

Seventh Semester									
S.No.	**Code**	**Course**		**Contact Hours**	**Total Contact Hours/week**	**Total credits**	**Marks**		
				L – T – P			**CIE**	**SEE**	**Total**
1	18CS71	Entrepreneurship and Management	HS	3 – 0 – 0	3	3	50	50	100
2	18CS72	Network Programming	PC	3 – 0 – 0	3	3	50	50	100
3	18CS73	Distributed Computing	PC	3 – 2 – 0	5	4	50	50	100
4	18CS74X	**Professional Elective-IV**	PE	3 – 0 – 0	3	3	50	50	100
5	18CS75X	**Professional Elective-V**	PE	3 – 0 – 0	3	3	50	50	100
6	18CS76X	**Open Elective – III (only for other branches)**	OE	3 – 0 – 0	3	3	50	50	100
7	18CSL77	Network Programming Laboratory	LAB	0 – 0 – 3	3	1.5	25	25	50
8	18CSL78	Mobile Application Development Laboratory	LAB	0 – 0 – 3	3	1.5	25	25	50
9	18CS79	**Seminar on Project synopsis (Design Thinking Approach) Project Phase -1**	**PC**	0 – 0 – 2	2	1	25	--	25
		Total			**28**	**23**	**375**	**350**	**725**

Project Phase -1: CIE- 25 marks (Average of 25 marks –Internal guide and 25 marks- presentation)

Seventh Semester					
Course Code	**Professional Elective IV**	**Course Code**	**Professional Elective V**	**Course Code**	**Open Elective III (only for other branches)**
18CS741	Cloud Computing	18CS751	System Simulation and Modeling	18CS761	Software Testing
18CS742	Soft Computing	18CS752	Storage Area Networks	18CS762	Web Programming
18CS743	Block Chain Management	18CS753	Agile Software Development	18CS763	Machine Learning
18CS744	Ad-Hoc Sensor Networks	18CS754	Service Oriented Architecture	18CS764	Big Data and Hadoop
18CS745	*Industry Supported Elective (2-0-2 scheme)				

* Salesforce Lightning

Eighth Semester									
S.No.	**Code**	**Course**		**Contact Hours**	**Total Contact Hours/week**	**Total credits**	**Marks**		
				L – T - P			**CIE**	**SEE**	**Total**
1	18CS81	Internship	PC			2	50	--	50
2	18CS82	Intellectual Property Rights	HS	Self-Study		1	50		50
3	18CS83	Professional Certification – 1 (English / any other foreign language)	HS			1	25	--	25
4	18CS84	Professional Certification – 2	PC			1	25	--	25
5	18CS85	Project Phase -2	PC			2	50(25+25)	--	50
6	18CS86	Project Phase -3	PC			4	50(25+25)	--	50
7	18CS87	Project Phase-4 (Final Viva Voce)	PC	Final		5	--	100	100
		Total				**16**	**250**	**100**	**350**

Internship: 6 to 8 weeks duration

Project Phase -2 and 3: CIE- 50 marks (25 marks –Internal guide + 25 marks- presentation)

3rd Semester Detailed Syllabi

Statistical – Numerical – Fourier Techniques

(Common to all branches)

Course Code	18MATCS31	**Credits**	04
Course type	BS	**CIE Marks**	50
Hours/week: L-T-P	4 – 0 – 0	**SEE Marks**	50
Total Hours:	40	**SEE Duration**	3 Hours for 100 marks

Course Learning Objectives(CLO's)

Students should

1. Learn Numerical methods to solve Algebraic, Transcendental and Ordinary Differential Equations.
2. Understand the concept of Fourier series and apply when needed.
3. Get acquainted with Fourier Transforms and its properties.
4. Study the concept of Random variables and its applications.
5. Get acquainted with Joint Probability Distribution and Stochastic processes.

Pre-requisites :

1.Basic Differentiation and Integration

2. Basic Probability

3. Basic Statistics

Unit – I **8 Hours**

Numerical solution of Algebraic and Transcendental equations:

Method of False position, Newton- Raphson method (with derivation), Fixed point iteration method (without derivation).

Numerical solution of Ordinary differential equations: Taylor's Series method, Euler and Modified Euler method, Fourth order Runge–Kutta method

Unit – II **8 Hours**

Fourier Series: Periodic functions. Dirichlet's conditions, Fourier series, Half range Fourier sine and cosine series. Practical examples, Harmonic analysis.

Unit - III **8 Hours**

Fourier Transforms: Infinite Fourier Transform and Properties. Fourier Sine and Cosine Transforms Properties and Problems.

Unit - IV **8 Hours**

Probability: Random Variables (RV), Discrete and Continuous Random variables, (DRV, CRV) Probability Distribution Functions (PDF) and Cumulative Distribution Functions(CDF),

Expectations (Mean, Variance). Binomial, Poisson, Exponential and Normal Distributions. Practical examples.

Unit - V **8 Hours**

Joint PDF and Stochastic Processes: Discrete Joint PDF, Conditional Joint PDF, Expectations (Mean, Variance and Covariance).Definition and classification of stochastic processes. Discrete state and discrete parameter stochastic process, Unique fixed probability vector, Regular Stochastic Matrix, Transition probability, Markov chain.

Books

Text Books

1 B.S. Grewal – Higher Engineering Mathematics, Khanna Publishers, 42nd Edition, 2012.

2. Erwin Kreyszig –Advanced Engineering Mathematics, John Wiley & Sons Inc., 9th Edition, 2006.
3. B. V. Ramana- Higher Engineering Mathematics, Tata McGraw-Hill Education Private Limited, Tenth reprint 2010 and onwards.

Reference Books:

1. P.N.Wartikar & J.N.Wartikar– Applied Mathematics (Volume I and II) Pune Vidyarthi Griha Prakashan, 7th Edition 1994.

2 Peter V. O' Neil – Advanced Engineering Mathematics, Thomson Brooks/Cole, 7th Edition, 2011.

3 Glyn James – Advanced Modern Engineering Mathematics, Pearson Education, 4th Edition, 2010.

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	**Use** Numerical methods and **Solve** Algebraic, Transcendental and Ordinary differential equations.	**[L2]**
2.	**Develop** frequency bond series from time bond functions using Fourier series.	**[L2]**
3.	**Understand** Fourier Transforms and its properties.	**[L2]**
4.	**Understand** the concept of Random variables, PDF, CDF and its applications	**[L2]**
5.	**Extend** the basic probability concept to Joint Probability Distribution, Stochastic processes.	**[L3]**
6.	**Apply** Joint Probability Distribution, Stochastic processes to solve relevant problems.	**[L3]**

	Program Outcome of this course (POs)	**PO No.**
1.	An ability to apply knowledge of Mathematics, science and Engineering.	**[PO1]**
2.	An ability to identify, formulate and solve engineering problems.	**[PO5]**
3.	An ability to use the techniques, skills and modern engineering tools necessary for engineering practice	**[PO11]**

Course delivery methods	**Assessment methods**
1. Black Board Teaching	1. Internal Assessment
2. Power Point Presentation	2. Assignment
3. **Scilab/Matlab/ R-Software/Geogebra**	3. Quiz

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Average of two assignments /matlab/Scilab activity	Quiz/Seminar/Course Project	Total Marks
Maximum marks :50	15+15 = 30	10	10	50
Writing two IA tests is compulsory. Minimum marks required to qualify for SEE : 20 out of 50 marks				

Semester End Examination (SEE):

1. It will be conducted for 3 hours duration and 100 marks. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. Minimum passing marks required to be scored in SEE: 40 out of 100 marks
3. Question paper will have 10 questions carrying 20 marks each. Students have to answer FIVE full questions selecting atleast one full question from each unit.

DATA STRUCTURES WITH C (Theory)

Course Code	18CS32/18IS32	**Credits**	04
Course type	PC4	**CIE Marks**	50 marks
Hours/week: L-T-P	4– 0 – 0	**SEE Marks**	50 marks
Total Hours:	Lecture = 45Hrs; Tutorial = 0Hrs Total = 45Hrs	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. To learn the fundamentals of data structure and realize their importance in designing variety of applications.
2. To illustrate the implementation of data structures such as stack, queue and linked list and to apply tem for the given problem.
3. To introduce non linear data structures like Binary Tree, Heap, AVL tree and their applications and also to provide insight of advanced searching techniques like Hashing.
4. To create and use appropriate data structures for solving real life problems.

Pre-requisites : Basic computer concepts & C programming.

Unit – I 09Hours

Pointers, Structures: Introduction to Pointers, Pointers and Arrays, Pointers to Pointers, **Pointers to functions**, Dynamic memory management in C (malloc(), calloc(), free() and realloc() functions). Introduction to Structures, Declaration, Initialization, Accessing Structures, Internal implementation of Structures, Union and its Definition.

Self-learning topics : Enumerations.

Unit – II 09Hours

Files, Linked lists:

Files in C: Text input output with respect to files in C, Basic file handling functions in C.

General linear lists: Basic operations, Implementation, List ADT. Complex implementations: circular linked lists, doubly linked lists.

Unit – III 09Hours

Stacks & Queues:

Stacks: Basic Stack operations, Stack ADT,Stack linked list Implementation, Stack applications:Conversion of Expression (Infix to Postfix), Evaluation of Expressions.

Queues: Queues, Queue ADT, Circular Queues Linked list design, Queue applications.

Self-learning topics: Implementation of stacks and queues using arrays

Unit – IV 09Hours

Trees: Basictree concepts, Binary trees, Binary search tree ADT, general trees, Binary search tree (BST) concept, BST operations, BST Applications. AVL trees basic concepts.

Unit – V 09Hours

Heaps and Hashing

Heap: Basic concepts, Heap implementation, Heap ADT, Heap applications

Hashing: Basic concept, Hashing methods, collision resolution.

Books

Text Books:

1. Richard.F.Gilberg, Behrouz.A. Forouzan, Data Structures: A Pseudocode Approach with C, Cengage Learning, 2nd edition 2007 and onwards
2. Horowitz, Sahni, Anderson-Freed, Fundamentals of Data Structures in C, Universities Press, 2nd Edition, 2007 and onwards.

Reference Books:

1. Yedidyah, Augenstein, Tannenbaum: Data Structures Using C and C++, Pearson Education, 2nd Edition and onwards.
2. ReemaThareja, Data structures using C, Oxford Higher Education, 1st edition, 2011 onwards

E-resourses

1. **NPTELcourse link** : https://nptel.ac.in/courses/106102064/
2. **SWAYAM course link:** https://swayam.gov.in/course/1407-programming-and-data-structures
3. **edx course link:** https://www.edx.org/course/data-structures-fundamentals

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	**Explore** the fundamental concepts of various data structures.	L1
2.	**Analyze** and represent various data structures.	L3
3.	**Design** algorithms for different data structures like Stack, Queue, List, Tree and Hashing.	L3
4.	**Develop** programs with suitable data structures based on requirements of real world applications.	L3

	Program Outcome of this course (POs)	**PO No.**
1.	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	**1**
2.	**Problem analysis:** Identify, formulate, review research literature, andanalyze complex engineering problems reaching substantiated conclusionsusing first principles of mathematics, natural sciences, and engineeringsciences.	**2**
3.	**Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	**3**
4.	**Life-long learning:** Recognize the need for, have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	**12**

	Course delivery methods		**Assessment methods**
1.	Chalk and board	1.	Internal assessment
2.	PPT	2.	Assignment
3.	Video lectures	3.	Quiz

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Average of two assignments	Quiz/Seminar/Course Project	Total Marks
Maximum marks :50	15+15 = 30	10	10	50
Writing two IA tests is compulsory. Minimum marks required to qualify for SEE : 20 out of 50 marks				

Semester End Examination (SEE):

1. It will be conducted for 3 hours duration and 100 marks. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. Minimum passing marks required to be scored in SEE: 40 out of 100 marks
3. Question paper will have 10 questions carrying 20 marks each. Students have to answer FIVE full questions selecting atleast one full question from each unit.

Digital Electronics (Theory)

Course Code	18CS33/18IS33	**Credits**	04
Course type	PC	**CIE Marks**	50 marks
Hours/week: L-T-P	3 – 2 – 0	**SEE Marks**	50 marks
Total Hours:	Lecture = 40Hrs; Tutorial = 08Hrs Total= 48Hrs	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. Introduce the basics of Minimizing Boolean functions by using various techniques like K-Map and Quine Mclusky methods and implement by using suitable Logic gates and MSI chips.
2. Discuss the combinational logic circuits like Full Adder, Subtractor, Magnitude Comparators, Code Converters etc. and implement by using logic gates/ ICs.
3. Present the working of sequential circuits like Flip- Flops, Registers, Counters, ADC/DAC and their applications.
4. Understand the concept of HDL programming and realize Boolean functions and data processing circuits.

Pre-requisites : Basic Electronics

Unit – I 08 Hours

Revision of Logic gates and Boolean algebra, Simplification of Boolean functions using Basic Logic gates, Universal Gates, SOP, POS form, K-Map Simplification (up to 4 variables), Don't-care Condition, Quine McClusky method to generate Prime Implicants, Prime Implicants chart, problem solving with multiple methods.

Tutorial: Implementation of SOP/POS Boolean function using Universal gates.

Unit – II 08 Hours

Data Processing Circuits: Multiplexers, De-multiplexers, Decoder, Encoders and implementation of Boolean functions using multiplexer and Decoders, Parity Generators and Checkers using XOR gates Magnitude Comparators (1 bit and 2 bit), PLA, PAL, Adder / Subtracter.

Tutorial: Implementation of Boolean functions using Multiplexer/Decoder, Realization of Adder/Substracter using logic gates.

Unit – III 08 Hours

Clocks and Flip Flops: Clock waveforms, TTL clock, RS Flip Flops, Gated flip-flops, Edge triggered RS Flip-Flops, Edge triggered D Flip-Flops, and Edge triggered JK Flip-Flops, JK master slave Flip Flops, various representations of Flip Flops.

Tutorial: Implementation of flip flops using logic gates.

Unit – IV 08 Hours

Analysis of Sequential Circuits: Conversion of flip flops: A synthesis example, Types of Shift Register, SISO, SIPO, PISO and PIPO, Applications of Shift Registers as Ring Counter, Johnson Counter, Serial Adder.

Counters: Asynchronous counters (4 bit), Synchronous Counters (4 bit), Changing the counter Modulus, Decade counter (using IC 7490).

Tutorial: Application of IC 7490, Design and implementation of MOD-N counter

Unit – V **08 Hours**

DAC, ADC and Introduction to HDL: Variable, Resistor Networks, Binary Ladders, D/A converters, D/A Resolution and Accuracy, A/D converters: Simultaneous Conversion, Successive Approximation and Counter type, A/D Resolution and Accuracy.

Introduction to HDL: Types of Model, Syntax for Data Flow model.

Tutorial: Simple programs for SOP equation, Multiplexer, Decoder and Adder using Verilog.

Books

Text Books:

1. Donald P Leach, Albert Paul Malvino and GoutamSaha: Digital Principles and Applications, 7th Edition and onwards, Tata McGraw Hill, 2011.

Reference Books:

1. Donald Givone: Digital Principles and Design, Palgrave Macmillan, 2003 and onwards.
2. R D Sudhaker Samuel: Illustrative Approach to Logic Design, Sanguine-Pearson, 2012 and onwards.
3. Ronald J. Tocci, Neal S. Widmer, Gregory L. Moss: Digital Systems Principles and Applications, 10th Edition, Pearson Education, 2007 and onwards.

E-resourses (NPTEL/SWAYAM.. Any Other)- mention links

1. **https://nptel.ac.in/courses/117106086/**

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	**Analyze** different simplification methods for Boolean functions and design the logic circuits.	**L4**
2.	**Realize** the combinational and sequential logic circuits by using various logical blocks	**L3**
3.	**Design** synchronous counters and develop sequential circuit applications using flip flop and registers.	**L4**
4.	**Develop** simple HDL programs for combinational logic circuits.	**L3**

	Program Outcome of this course (POs)	**PO No.**
1.	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	**1**
2.	**Problem analysis:** Identify, formulate, review research literature, and analyze complex Engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences	**2**
3.	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations	**5**
4.	**Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	**12**

Course delivery methods	Assessment methods
1. Chalk and board	1. Internal assessment
2. PPT	2. Assignment
3. Video lectures	3. Quiz
	4. Seminar / project

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Average of two assignments	Quiz/Seminar/Course Project	Total Marks
Maximum marks :50	15+15 = 30	10	10	50
Writing two IA tests is compulsory. Minimum marks required to qualify for SEE : 20 out of 50 marks				

Semester End Examination (SEE):

1. It will be conducted for 3 hours duration and 100 marks. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. Minimum passing marks required to be scored in SEE: 40 out of 100 marks
3. Question paper will have 10 questions carrying 20 marks each. Students have to answer FIVE full questions selecting atleast one full question from each unit.

Object Oriented Programming with Java (Theory)

Course Code	18CS34/18IS34	**Credits**	03
Course type	PC	**CIE Marks**	50 marks
Hours/week: L-T-P	3 – 0 – 0	**SEE Marks**	50 marks
Total Hours:	Lecture = 40 Hrs; Tutorial = 00 Hrs Total = 40 Hrs	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. Understand the fundamentals of object-oriented programming in Java.
2. Demonstrate the features of object-oriented programming such as encapsulation, inheritance and polymorphism to design and develop programs in Java.
3. Understand exception handling mechanism supported in Java to handle run time errors.
4. Understand the concept of packages and interfaces in Java.
5. To introduce the design of Graphical User Interface (GUI) programming through Java Swing.

Pre-requisites: Basics programming concepts.

Unit – I 08 Hours

OOP Paradigm: The key attributes of object-oriented programming.
Java basics: The Java language, JDK, arrays, multidimensional arrays, alternative array declaration, assigning array references, using the length member, the for-each loop, Strings, using the command line arguments.
Introducing classes and objects: Class fundamentals, how objects are created, reference variables and assignment.

Unit – II 08 Hours

Methods and classes: methods, returning from a method, returning a value, using parameters, constructors, parameterized constructors, the new operator revisited, garbage collection and finalizers, this keyword. controlling access to class members, pass objects to methods, argument passing, returning objects, method overloading, recursion, static, nested and inner classes, varargs.

Unit – III 08 Hours

Inheritance: Inheritance basics, member access and inheritance, constructors and inheritance, using super, multilevel hierarchy, when are constructors executed, superclass reference and subclass objects, method overriding, polymorphism, using abstract classes, using final, the Object class.
Interfaces: interface fundamentals, creating, implementing and using interfaces, implementing multiple interfaces, constants in interfaces, extending interfaces and nested interfaces.

Unit – IV 08 Hours

Packages: Package fundamentals, packages and member access, importing packages, static import.
Exception handling: the exception hierarchy, exception handling fundamentals, uncaught exceptions, handle errors gracefully, multiple catch, catching subclass exceptions, nested try, throwing exception, throwable, using finally and throws, built-in exceptions, new exception features in JDK7, creating exception subclasses.

String Handling: String fundamentals, constructors, String related language features, length(), obtaining characters within a String, String comparison, indexOf() and lastIndexOf(), obtaining a modified String, Changing Case, StringBuffer and StringBuilder.

Unit – V **08 Hours**

Swing fundamentals: origins and design philosophy, components and containers, layout managers, event handling, push button, JTextField, anonymous inner classes.

Swing Controls: JLabel and ImageIcon, Swing Buttons, Trees.

Books

Text Books:

1. Herbert Schildt& Dale Skrien, "Java Fundamentals A Comprehensive Introduction", TMH. Special Indian edition.

Reference Books:

1. 1. Kathy Sierra & Bert Bates, "Head First Java", O'Reilly, 2nd Edition and onwards.

E-resourses (NPTEL/SWAYAM.. Any Other)- mention links

Course Outcome (Cos)

	At the end of the course, the student will be able to:	Bloom's Level
1	**Identify** classes, objects, members of a class and relationships among them needed for a specific problem	**L2**
2	**Write** Java application programs using OOP principles and proper program structuring	**L3**
3	**Demonstrate** the concepts of polymorphism and inheritance	**L3**
4	**Write** Java programs to implement error handling techniques using exception handling	**L3**
5	**Create** and design GUI using Java Swing.	**L4**

	Program Outcome of this course (POs)	**PO No.**
1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	**1**
2	**Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	**3**
3	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	**12**

Course delivery methods

1. Lecture & Board
2. Power-point Presentation
3. Online Videos / Learning
4. Class Room Exercises

Assessment methods

1. Assignments
2. Quizzes
3. Internal Assessment Test

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Average of two assignments	Quiz/Seminar/Course Project	Total Marks
Maximum marks :50	15+15 = 30	10	10	50
Writing two IA tests is compulsory. Minimum marks required to qualify for SEE : 20 out of 50 marks				

Semester End Examination (SEE):

1. It will be conducted for 3 hours duration and 100 marks. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. Minimum passing marks required to be scored in SEE: 40 out of 100 marks
3. Question paper will have 10 questions carrying 20 marks each. Students have to answer FIVE full questions selecting atleast one full question from each unit.

Computer Organization
(Theory)

Course Code	18CS35/18IS35	**Credits**	03
Course type	PC	**CIE Marks**	50 marks
Hours/week: L-T-P	3 – 0 – 0	**SEE Marks**	50 marks
Total Hours:	Lecture = 40 Hrs; Tutorial = 0 Hrs Total = 40 Hrs	**SEE Duration**	3 Hours for 100 marks

Course Learning Objectives

1. To understand the operation of CPUs including I/O, Processor, Memory systems, Busses and Computer Arithmetic
2. To understand the different ways of communicating with I/O devices and to introduce the hierarchical memory system including cache memories
3. To understand the implementation of different computer arithmetic algorithms for various arithmetic operations
4. To study the internal functional units of processor and understand the generation of internal functions to execute instructions, pipelining and embedded systems.

Pre-requisites : Digital Electronics

Unit – I **08 Hours**

Basic Structure of Computers:
Functional Units, Basic Operational Concepts, Bus Structures, Performance – Processor Clock, Basic Performance Equation, Clock Rate, Performance Measurement, Machine Instructions and Programs: Numbers, Arithmetic Operations and Characters, Memory Location and Addresses, Memory Operations, Instructions and Instruction Sequencing. Addressing Modes.
Self learning topics: Computer Types, Historical Perspective

Unit – II **08 Hours**

Input / Output Organization:
Accessing I/O Devices, Program controlled I/O, Memory mapped I/O, Interrupts – Interrupt Hardware, Enabling and Disabling Interrupts, Handling Multiple Devices, Controlling Device Requests, Direct Memory Access, Bus Arbitration Techniques: Centralized & Distributed, Buses : Synchronous & Asynchronous

Unit – III **08 Hours**

Memory System
Basic Concepts, Semiconductor RAM Memories, Read Only Memories, Speed, Size, and Cost, Cache Memories–Mapping Functions: Direct Mapping, Associative Mapping, Set-Associative Mapping.

Unit – IV **08 Hours**

Arithmetic:

Addition and Subtraction of Signed Numbers, Design of Fast Adders, Multiplication of Positive Numbers, Signed Operand Multiplication, Fast Multiplication, Integer Division.

Application of the algorithms for arithmetic operations.

Self learning topics: Floating-point Numbers and Operations

Unit – V **08 Hours**

Basic Processing Unit:

Fundamental Concepts, Execution of a Complete Instruction, Multiple Bus Organization, Hard-wired Control.

Self learning topics: Embedded Systems

Books

Text Books:

1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky: Computer Organization, 5th Edition, Tata McGraw Hill, 2002.Chapter 1, 2, 4, 5, 6, 7 & 9.

Reference Books:

1. Computer Architecture, A Quantitative Approach – John L. Hennessey and David A. Patterson: 5th Edition, Elsevier.
2. William Stallings: Computer Organization & Architecture, 8th Edition, PHI, 2006.

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	**Identify** the functional units of the processor and the factors affecting the performance of a computer	L1
2.	**Explain** the addressing modes and instructions sets.	L2
3.	**Discuss** the algorithms for computer arithmetic operations and learn the working of those algorithms for arithmetic operations	L3
4.	**Infer** the internal functional units of processor and generate sequence of signals to execute different instructions	L4

	Program Outcome of this course (POs)	**PO No.**
1.	**Engineering Knowledge**: Apply the knowledge of mathematics , science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems	**1**
2.	**Conduct investigation of complex problems:** Use research based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusion.	**4**

Course delivery methods	**Assessment methods**
1. Power Point Presentation	1. **Assignment**
2. Chalk & Talk	2. **Quiz**

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Average of two assignments	Quiz/Seminar/Course Project	Total Marks
Maximum marks :50	15+15 = 30	10	10	50
Writing two IA tests is compulsory. Minimum marks required to qualify for SEE : 20 out of 50 marks				

Semester End Examination (SEE):

1. It will be conducted for 3 hours duration and 100 marks. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. Minimum passing marks required to be scored in SEE: 40 out of 100 marks
3. Question paper will have 10 questions carrying 20 marks each. Students have to answer FIVE full questions selecting atleast one full question from each unit.

Web Programming (Integrated)

Course Code	18CSL36/18ISL36	**Credits**	03
Course type	PC	**CIE Marks**	25 marks
Hours/week: L-T-P	2 – 0 – 2	**SEE Marks**	25 marks
Total Hours:	Lecture =20 Hrs; Practical = 20 Hrs Total = 40 Hrs	**SEE Duration**	3 Hours for 50 marks

Course learning objectives

1. To introduce the fundamentals of world wide web.
2. To develop client based web pages using HTML5, CSS3, JavaScript, Jquery and AngularJS.
3. To develop responsive web pages using Bootstrap.

Pre-requisites : Computer Concepts and C Programming

Unit – I 08 Hours

Introduction: The Internet Versus the Web, Serving Up Your Information, Web Page Addresses (URLs), The Anatomy of a Web Page, A Dizzying Multitude of Devices, Sticking with the Standards, Progressive Enhancement, Responsive Web Design, Accessibility, Site Performance, Steps to becoming a web developer, skills and tools, Dos and Don'ts, career trends

Self learning topics: Web history, web standards

Unit – II 08 Hours

HTML5: Basic Elements, drag and drop, File upload, Dropdown menu, audio player, local storage, graphics and animation, Geolocation and form validation, CSS3: Basic properties, Inheritance, Multiple classes, Box model, Effects.

Self learning topics: HTML5 code validation

Unit – III 08 Hours

Basics of JavaScript: Dialog boxes, Conditional statements, loops, arrays, objects, events, Jquery: Add/Remove class, UI Datepicker, File upload, Autocomplete

Self learning topics: JavaScript Code Validation, JQuery basics

Unit – IV 08 Hours

Basics of AngularJS: Form validation, Routing, Controller, Table, Data binding

Self learning topics: AgularJS API, W3.CSS, Includes

Unit – V 08 Hours

Basics of Bootstrap: Grid, Navbar, Table, Dropdown, Form, Layout, Tooltip, Panel, Pop-over, Tabs, Modals

Self learning topics: Concepts of responsive design, BS4 basic template

PART A

List of experiments

1. Create multi column article using HTML tags. Integrate social sharing feature. Implement both web view and mobile view.
2. Implement HTML5 dropdown menu with CSS3 and bootstrap.
3. Implement HTML5 Local Storage.
4. Form Validation using HTML5, JavaScript, angularJS and Bootstrap.

5. Implement AngularJS Routing and AngularJS Controller.
6. Implement UI Datepicker using Jquery.
7. Implement Drag and drop using, HTML5 and Jquery.
8. Implement UI Autocomplete using Jquery

PART B

Each student needs to formulate a problem definition in consultation with the guide for the Project component and work towards completion after approval. Project report has to be submitted by each student individually.

Books

1. Jennifer Niederst Robbins, Learning Web Design: A Beginner's Guide to HTML, CSS, JavaScript, and Web Graphics, O'reilly, 4th Edition,2012
2. Cody Lindley, jQuery Cookbook, O'Reilly Media, 2009
3. Matt Frisbie, AngularJS Web Application Development Cookbook, Packt Publishing, 2014
4. Syed Fazle Rahman, Jump Start Bootstrap, SitePoint, 2014

E-Resourses

1. www.w3schools.com
2. www.tutorialspoint.com

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	**Explain** basic concepts and principles of world wide web.	L2
2.	**Apply** design principles for interactive client side web pages	L3
3.	**Design** and **develop** responsive website for a given application.	L5

	Program Outcome of this course (POs)	PO No.
1.	**Individual and team work:** An ability to visualize and work on multidisciplinary tasks.	**5**
2.	**Use of engineering tools:** An ability to create, select, apply, adapt, and extend appropriate techniques, resources, and modern engineering tools to a range of engineering activities, from simple to complex, with an understanding of the associated limitations.	**6**
3.	**Communication skills:** An ability to communicate complex engineering concepts within the profession and with society at large. Such ability includes reading, writing, speaking and listening, and the ability to comprehend and write effective reports and design documentation, and to give and effectively respond to clear instructions.	**8**
4.	**Life-long learning:** An ability to identify and to address their own educational needs in a changing world in ways sufficient to maintain their competence and to allow them to contribute to the advancement of knowledge.	**12**

Assessment methods

1. **I A Test**
2. **Mini Project**
3. **Periodic Journal Evaluation**

Scheme of Continuous Internal Evaluation (CIE):

Components	IA test*	Journal and lab test **OR** Project report and intermediate evaluation	Total Marks
Maximum marks :50	30	20	50
*IA test could be two tests each of one hour duration or only one test of 2 hours duration. Submitting Journal/ Project report is compulsory. Minimum marks required to qualify for SEE : 20 out of 50 marks			

Semester End Examination (SEE):

1.	It will be conducted for 50 marks having 3 hours/2 hours duration. It will be reduced to 25 marks for the calculation of SGPA and CGPA.		
2.	Initial write up stating the objectives, methodology and the outcome	10 marks	50 marks
	Presentation (PPT) of the project	15 marks	
	Hardware project: Exhibiting and demonstration of working of project. Software project: Demonstration of the programming capabilities by writing flowchart, algorithm and codesrelated to a section of the project.	25 marks	
3.	Minimum passing marks to be scored in SEE: 20 out of 50 marks		

DATA STRUCTURES With C Laboratory

Course Code	18CSL37/18ISL37	**Credits**	1
Course type	Lab	**CIE Marks**	25 marks
Hours/week: L-T-P	0 – 0 – 2	**SEE Marks**	25 marks
Total Hours:	30	**SEE Duration**	3 Hours for 50 marks

Course learning objectives

1. Demonstrate the abstract properties of various data structures such as stacks, queues, lists, and trees.
2. Compare different implementations of data structures and recognize the advantages and disadvantages of the different implementations
3. Able to demonstrate features of different data structures such as Linked List, Hash Table, Queues to solve real world problems.

Pre-requisites :C programming Skills

List of experiments

1. Write a C program to merge contents of two files containing USNs of students in a sorted order in to the third file such that the third file contains Unique USNs. Program should also display common USNs in both the files.

2. A data ware house is maintaining product Id in a file and a client need to fetch all these product Ids in to other file.

3. Consider a calculator that needs to perform checking the correctness of parenthesized arithmetic expression and convert the same to postfix expression for evaluation. Develop and execute a program in C using suitable data structures to perform the same and print both the expressions. The input expression consists of single character operands and the binary operators + (plus), - (minus), * (multiply) and /(divide)

4. A calculator needs to evaluate a postfix expression. Develop and execute a program in C using a suitable data structure to evaluate a valid postfix expression. Assume that the postfix expression is read as a single line consisting of non-negative single digit operands and binary arithmetic operators. The arithmetic operators are + (add), - (subtract), * (multiply) and / (divide).

5. Write a C program to simulate the working of Messaging System in which a message is placed in a Queue by a Message Sender, a message is removed from the queue by a Message Receiver, which can also display the contents of the Queue.

6. Write a C program for the following -
   a. Create Initial Hash Table.
   b. Compute Hash Value Using the function H(k) = k % m, where k is the key item to insert and m is any prime number.
   c. Insert an Item into the using linear probing

d. Display the Hash Table

7. Consider a warehouse where the items have to be arranged in an ascending order. Develop and execute a program in C using suitable data structures to implement warehouse such that items can be traced easily.

8. Given a list of integers stored in a tree data structure. Inorder traversing of this tree will result in to a sorted list. Write a code construct this tree.

9. Develop and execute a program in C to perform following operations on binary search tree:
   a.To count number of non terminal nodes.
   b. To count number of terminal nodes.
   c. To count nodes with degree2.
   d. To count total number of nodes.

10. Develop and execute a program in C using suitable data structures to perform Searching a data item in an ordered list of items in both directions and implement the following operations:
    a. Create a doubly linked list by adding each node at thestart.
    b. Insert a new node at the end of thelist.
    c. Display the content of alist.
    d. Consider an integer number as a data item.

Books

1. Richard.F.Gilberg, Behrouz.A. Forouzan, Data Structures: A Pseudo code Approach with C, Cengage Learning, 2nd edition 2007 and onwards.
2. Horowitz, Sahni, Anderson-Freed, Fundamentals of Data Structures in C, Universities Press, 2nd Edition, 2007 and onwards.

E-Recourses

1. https://www.geeksforgeeks.org/
2. https://www.sanfoundry.com/c-programming-examples-data-structures/
3. https://www.programmingsimplified.com/c/data-structures/c-program-implement-linked-list

Course Outcome (COs)

At the end of the course, the student will be able to	Bloom's Level
1. **Demonstrate** the understanding of structured programming.	L3
2. **Analyze** the problem statement and able to choose right data structure for implementation.	L4
3. **Develop** an ability to construct robust, maintainable programs which satisfy the requirements of user.	L3

Program Outcome of this course (POs)	**PO No.**
1. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	**3**

2.	**Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	**4**
3.	**Modern tool usage:** Create, select, and apply appropriate techniques resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.	**5**
4.	**Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	**12**

Assessment methods

1. Periodic journal evaluation
2. I.A Test
3. Viva Voce

Scheme of Continuous Internal Evaluation (CIE):

Components	Attendance/conduct of lab	Journal	Lab project	Total Marks
Maximum marks :25	10	10	5	25
Submission and certification of journal is compulsory to qualify for SEE Minimum marks required to qualify for SEE : 10 out of 25 marks				

Semester End Examination (SEE):

1.	It will be conducted for 50 marks having 3 hours/2 hours duration. It will be reduced to 25 marks for the calculation of SGPA and CGPA.		
2.	Only one experiment to be conducted. In case, there are two parts then one experiment from each part.		
3.	Initial write up:Algorithm/Flowchart/Tracing	10 marks	50 marks
	Conduct of experiment(s), result and conclusion	20 marks	
	One marks question	10 marks	
	Viva-voce	10 marks	
4.	Viva voce is conducted for individual student and not in group		
5.	Minimum passing marks to be scored in SEE: 20 out of 50 marks		

Object Oriented Programming with Java Lab

Course Code	18CSL38/18ISL38	**Credits**	1
Course type	Lab	**CIE Marks**	25 marks
Hours/week: L-T-P	0 – 0 – 2	**SEE Marks**	25 marks
Total Hours:	40	**SEE Duration**	3 Hours

Course learning objectives (CLOs):

1. To introduce Java compiler and the NetBeans IDE.
2. To learn and apply the object-oriented approach to developing software programs.
3. Design,using good design principles simple software programs to solve problems.
4.Analyse and implement a given problem using Java with the specified concept.

Pre-requisites: Basics of C and Object-Oriented Programming.

List of Experiments:

The students are required to develop and execute the following programs in Java:

1. Write a program to demonstrate the implementation of 2-dimension array.
2. Write a program to demonstrate the implementation of class and its member methods.
3. Write a program to demonstrate the implementation of parameterized:
    a. Methods.
    b. Constructor.
4. Write a program to demonstrate the implementation of inheritance.
5. Write a program to demonstrate the implementation of method:
    a. Overloading.
    b. Overriding.
6. Write a program to demonstrate the implementation of interface.
7. Write a program to demonstrate the implementation of packages.
8. Write a program to demonstrate the implementation of customized exception handling.
9. Write a program to demonstrate the implementation of string handling.
10. Write a program to demonstrate the implementation of JAVA swings.

Course Outcome (Cos)

At the end of the course, the student will be able to:	Bloom's Level
1. Use the NetBeans IDE to write and execute Java programs.	**L3**
2. Write Java application programs using OOP principles and proper program structuring.	**L3**
3. Identify classes, members of a class and relationships among them needed for a specific problem	**L2**
4. Write Java programs to demonstrate error handling techniques using exception handling.	**L3**
5. Write Java programs to demonstrate packages and interfaces and String handling.	**L3**
6. Use Swing concept to develop simple GUI applications.	**L3**

Program Outcome of this course (POs)	**PO No.**
1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	**1**

2. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations. **3**
3. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations. **5**
4. **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change. **12**

Books

Text Books:

1. Herbert Schildt& Dale Skrien, "Java Fundamentals A Comprehensive Introduction", TMH. Special Indian edition.

Reference Books:

1. 1. Kathy Sierra & Bert Bates, "Head First Java", O'Reilly, 2nd Edition and onwards.

Assessment methods	
1.	Regular Journal Evaluation and Attendance Monitoring.
2.	Lab Internal Assessment.

Scheme of Continuous Internal Evaluation (CIE):

Components	Attendance/conduct of lab	Journal	Lab project	Total Marks
Maximum marks :25	10	10	5	25
Submission and certification of journal is compulsory to qualify for SEE Minimum marks required to qualify for SEE : 10 out of 25 marks				

Semester End Examination (SEE):

1	It will be conducted for 50 marks having 3 hours/2 hours duration. It will be reduced to 25 marks for the calculation of SGPA and CGPA.		
2	Only one experiment to be conducted. In case, there are two parts then one experiment from each part.		
3	Initial write up	10 marks	50 marks
	Conduct of experiment(s), result and conclusion	20 marks	
	One marks question	10 marks	
	Viva-voce	10 marks	
4	Viva voce is conducted for individual student and not in group		
5	Minimum passing marks to be scored in SEE: 20 out of 50 marks		

Calculus, Fourier Analysis and Linear Algebra
(All Branches)

Course Code	18DMATCS31	**Credits**	04
Course type	BS	**CIE Marks**	50 marks
Hours/week: L-T-P	4–0– 0	**SEE Marks**	50 marks
Total Hours:	50	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

Students should

1. Learn the concept of series expansion using Taylor's and Maclaurin's series and get acquainted with the polar curves and partial differentiation.
2. Learn Differential Equations of first order and higher order and apply them.
3. Get acquainted with Fourier transforms and its properties.
4. Learn numerical methods to solve algebraic, transcendental and ordinary differential equations.
5. Understand and interpret the system of equations and various solutions.

Pre-requisites :

1. Basic differentiation and integration
2. Trigonometry
3. Matrix and determinant operations
4. Vector algebra

Unit – I **10 Hours**

Differential Calculus: Taylor's and Maclaurin's theorems for function of one variable (statement only)-problems. Angle between polar curves. **Partial Differentiation:** Definition and problems. Total differentiation- problems. Partial differentiation of composite functions- problems.

Unit – II **10 Hours**

Laplace Transforms: Definition, Laplace transforms of elementary functions. Laplace transforms of $e^{at} f(t)$, $t^n f(t)$, $\int_0^t f(t)\,dt$, $\frac{f(t)}{t}$ (without proof), Inverse Laplace transforms: Inverse Laplace transforms -problems, applications to solve linear differential equation.

Unit –III **10 Hours**

Fourier Analysis: Fourier Series: Fourier series, half range Fourier sine and cosine series. Practical examples. Harmonic analysis.

Fourier Transforms: Infinite Fourier transform and properties. Fourier sine and cosine transforms. Properties and problems.

Unit – IV **10 Hours**

Numerical Techniques: Numerical solution of algebraic and transcendental equations: Method of false position, Newton- Raphson method, fixed point iteration method (without derivation).

Numerical solution of ordinary differential equations: Taylor's series method, Euler and modified Euler method, fourth order Runge-Kutta method (without derivation).

Unit – V **10 Hours**

Linear Algebra: Rank of a matrix by elementary transformation, solution of system of linear equations-Gauss elimination method and Gauss-Seidal method. Eigen value and eigen vectors – Rayleigh's Power method.

Books

Text Books:

1. B.S. Grewal – Higher Engineering Mathematics, Khanna Publishers, 42nd Edition, 2012 and onwards.
2. Erwin Kreyszig –Advanced Engineering Mathematics, John Wiley & Sons Inc., 9th Edition, 2006 and onwards.
3. B. V. Ramana - Higher Engineering Mathematics, Tata McGraw-Hill Education Private Limited, Tenth reprint 2010 and onwards.

Reference Books:

1. P. N. Wartikar & J. N. Wartikar – Applied Mathematics (Volume I and II) Pune Vidyarthi Griha Prakashan, 7th Edition 1994 and onwards.
2. Peter V. O' Neil –Advanced Engineering Mathematics, Thomson Brooks/Cole, 7th Edition, 2011 and onwards.
3. Glyn James –Advanced Modern Engineering Mathematics, Pearson Education, 4th Edition, 2010 and onwards.

Course Outcome (COs)

At the end of the course, the student will be able to	**Bloom's Level**
1. **Develop** the Taylors and Maclaurins series using derivative concept.	L1, L2
2. **Demonstrate** the concept and use of Partial Differentiation in various problems.	L1, L2
3. **Classify** Laplace transforms of various categories and **apply** them to solve relevant problems**.**	L1, L3
4. **Develop** frequency bond series from time bond functions using Fourier series.	L3
5. **Use** numerical methods and **Solve** algebraic, transcendental and ordinary differential equations	L1, L2
6. **Interpret** the various solutions of system of equations and **Solve them.**	L2

Program Outcome of this course (POs)	**PO No.**
Students will acquire	
1. An ability to apply knowledge of mathematics, science and engineering.	**PO1**
2. An ability to identify, formulate and solve engineering problems.	**PO5**
3. An ability to use the techniques, skills and modern engineering tools necessary for engineering practice.	**PO11**

Course delivery methods	**Assessment methods**
1. Black board teaching	1. Internal Assessment Tests
2. Power point presentation	2. Assignments
3. Scilab/ Matlab/ R-Software	3. Quizes

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Average of two assignments /matlab/Scilab activity	Quiz/Seminar/Course Project	Total Marks
Maximum marks :50	15+15 = 30	10	10	50
Writing two IA tests is compulsory. Minimum marks required to qualify for SEE : 20 out of 50 marks				

Semester End Examination (SEE):

1. It will be conducted for 3 hours duration and 100 marks. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. Minimum passing marks required to be scored in SEE: 40 out of 100 marks
3. Question paper will have 10 questions carrying 20 marks each. Students have to answer FIVE full questions selecting atleast one full question from each unit.

4th Semester Detailed Syllabi

IV SEM
(2018-19)

Discrete Mathematical Structures and Graph Theory

(Computer Science / Information Science)

Subject Code:	18MATCS41	**Credits:**	04
Course Type:	BS	**CIE Marks:**	50
Hours/week: L – T – P	4 –0– 0	**SEE Marks:**	50
Total Hours:	40	**SEE Duration:**	3 Hours

Course Learning Objectives (CLOs):

Students should

1. Understand and apply Logic in the field of Computer science.
2. Understand the various Relations and Functions.
3. Understand advanced counting techniques.
4. Get acquainted with basic concepts of Graph Theory and their applications.
5. Get acquainted with elementary Number theory, and their properties for applications in Cryptography.

Prerequisites:

1. Set Theory
2. Power series
3. Binomial Series
4. Basics of Counting

Unit-I **08 hrs**

Fundamentals of Logic: Laws of Logic, Logical Implication-Rules of Inference. Quantifiers-Universal and Existential Quantifiers, Proofs Techniques: direct, indirect and Contradiction.

Unit–II **08 hrs**

Relations and Functions: Zero-One Matrices and Directed Graphs, Closure and Equivalence Relations and Partitions, Partial Orders, Hasse Diagrams, Lattice, Properties of functions, Composition and Invertible functions.

Unit-III **08 hrs**

Advanced Counting Techniques: Sterling Number of second kind, Inclusion and Exclusion, Pigeonhole Principle, Generating Function, Recurrence relations, Solution of Linear homogeneous and non-homogeneous recurrence relations with constant coefficients, Divide and Conquer Algorithms, Merge sort algorithm.

Unit-IV **08 hrs**

Basic Graph Theory: Definitions and Examples, Subgraphs, Complements and Graph Isomorphism, Connectivity, Euler Trails and Circuits, Planar Graphs, Hamiltonian Paths and Cycles, Coloring, Matching.

Unit-V **08 hrs**

Elementary Number Theory and Cryptography: Fields, Modular Arithmetic, Prime Numbers, Fermat's and Euler's theorem. Testing of Primality, Chinese Remainder Theorem. Caesar Encryption/Decryption, RSA Cryptosystem.

Text Books:

1. Kolman, Busby, Ross "Discrete Mathematical Structures", 6th Edition Prentice Hall of India, 2010 onwards.
2. William Stallings "Cryptography and Network Security", Pearson Prentice Hall 6th Edition, 2013 onwards.
3. Kenneth H. Rosen "Discrete Mathematics and its applications", Mc Graw Hill 7th Edition.

Reference Books:

1. Ralph P. Grimaldi, "Discrete and Combinatorial Mathematics", 5th Edition, Pearson Education, 2004 onwards.
2. K. D. Joshi, "Foundations of Discrete Mathematics", 2nd Edition, New Age International Publishers, 2014 onwards.

Course Outcomes (COs): At the end of the course students will be able to:

1. **Understand** and **Apply** the Logic of Mathematics in the field of Computer science. **[L2, L3]**
2. **Explain and Analyze** Different Relations and Functions**. [L2, L3]**
3. **Discuss** basic concepts of Graph Theory and its **Use** in Computer Science. **[L2, L3]**
4. **Explain** the concept of Finite Fields. **[L2]**
5. **Apply** Finite Fields to Cryptography. **[L3]**

Program Outcomes (POs) of the course: Students will acquire

1. An ability to apply knowledge of Mathematics, science and Engineering. **[PO1]**
2. An ability to identify, formulate and solve engineering problems. **[PO5]**
3. An ability to use the techniques, skills and modern engineering tools necessary for engineering practice. **[PO11]**

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Average of two assignments /matlab/Scilab activity	Quiz/Seminar/Course Project	Total Marks
Maximum marks :50	15+15 = 30	10	10	50
Writing two IA tests is compulsory. Minimum marks required to qualify for SEE : 20 out of 50 marks				

Semester End Examination (SEE):

1. It will be conducted for 3 hours duration and 100 marks. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. Minimum passing marks required to be scored in SEE: 40 out of 100 marks
3. Question paper will have 10 questions carrying 20 marks each. Students have to answer FIVE full questions selecting atleast one full question from each unit.

Operating System (Theory)

Course Code	18CS42/18IS42	**Credits**	04
Course type	PC	**CIE Marks**	50 marks
Hours/week: L-T-P	4 – 0 – 0	**SEE Marks**	50 marks
Total Hours:	Lecture = 47 Hrs; Tutorial = 00 Hrs Total = 47 Hrs	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. To introduce the functions of operating system, design, structure and associated system calls.
2. To study and analyze various scheduling algorithms and process synchronization techniques.
3. To develop an understanding about deadlocks and deadlock recovery techniques.
4. To discuss and realize the importance of memory management techniques.
5. To gain the knowledge of file systems and secondary storage structures.

Pre-requisites: Basic knowledge of computer concepts & programming, Computer Organization.

Unit – I **10 Hours**

Introduction to Operating System: System structures: What operating systems do; Operating System operations; Process management; Memory management; Storage management; Protection and security; Distributed system; Operating System Services; System calls; Types of system calls; Operating System structure; System boot.

Introduction to UNIX File System: Inside UNIX, Internal and External Commands, Command structure.

Case Study: Android Operating System / iOS

Unit – II **09 Hours**

Process Management: Process concept; Process scheduling; Process Scheduling: Basic concepts; Scheduling criteria; Scheduling algorithms.

The Process: Understanding the process, How a process is created, the login shell, init, internal and external commands, ps.

Unit – III **09 Hours**

Process Synchronization: Synchronization: The Critical section problem; Peterson's solution; Semaphores; Classical problems of synchronization.

Deadlocks: Deadlocks: System model; Deadlock characterization; Methods for handling deadlocks; Deadlock prevention; Deadlock avoidance; Deadlock detection and recovery from deadlock.

Unit – IV **09 Hours**

Memory Management: Memory Management Strategies: Background; Swapping; Contiguous memory allocation; Paging; Virtual Memory Management: Background; Demand paging; Copy-on-write; Page replacement;

Unit – V **10 Hours**

File System: Implementation of File System: File System: File concept; Access methods; Directory structure; File system mounting; File sharing; Protection. Implementing File System: File system structure.
The File System: The parent child relationship, The UNIX file system, Absolute Pathnames, Relative Pathnames, pwd, cd, mkdir, rmdir, cp, rm, mv, cat. **File Attributes:** ls, ls-l, ls-d, file permissions, chmod.

Books

Text Books:

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, "Operating System Principles", Wiley India, 6th edition and onwards.
2. Sumitabha Das: "YOUR UNIX – The Ultimate Guide" , Tata McGraw Hill, 23rd reprint , 2012 and onwards.

Reference Books:

1. Gary Nutt, "Operating System", Pearson Education, 2nd edition and above.
2. Harvey M Deital, "Operating system", Addison Wesley, 2nd edition and above.
3. D.M Dhamdhere, "Operating System", "A concept based Approach", Tata McGraw- Hill, 2nd edition and onwards.
4. Behrouz A. Forouzan and Richard F. Gilberg: "UNIX and Shell Programming ", Cengage Learning, 2005 and onwards.

E-resourses (NPTEL/SWAYAM)

1. **https://onlinecourses.nptel.ac.in/**

Course Outcome (COs)

At the end of the course, the student will be able to	Bloom's Level
1. **Explain** the computer system resources and the role of an operating system in managing those resources.	**L2**
2. **Develop** applications keeping concurrency and synchronization, semaphores, Monitors, sharedmemory, **mutual** exclusion, process scheduling services of general operating system in the mind.	**L3**
3. **Describe and analyze memory** management, file management and secondary Memory Management techniques**.**	**L3**
4. **Discuss** UNIX shell commands for file handling , process control and do the case study on on Android Operating System / iOS.	**L2**

Program Outcome of this course (POs)	**PO No.**
1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	**PO1**
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	**PO2**

Course delivery methods	Assessment methods
1. Lecture & Board	1. Assignments
2. Power-point Presentation	2. Quizzes
3. Online Videos / Learning	3. Internal Assessment Tests
4. NPTEL / Edusat	4. Course Seminar
5. Class Room Exercises	5. Course Project (Mini project)
	6. Case Studies

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Average of two assignments	Quiz/Seminar/Course Project	Total Marks
Maximum marks :50	15+15 = 30	10	10	50
Writing two IA tests is compulsory. Minimum marks required to qualify for SEE : 20 out of 50 marks				

Semester End Examination (SEE):

1. It will be conducted for 3 hours duration and 100 marks. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. Minimum passing marks required to be scored in SEE: 40 out of 100 marks
3. Question paper will have 10 questions carrying 20 marks each. Students have to answer FIVE full questions selecting atleast one full question from each unit.

Database Management System (Theory)

Course Code	18CS43/18IS43	**Credits**	04
Course type	PC	**CIE Marks**	50 marks
Hours/week: L-T-P	4 – 0 – 0	**SEE Marks**	50 marks
Total Hours:	Lecture = 48 Hrs; Tutorial = 00 Hrs Total = 48 Hrs	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. To discuss and realize the importance of Database Architecture Design notations, ER Modeling, Mapping and Schema design.
2. To gain the knowledge Relational algebra and learn the use of SQL and PL/SQL.
3. To introduce formal database design approach through normalization and discuss various normal forms.
4. To understand the importance of Concurrent Transactions and discuss issues and transaction control algorithms.

Pre-requisites :

- Basic programming concepts.

Unit – I **9 Hours**

Introduction: Introduction to database, Characteristics of Database approach, Advantages of using DBMS approach, Three-schema architecture and data independence.

Entity-Relationship Model: Using High-Level Conceptual Data Models for Database Design; An Example Database Application; Entity Types, Entity Sets, Attributes and Keys; Relationships, Relationship types, Roles and Structural Constraints; Weak Entity Types.

CASE STUDY: ER-Modeling of Airline Reservation System, Hospital Management and Educational Institute.

Unit – II **9 Hours**

Relational Model and Relational Algebra: Relational Model Concepts; Relational Model Constraints and Relational Database Schemas; Update Operations, Dealing with constraint violations; Unary Relational Operations: SELECT and PROJECT; Relational Algebra Operations from Set Theory; Binary Relational Operations: JOIN and DIVISION; Additional Relational Operations.

Unit – III **9 Hours**

Database Design: Informal Design Guidelines for Relation Schemas; Functional Dependencies; Normal Forms Based on Primary Keys; General Definitions of Second and Third Normal Forms; Boyce-Codd Normal Form.

Transaction Processing Concepts: Introduction to Transaction processing, Transaction and System concepts, Desirable properties of Transactions and issues with concurrent transactions.

SELF STUDY: Triggers **1 Hour**

Unit – IV **9 Hours**

SQL :SQL Data Definition and Data Types; Specifying basic constraints in SQL; Schema change statements in SQL; Basic queries in SQL; More complex SQL Queries. Insert, Delete and Update statements in SQL.

Unit – V **9 Hours**

PL/SQL :PL/SQL Block Structure, PL/SQL Variables, PL/SQL Function , PL/SQL Procedure, PL/SQL IF Statement , PL/SQL Loop Statement: PL/SQL WHILE Loop Statement, PL/SQL FOR Loop Statement.

SELF STUDY: PLSQL installation and Programming. **2 Hours**

Text Books:

1. Elmasri and Navathe: Fundamentals of Database Systems, Addison-Wesley, 3rd edition and onwards.
2. Raghu Ramakrishnan and Johannes Gehrke: Database Management Systems, McGraw-Hill, 2nd edition and onwards.

Reference Books:

1. Silberschatz, Korth and Sudharshan: Data base System Concepts, Mc-GrawHill, 3rd edition and onwards.
2. C.J. Date, A. Kannan, S. Swamynatham: A Introduction to Database Systems, Pearson education, 5th edition and onwards.

E Resources:

3. PL/SQL study material.

Course Outcome (Cos)

At the end of the course, the student will be able to	**Bloom's Level**
1. **Apply** the database concepts and design database for given application scenerio.	**L3**
2. **Apply** the concepts of Normalization and design database which eliminates all anomalies.	**L3**
3. **Create** database and develop database programming skills in SQL and PL/SQL.	**L4**
4. **Explain** the issue of concurrency control in transaction processing.	**L2**

Program Outcome of this course (POs)	**PO No.**
1. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	**PO2**
2. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	**PO3**
3. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	**PO4**
4. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	**PO10**
5. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	**PO12**

Course delivery methods

1. Lecture & Board
2. Power-point Presentation
3. Online Videos / Learning
4. NPTEL / Edusat
5. Class Room Exercises

Assessment methods

1. Assignments
2. Quizzes
3. Internal Assessment Tests
4. Course Project (Mini project)
5. Case Studies

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Average of two assignments	Quiz/Seminar/Course Project	Total Marks
Maximum marks :50	15+15 = 30	10	10	50
Writing two IA tests is compulsory. Minimum marks required to qualify for SEE : 20 out of 50 marks				

Semester End Examination (SEE):

1. It will be conducted for 3 hours duration and 100 marks. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. Minimum passing marks required to be scored in SEE: 40 out of 100 marks
3. Question paper will have 10 questions carrying 20 marks each. Students have to answer FIVE full questions selecting atleast one full question from each unit.

Design and Analysis of Algorithm(Theory)

Course Code	18CS44/18IS44	**Credits**	03
Course type	PC	**CIE Marks**	50 marks
Hours/week: L-T-P	3 – 0 – 0	**SEE Marks**	50 marks
Total Hours:	Lecture = 40 Hrs; Tutorial = 00 Hrs Total = 40 Hrs	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. To bring out the importance of the study of algorithms.
2. To study and analyze time complexity of various algorithms.
3. To discuss various algorithm design techniques.
4. To develop a technique of analyzing and computing the performance of algorithms.
5. To discuss various string matching algorithms.

Pre-requisites: Basic Computer Programming

Unit – I **8 Hours**

Introduction: Fundamentals of Algorithmic Problem Solving, Analysis Framework, Asymptotic Notations and basic efficiency classes, Mathematical Analysis of Non-Recursive and Recursive Algorithms, Brute Force Approaches: Introduction, Selection Sort, linear search.

Self learning topics: Short Tutorial on Recurrence Relations, Bubble Sort(1Hr)

Unit – II **8 Hours**

Algorithm Design Technique-I: Divide and Conquer, Decrease-and-Conquer Transform and Conquer, the General approach and illustration.

Applications of Divide and Conquer technique: Binary Search, Merge Sort, Quick Sort and their performance comparison. Counting Leaf-nodes, Tiling-Game Implementation.

Applications of Decrease and Conquer technique: Insertion Sort, Depth First Search and Breadth First Search. Maze-Game implementation.

Applications of Transform and Conquer: Heaps and Heap Sort, Horner's Rule. Clustering.

Self learning topics: Multiplication of Large Integers and Binary Exponentiation. (2 Hrs)

Unit – III **8 Hours**

Algorithm Design Technique-II: The General Greedy Technique, Illustration with examples**.**

Applications of Greedy method: Kruskal's Algorithm – Minimum-Cost Spanning Trees: Prim's Algorithm, Single Source Shortest Path - Dijkstra's Algorithm, Huffman Trees – Encoding of Data.

Unit – IV **8 Hours**

Algorithm Design Technique-III: Dynamic Programming Definition and Concept Illustration. The General Method,

Applications of Dynamic programming: Warshall's Algorithm – Transitive Closure, Floyd's Algorithm for the All-Pairs Shortest Paths, Knapsack using General Weights and 0/1 Knapsack. Longest Common Difference – Used in implementation of Diff command and polynomial interpolation.

Self learning topics: Computing nCr, the dynamic approach (1 Hr)

Unit – V **8Hours**

Algorithm Design Technique-IV: Backtracking, Branch-and-Bound, String Matching, basics and illustrations.

Applications of backtracking: N - Queens's problem, Hamiltonian Circuit Problem, Sum of Subset – Problem and its use in public key cryptosystem. Graph coloring problem.

Applications of branch and bound: JobAssignment Problem, Knapsack Problem, Traveling Salesperson Problem. Best First Search used in AI.
Applications string matching: Input Enhancement in String Matching, Horsepool's method, Rabin-Karp Algorithm. Used in Text processing toolkits like nltk.
Self learning topics: Naïve String Matching Algorithm. (1Hr)

Text Books:

1. Anany Levitin, Introduction to The Design & Analysis of Algorithms, Pearson Education 1st edition and onwards.
2. Ellis Horowitz, SartajSahni, SanguthevarRajasekaran, Fundamentals of Computer Algorithms Universities Press, 1st edition and onwards.

Reference Books:

1. Kenneth Berman, Jerome Paul, Algorithms, Cengage Learning.
2. Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein, introduction to Algorithms PHI, 2nd edition and above.
3. R.C.T. Lee, S.S. Tseng, R.C. Chang &Y.T.Tsai: Introduction to the Design and analysis of Algorithms A Strategic Approach, TataMcGraw Hill.
4. NarasimhaKarumanchi, Data structures and Algorithms Made Easy, Career Monk Publications, 1st edition and above.

E Resources:
https://onlinecourses.nptel.ac.in/

Course Outcome (COs)

At the end of the course, the student will be able to	**Bloom's Level**
1. **Formulate and Solve** recurrence equation and compute time complexity of recursive and iterative algorithms	L3
2. **Explain** divide ,decrease ,transform and conquer strategy as applied to sorting and analyze the algorithm complexity	L2
3. Apply Dynamic Programming, Greedy approach, to solve a variety of problems.	L3
4. Design and analyze String search algorithms and Compare their time complexities.	L4
5. Apply branch and bound and backtracking approaches to solve a variety of practical problems	L3

	Program Outcome of this course (POs)	**PO No.**
1.	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	**PO1**
2.	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	**PO2**
3.	**Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	**PO4**

Course delivery methods	Assessment methods
1. Lecture & Board	1. Assignments
2. Power-point Presentation	2. Quizzes
3. Online Videos / Learning	3. Internal Assessment Tests
4. NPTEL / Edusat	4. Course Seminar
5. Class Room Exercises	5. Course Project (Mini project)
	6. Case Studies

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Average of two assignments	Quiz/Seminar/Course Project	Total Marks
Maximum marks :50	15+15 = 30	10	10	50
Writing two IA tests is compulsory. Minimum marks required to qualify for SEE : 20 out of 50 marks				

Semester End Examination (SEE):

1. It will be conducted for 3 hours duration and 100 marks. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. Minimum passing marks required to be scored in SEE: 40 out of 100 marks
3. Question paper will have 10 questions carrying 20 marks each. Students have to answer FIVE full questions selecting atleast one full question from each unit.

Software Engineering (Theory)

Course Code	18CS45/18IS45	**Credits**	03
Course type	PC	**CIE Marks**	50 marks
Hours/week: L-T-P	3 – 0 – 0	**SEE Marks**	50 marks
Total Hours:	40	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. **Recall** the professional & ethical responsibilities and process models of Software Engineering.
2. **Prepare** Test cards and Project schedule models for the given scenarios.
3. **Identify** the requirements and the cost for the development of Software.
4. **Compare** the various software testing processes

Pre-requisites: Knowledge of Basic Programming Language.

Unit – I **8 Hours**

Introduction: Professional Software Development: Software Engineering, Software Engineering Ethics. A Case Study.

Software Process: Software Process models: The Waterfall model – A Case study**,** Incremental development, Reuse- oriented software engineering, Process activities: Software specification, Software design and implementation, Software validation, Coping with Change: Prototyping, Incremental Delivery, Boehm's Spiral Model.

Unit – II **8 Hours**

Requirements Engineering: Functional and non-functional requirements: Functional requirements, non-functional requirements, Case studies, The Software requirements document, Introduction to Requirements specification, Requirements Engineering processes: Requirement Elicitation and Analysis.

Unit – III **8 Hours**

Design Engineering: Context Models, Interaction Models, Design within the Context of Software Engineering ,Design Process and Design Quality, Design Concepts: Abstraction , Architecture, Patterns, Modularity , Information Hiding, Functional Independence, Refinement, Refactoring

Agile Software Development: Agile methods, Plan driven and Agile Development, Introduction to Extreme Programming. Self Study: SCRUM

Unit – IV **8 Hours**

Project Planning: Software pricing, Plan-driven Development: Project Plans, Planning process, Project scheduling: Schedule Representation, Agile Planning, Estimation techniques: Algorithmic Cost Modeling. The COCOMO II Model. Project Duration and Staffing.

Unit – V **8 Hours**

Software Testing: Development Testing: Unit Testing, Choosing Unit Test Cases, Component Testing, System Testing, Test Driven Development, Release Testing, Requirements Based Testing, Scenario Testing, Performance Testing, User Testing. A Demo of Selenium.

Books

Text Books:

1. Ian Sommerville: Software Engineering, Pearson Education, 9th Edition onwards.
   Chapter 1: 1.1, 1.2, 1.3 , Chapter 2: 2.1, 2.2, 2.3, Chapter 3: 3.1, 3.2, 3.3 Chapter 4: 4.1, 4.2, 4.3, 4.4, 4.5, Chapter 5: 5.1, 5.2 , Chapter 8: 8.1, 8,2, 8.3, 8.4 Chapter 23: 23.1, 23.2, 23.3, 23.4, 23.5

2. Rajib Mall, Fundamentals of Software Engineering , 4th Edition onwards PHI Learning Private Ltd.

Reference Books:

1. Roger .S. Pressman: Software Engineering-A Practitioners approach, 6th Edition and above, Tata McGraw Hill, 2007 onwards. **(Chapter 9th : 9.1 to 9.3)**
2. Pankaj Jalote: An Integrated Approach to Software Engineering, Wiley India, 2009 onwards.

E Resources:
https://onlinecourses.nptel.ac.in/

Course Outcome (COs)

At the end of the course, the student will be able to

		Bloom's Level
1.	**Recall** the professional & ethical responsibilities and process models of Software Engineering.	**L1,L2**
2.	**Prepare** Test cards and Project schedule models for the given scenarios.	**L3**
3.	**Identify** the requirements and the cost for the development of Software.	**L2**
4	**Compare** the various software testing processes	**L4**

	Program Outcome of this course (POs)	**PO No.**
1.	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	1
2.	**Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	**3**
3.	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.	**8**
4.	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	**9**
5.	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	**11**
6.	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	**12**

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Average of two assignments	Quiz/Seminar/Course Project	Total Marks
Maximum marks :50	15+15 = 30	10	10	50
Writing two IA tests is compulsory. Minimum marks required to qualify for SEE : 20 out of 50 marks				

Semester End Examination (SEE):

1. It will be conducted for 3 hours duration and 100 marks. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. Minimum passing marks required to be scored in SEE: 40 out of 100 marks
3. Question paper will have 10 questions carrying 20 marks each. Students have to answer FIVE full questions selecting atleast one full question from each unit.

Python Programming (Integrated Lab)

Course Code	**18CSL46/18ISL46**	**Credits**	03
Course type	PC	**CIE Marks**	25 marks
Hours/week: L-T-P	2 – 0 – 2	**SEE Marks**	25 marks
Total Hours:	Lecture = 20 Hrs; Lab= 30 Hrs Total = 50 Hrs	**SEE Duration**	3 Hours for 50 marks

Course learning objectives

1. Gain knowledge about basic Python language syntax and semantics to write Python programs and use concepts such as variables, conditional and iterative execution methods etc.
2. Understand the fundamentals of object-oriented programming in Python, including defining classes, objects, invoking methods,exception handling mechanisms.
3. Understand the principles of inheritance, packages and interfaces.
4. Demonstrate the NumPy and SciPy package for scientific computing and data manipulation.

Pre-requisites : Basics of Object Oriented Programming using C++/Java

Unit - I — 8 Hours

Introduction to Python, use IDLE to develop programs, Basic coding skills, working with data types and variables, working with numeric data, working with string data, Python functions, Boolean expressions, selection structure, iteration structure, Illustrative Programs

Unit - II — 8 Hours

Define and use functions and modules, Basic skills for working with lists, work with a list of lists, work with tuples, get started with dictionaries, An introduction to file I/O, use text files, use CSV files, Handle a single exception, handle multiple exceptions Illustrative programs

Unit - III — 8 Hours

Object Oriented Programming, An introduction to classes and objects, define a class, work with object composition, work with encapsulation, work with inheritance, override object methods, Using SQLite Manager to work with a database, Using Python to work with a database, Creating a GUI that handles an event Illustrative programs

Unit - IV — 8 Hours

NumPy Basics: Arrays and Vectorized Computation: Creating ndarrays, Data Types for ndarrays, Operations between Arrays and Scalars, Basic Indexing and Slicing, Indexing with slices, Boolean Indexing, Transposing Arrays and Swapping Axes.

Unit - V — 8 Hours

SciPy:Optimization and Minimization, Interpolation, Integration, Statistics

Books

Text Books:

1. Michael Urban and Joel Murach, Python Programming, Shroff/Murach, 2016

2. Wes McKinney, Python for Data Analysis, OReilly, 1st Edition, 2012
3. Mark Lutz, Programming Python, O`Reilly, 4th Edition, 2010

Reference Books:

1. SciPy and NumPy, O`Reilly, 1st Edition, 2012

E-resourses

1. NumPy Reference Manual

Course Outcome (COs)

At the end of the course, the student will be able to	Bloom's Level
1. **Explain** basic principles of Python programming language	L2
2. **Implement** object oriented concepts, database and GUI applications.	L3
3. **Implement** basic programs using Numpy and Panda packages	L3

Program Outcome of this course (POs)	PO No.
1. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	PO3
2. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.	PO5
3. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	PO12

Course delivery methods	Assessment methods
1. Chalk and board	1. Project
2. PPT	2. Experiments
3. Video lectures	

List of Experiments (Part A)

1. Develop and execute an Object Oriented program in Python using basic data structures like arrays and dictionaries.
2. Develop and execute an Object Oriented program in Python to demonstrate inheritance and polymorphism.
3. Develop and execute an Object Oriented program in Python to demonstrate database connectivity.
4. Develop and execute an Object Oriented program in Python using file I/O and exception handling.
5. Develop a program in Python to demonstrate the use of NumPy package.
6. Develop a program in Python to demonstrate the use of SciPy package.

PART B

Each student needs to formulate a problem definition in consultation with the guide for the Project component and work towards completion after approval. Project report has to be submitted by each student individually.

Scheme of Continuous Internal Evaluation (CIE):

Components	IA test*	Journal and lab test **OR** Project report and intermediate evaluation	Total Marks
Maximum marks :50	30	20	50
*IA test could be two tests each of one hour duration or only one test of 2 hours duration. Submitting Journal/ Project report is compulsory. Minimum marks required to qualify for SEE : 20 out of 50 marks			

Semester End Examination (SEE):

1.	It will be conducted for 50 marks having 3 hours/2 hours duration. It will be reduced to 25 marks for the calculation of SGPA and CGPA.		
2.	Initial write up stating the objectives, methodology and the outcome	10 marks	50 marks
	Presentation (PPT) of the project	15 marks	
	Hardware project: Exhibiting and demonstration of working of project. Software project: Demonstration of the programming capabilities by writing flowchart, algorithm and codesrelated to a section of the project.	25 marks	
3.	Minimum passing marks to be scored in SEE: 20 out of 50 marks		

Algorithms Laboratory

Course Code	18CSL47/18ISL47	**Credits**	1.5
Course type	LAB	**CIE Marks**	25 marks
Hours/week: L-T-P	0 – 0 – 3	**SEE Marks**	25 marks
Total Hours:	36	**SEE Duration**	3 Hours for 50 marks

Course learning objectives

1. Illustrate the importance of algorithms in a variety of applications.
2. Illustrate the use of recursive/iterative sorting algorithms in different scenarios.
3. Demonstrate time complexity of various algorithms using various design techniques.
4. Demonstrate efficient algorithms by drawing comparisons.
5. Illustrate the use of algorithms for graph search problems.

Pre-requisites :

- Basic computer science concepts such as procedures, decision statements, and loops.
- Basic data structures such as lists, dictionaries, and hash tables.

List of experiments(Programming language C / Java)

1. Implement Merge Sort algorithm to sort a given set of elements and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus n.
2. Implement Quick Sort algorithm and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus n.
3. Implement Insertion Sort algorithm and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus n.
4. Implement Heap Sort algorithm and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus n.
5. From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm.
6. Find the Minimum Cost Spanning Tree of a given undirected graph using Prim’s algorithm.
7. Implement All-Pairs Shortest Paths Problem using Floyd's algorithm.
8. Implement 0/1 Knapsack problem using Dynamic Programming.
9. Find a subset of a given set S = {sl, s2,.....,sn} of n positive integers whose sum is equal to a given positive integer d. For example, if S={1, 2, 5, 6, 8} and d = 9 there are two solutions{1,2,6}and{1,8}. A suitable message is to be displayed if the given problem instance doesn't have a solution.
10. Implement N Queen's problem using Back Tracking.

Text Books:

1. Anany Levitin, Introduction to The Design & Analysis of Algorithms, Pearson Education, 1st edition and onwards.
2. Java, The Complete Reference, Herbert Schildt.

Reference Books:

1. Kenneth Berman, Jerome Paul, Algorithms, Cengage Learning.

2. Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein, introduction to Algorithms PHI, 2nd edition and onwards.

E Resources:
https://onlinecourses.nptel.ac.in/

Course Outcome (COs)

At the end of the course, the student will be able to	**Bloom's Level**
1. **Identify** and implement an appropriate algorithm design technique for a given problem.	**L1**
2. **Implement** and **Compute** time required for recursive and iterative algorithms.	**L3**
3. **Design** algorithms for specific applications using appropriate techniques.	**L6**
4. **Design** graph search and sorting algorithms.	**L6**

Program Outcome of this course (POs)	**PO No.**
1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	**PO1**
2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	**PO2**
3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	**PO3**
4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	**PO4**

Assessment methods

1. Regular Journal Evaluation & Attendance Monitoring.
2. Lab Internal Assessment.

Scheme of Continuous Internal Evaluation (CIE):

Components	Attendance/conduct of lab	Journal	Lab project	Total Marks
Maximum marks :25	10	10	5	25
Submission and certification of journal is compulsory to qualify for SEE Minimum marks required to qualify for SEE : 10 out of 25 marks				

Semester End Examination (SEE):

1.	It will be conducted for 50 marks having 3 hours/2 hours duration. It will be reduced to 25 marks for the calculation of SGPA and CGPA.		
2.	Only one experiment to be conducted. In case, there are two parts then one experiment from each part.		
3.	Initial write up:Algorithm/Flowchart/Tracing	10 marks	50 marks
	Conduct of experiment(s), result and conclusion	20 marks	
	One marks question	10 marks	
	Viva-voce	10 marks	
4.	Viva voce is conducted for individual student and not in group		
5.	Minimum passing marks to be scored in SEE: 20 out of 50 marks		

Database Application Laboratory

Course Code	18CSL48/18ISL48	**Credits**	1.5
Course type	LAB	**CIE Marks**	25 marks
Hours/week: L-T-P	0 – 0 – 3	**SEE Marks**	25 marks
Total Hours:	36	**SEE Duration**	3 Hours for 50 marks

Course learning objectives

1. Gain a good understanding of the architecture and functioning of Database Management Systems as well as associated tools and techniques.
2. Understand and apply the principles of data modeling using Entity Relationship and develop a good database design
3. Apply Normalization techniques to normalize a database.
4. Understand the use of Structured Query Language (SQL) and its syntax.
5. Learn the tools required for graphical user interface design

LAB TERM WORKS:

PART – A

1. Suppose you are given the following requirements for a simple database for the National Hockey League (NHL):
   - the NHL has many teams,
   - each team has a name, a city, a coach, a captain, and a set of players,
   - each player belongs to only one team,
   - each player has a name, a position (such as left wing or goalie), a skill level, and a set of injury records,
   - a team captain is also a player,
   - a game is played between two teams (referred to as host_team and guest_team) and has a date (such as May 11th, 1999) and a score (such as 4 to 2).

   Design a ER-Model for this application scenario using all the standard notations of ER-Model. Apply the ER-to-Relational Rules and normalization to get the relational schema and do the following :
   a. Create the database with all necessary constraints(Primary and Foreign keys)
   b. Populate each table with appropriate data
   c. Execute queries on the tables created.(open ended)
   d. Create graphical user interfaces (GUI) using HTML/PHP/VB.Net/Java

2. Design an ER-Model for an educational institute which is required to record the students attendance and IA performance in all the subjects and inform the same to their parents. The institute will have many department, each with its own faculty and Head of the department. The subjects the students study can be either elective or core. A faculty has to take atleast one subject and atmost 2 subjects and the subjects are not shared. The students take 3 tests and the average is computed by taking average of best two of the three scores. The model be designed to record only the CIE marks and not SEE marks. After the ER-Model, map it to relational schema by indentifying Primary and Foreign keys. Normalize and do the following.
   a. Create the database with all necessary constraints(Primary and Foreign keys)
   b. Populate each table with appropriate data
   c. Execute queries on the tables created.(open ended)
   d. Create graphical user interfaces (GUI) using HTML/PHP/VB.Net/Java

3. Consider the schema for airline flight information Database:

FLIGHTS (*no: integer, fromPlace: string, toPlace: string, distance: integer, Departs: date,arrives: date, price: real*)

AIRCRAFT (*aid: integer, aname: string, cruisingrange: integer*)

CERTIFIED (*eid: integer,aid: integer*)

EMPLOYEES (*eid: integer, ename: string, salary: integer*)

Create tables and populate with appropriate values(Atleast 5 records in each table) for the given database.

Write SQL queries to

1. Find the names of aircraft such that all pilots certified to operate them have salaries more than Rs.80,000.

2. For each pilot who is certified for more than three aircrafts, find the eid, ename and the maximum cruising range of the aircraft for which she or he is certified.

3. Find the names of pilots whose salary is less than the price of the cheapest route from Bengaluru to Frankfurt.
4. Find the aids of all aircraft that can be used on routes from Bengaluru to New Delhi

4. Consider the following schema for Order Database:

SALESMAN (*Salesman_id, Name, City, Commission*)
CUSTOMER (*Customer_id, Cust_Name, City, Grade, Salesman_id*)
ORDERS (*Ord_No, Purchase_Amt, Ord_Date, customer_id,Saleman_id)*

Create tables and populate with appropriate values(Atleast 5 records in each table) for the given database.

Write SQL queries to

1. Count the customers with grades above Bangalore‘s average.

2. Find the name and numbers of all salesmen who had more than one customer.

3. List all salesmen names and customer names for whom order amount is more than 4000.

4. Demonstrate the DELETE operation by removing salesman with id 1000. All his orders must also be deleted.

5. Consider the schema for Movie Database:

ACTOR (*Act_id, Act_Name, Act_Gender*)

DIRECTOR (*Dir_id, Dir_Name, Dir_Phone*)

MOVIES (*Mov_id, Mov_Title, Mov_Year, Mov_Lang, Dir_id*)

MOVIE_CAST (*Act_id,Mov_id, Role*)

RATING (*Mov_id, Rev_Stars*)

Create tables and populate with appropriate values(Atleast 5 records in each table) for the given database.

Write SQL queries to

1. List the titles of all movies directed by "Sanjay Leela Bansali" .
2. Find the movie names where one or more actors acted in two or more movies.
3. Find the title of movies and number of stars for each movie that has at least one rating and find the highest number of stars that movie received. Sort the result by movie title.
4. Update rating of all movies directed by "Ram GopalVerma" to 5.

PART – B

The students will design and implement a mini project on the lines of part A.

Text Books:

1. Elmasri and Navathe: Fundamentals of Database Systems, Addison-Wesley, 3rd edition and onwards.
2. Raghu Ramakrishnan and Johannes Gehrke: Database Management Systems, McGraw-Hill, 2nd edition and onwards.

Reference Books::

1. Silberschatz, Korth and Sudharshan: Data base System Concepts, Mc-GrawHill, 3rd edition and onwards.
2. C.J. Date, A. Kannan, S. Swamynatham: A Introduction to Database Systems, Pearson education, 5th edition and onwards.

E Resources:

3. PL/SQL study material.

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1	**Apply** the ER-Modeling concepts,Normalization and design a database accordingly	**L3**
2	**Demonstrate** use of DDL and DML statements	**L3**
3	**Identify and write** SQL statements for the given end user queries	**L3**
4	**Demonstrate** the use of GUI tools	**L3**

Program Outcome of this course (POs)		PO No.
1.	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	**PO2**
2.	**Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	**PO3**

3. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations. **PO5**

Assessment methods

1. Lab Journal
2. Lab Test
3. Demo and Viva

Scheme of Continuous Internal Evaluation (CIE):

Components	Attendance/conduct of lab	Journal	Lab project	Total Marks
Maximum marks :25	10	10	5	25
Submission and certification of journal is compulsory to qualify for SEE Minimum marks required to qualify for SEE : 10 out of 25 marks				

Semester End Examination (SEE):

1.	It will be conducted for 50 marks having 3 hours/2 hours duration. It will be reduced to 25 marks for the calculation of SGPA and CGPA.		
2.	Only one experiment to be conducted. In case, there are two parts then one experiment from each part.		
3.	Initial write up:Algorithm/Flowchart/Tracing	10 marks	50 marks
	Conduct of experiment(s), result and conclusion	20 marks	
	One marks question	10 marks	
	Viva-voce	10 marks	
4.	Viva voce is conducted for individual student and not in group		
5.	Minimum passing marks to be scored in SEE: 20 out of 50 marks		

Graph Theory and Discrete Mathematical Structures

(Computer Science / Information Science)

Subject Code:	18DMATCS41	**Credits:**	04
Course Type:	BS	**CIE Marks:**	50
Hours/week: L – T – P	4 –0– 0	**SEE Marks:**	50
Total Hours:	50	**SEE Duration:**	3 Hours

Course Learning Objectives (CLOs):

Students should

1. Understand and apply Logic in the field of Computer science.
2. Understand the various Relations and Functions.
3. Understand advanced counting techniques.
4. Get acquainted with basic concepts of Graph Theory and their applications.
5. Get acquainted with elementary Number theory, and their properties for applications in Cryptography.

Prerequisites:

1. Set Theory
2. Power series
3. Binomial Series
4. Basics of Counting

Detailed Syllabus

Unit-I **10 hrs**

Fundamentals of Logic: Laws of Logic, Logical Implication-Rules of Inference. Quantifiers- Universal and Existential Quantifiers, Proofs Techniques: direct, indirect and Contradiction.

Unit –II **10 hrs**

Relations and Functions: Zero-One Matrices and Directed Graphs, Closure and Equivalence Relations and Partitions, Partial Orders, Hasse Diagrams, Lattice, Properties of functions, Composition and Invertible functions.

Unit III **10 hrs**

Advanced Counting Techniques: Sterling Number of second kind, Inclusion and Exclusion, Pigeonhole Principle, Generating Function, Recurrence relations, Solution of Linear homogeneous and non-homogeneous recurrence relations with constant coefficients, Divide and Conquer Algorithms, Merge sort algorithm.

Unit IV **10 hrs**

Basic Graph Theory: Definitions and Examples, Subgraphs, Complements and Graph Isomorphism, Connectivity, Euler Trails and Circuits, Planar Graphs, Hamiltonian Paths and Cycles, Coloring, Matching.

Unit V **10 hrs**

Elementary Number Theory and Cryptography: Fields, Modular Arithmetic, Prime Numbers, Fermat's and Euler's theorem. Testing of Primality, Chinese Remainder Theorem. Caesar Encryption/Decryption, RSA Cryptosystem.

Text Books:

1. Kolman, Busby, Ross "Discrete Mathematical Structures", 6th Edition Prentice Hall of India, 2010 onwards.
2. William Stallings "Cryptography and Network Security", Pearson Prentice Hall 6th Edition, 2013 onwards.
3. Kenneth H. Rosen "Discrete Mathematics and its applications", Mc Graw Hill 7th Edition.

Reference Books:

1. Ralph P Grimaldi, "Discrete and Combinatorial Mathematics", 5th Edition, Pearson Education, 2004 onwards.
2. K. D. Joshi, "Foundations of Discrete Mathematics", 2nd Edition, New Age International Publishers, 2014 onwards.

Course Outcomes (COs): At the end of the course students will be able to:

1. **Understand** and **Apply** the Logic of Mathematics in the field of Computer science **[L2, L3]**
2. **Explain and Analyze** Different Relations and Functions**. [L2, L3]**
3. **Discuss** basic concepts of Graph Theory and its **Use** in Computer Science. **[L2, L3]**
4. **Explain** the concept of Finite Fields. **[L2]**
5. **Apply** Finite Fields to Cryptography. **[L3]**

Program Outcomes (POs) of the course: Students will acquire

1. An ability to apply knowledge of Mathematics, science and Engineering. **[PO1]**
2. An ability to identify, formulate and solve engineering problems. **[PO5]**
3. An ability to use the techniques, skills and modern engineering tools necessary for engineering practice. **[PO11]**

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Average of two assignments	Quiz/Seminar/Course Project	Total Marks
Maximum marks :50	15+15 = 30	10	10	50
Writing two IA tests is compulsory. Minimum marks required to qualify for SEE : 20 out of 50 marks				

Semester End Examination (SEE):

1. It will be conducted for 3 hours duration and 100 marks. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. Minimum passing marks required to be scored in SEE: 40 out of 100 marks
3. Question paper will have 10 questions carrying 20 marks each. Students have to answer FIVE full questions selecting atleast one full question from each unit.

ENVIRONMENTAL STUDIES (MNC)

Subject Code:	18CS49	Credits:	MNC
Course Type:	HS	CIE Marks:	25 marks
Hours/week: L – T – P	2– 0– 0	SEE Marks:	-
Total Hours:	28	SEE Duration:	-

Course Learning Objectives (CLOs)

1. To understand the scope of Environmental Engineering.
2. Identify the Environmental impact due to Human activities.
3. To understand the concept of Disaster Management.
4. Identify the renewable and non renewable sources of energy.
5. Identify the various Legal aspects in Environmental Protection.

Pre-requisites: NIL

UNIT I **06 Hours**

Definition of Environment, Ecology and Eco-system, Structure and functions of ecosystem, balanced ecosystem, Introduction to Environmental Impact Assessment.

Natural Resources: Material Cycles - Oxygen, Carbon, Nitrogen and Hydrological cycle. Importance of water quality, Water borne diseases, Water induced diseases, Significance of Fluoride in drinking water.

UNIT II **06 Hours**

Energy - Different types of energy, Conventional and Non - Conventional sources – Advantages and Limitations of Wind Mills, Hydro Electric, Fossil fuel, Nuclear, Solar, Biomass and Bio-gas, Geothermal energy.

UNIT III **06 Hours**

Disasters - Natural Disasters: Meaning and nature of natural disasters, their types and effects (Floods, drought, cyclone, earthquakes, Tsunami). Man Made Disasters: Nuclear disasters, chemical disasters, biological disasters, building fire, coal fire, forest fire, oil fire, air pollution, water pollution, deforestation, industrial waste water pollution and marine pollution.

UNIT IV **05 Hours**

Disaster Management: International strategy for disaster reduction. Concept of disaster management and national disaster management framework

UNIT V **05 Hours**

Environmental Protection: Role of Government, Legal aspects, Initiatives by Non - Governmental Organizations (NGO), Environmental Education, Women Education. E waste and solid waste management rules

Text Books:

1. Benny Joseph, "**Environmental Studies**", Tata McGraw - Hill Publishing Company Limited (2005).
2. Ranjit Daniels R.J. and Jagdish Kirshnaswamy, "**Environmental Studies**", Wiley India Private Ltd., New Delhi (2009).
3. Rajagopalan R. "**Environmental Studies – From Crisis to Cure**", Oxford University Press (2005).
4. Sanjay K. Sharma, "**Environment Engineering and Disaster Management**", USP (2011).
5. Harsh K. Gupta, "**Disaster Management**", Universities Press (India) Pvt. Ltd (2003).

References Books:

1. Raman Sivakumar, "**Principles of Environmental Science and Engineering**", Second Edition, Thomson Learning, Singapore (2005).
2. Meenakshi P., "**Elements of Environmental Science and Engineering**", Prentice Hall of India Private Limited, New Delhi (2006).
3. Prakash S.M., "**Environmental Studies**", Elite Publishers, Mangalore (2007).
4. Erach Bharucha, "**Text Book of Environmental Studies**", for UGC, Universities Press (2005).
5. Tyler Miller Jr. G., "**Environmental Science – Working with the Earth**", Tenth Edition, Thomson Brooks/Cole (2004).

Course Outcomes (COs)

	At the end of the course, the student will be able to	Bloom's Level
1	**Explain** the importance of the Environment	**L2**
2	**Evaluate** Environmental disasters caused by human activities	**L5**
3	**Outline** the water stress problems and energy crisis in present era.	**L2**
4	**Explain and classify** the Renewable and Non Renewable sources of energy.	**L2**
5	**Summarize** the various Legislations related to Environment.	**L2**

Program Outcomes (POs)

1	Graduates shall be able to understand and apply the basic mathematical and scientific concepts that underlie the field of Civil Engineering**.**	**PO 1**
2	Graduates shall continue to upgrade the skills and possess the motivation for continuing education and professional growth	**PO 8**
3	Graduates shall maintain an awareness of contemporary issues and arrive at the environmentally sustainable solutions	**PO 9**
4	Graduates shall be proficient in the core principles of Civil Engineering such as Environmental Engineering, Geotechnical Engineering, Structural Engineering and Water Resources Engineering, and shall be able to apply these principles in Engineering practice.	**PO 10**

Content Delivery/Assessments methods and Scheme of Evaluation:

Course delivery methods	Assessment methods
1. Lecture and Board	1. Assignments and Open Book Assignment
2. NPTEL/ Edusat	2. Quizzes
3. Power Point Presentation	3. Internal Assessment Tests
4. Videos	4. Semester End Examination

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Quiz/Assignment/Activity	Total Marks
Maximum marks: 25	10+10 = 20	05	25
•Writing two IA tests is compulsory. •Minimum marks required: 10 out of 25 marks			

5th Semester Detailed Syllabi

Computer Networks

Note: This course is only for regular students; Diploma students are exempted from this course.

Course Code	**18CS51**	**Credits**	4
Course type	PC	**CIE Marks**	50 marks
Hours/week: L-T-P	3 – 2 – 0	**SEE Marks**	50 marks
Total Hours:	Lecture = 40 Hrs; Tutorial = 10Hrs Total = 50 Hrs	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. Elucidate basic computer networking.
2. Demonstration of application layer protocols application layer protocols.
3. Discuss transport layer services and understand UDP and TCP protocols.
4. Explain routers, IP and Routing Algorithms in network layer.
5. Demonstrate the error detection and correction at link layer.

Pre-requisites: Fundamentals of basic mathematics, Data Structures and algorithms, Computer Organization, Operating systems.

Unit – I 10 Hours

Introduction to Computer Networks and the Internet: What Is the Internet?, The Network Edge, The Network Core, Delay, Loss, and Throughput in Packet-Switched Networks, Protocol Layers and Their Service Models.

Tutorials: Networks Under Attack, Introduction to network analysis tool- Wireshark

Unit – II 10 Hours

Application Layer: Principles of Network Applications, The Web and HTTP, File Transfer: FTP Commands and Replies, Electronic Mail in the Internet, The Internet's Directory Service, Peer-to-Peer Applications-Bit Torrent File distribution protocol.

Tutorials: Wireshark demonstration for HTTP and DNS, Introduction to RFC.

Unit – III 10 Hours

Transport Layer: Introduction and Transport-Layer Services, Multiplexing and De-multiplexing, Connectionless Transport : UDP, Principles of Reliable Data Transfer: Go-Back-N and Selective Repeat, Connection-Oriented Transport: TCP.

Tutorials: Programming assignment on Implementing a Reliable Transport Protocol and Using the Wireshark for exploring the TCP and UDP

Unit – IV **10 Hours**

The Network layer: Introduction, Virtual Circuit and Datagram Networks, What's Inside a Router?, The Internet Protocol (IP): Forwarding and Addressing in the Internet.

Tutorials : Introduction to Routing in the Internet-BGP, Wireshark for Exploring ICMP using ping and trace-route

Unit – V **10 Hours**

The Link Layer: Links, Access Networks, and LANs:

Introduction to the Link Layer, Error Detection and Correction Techniques, Multiple Access Links and Protocols, Introduction to Link Virtualization and Data Center Networking.

Tutorials : Use of Wireshark in exploring Ethernet, ARP and DHCP

Books

Text Books:

1. James F Kurose and Keith W Ross, Computer Networking, A Top-Down Approach, Sixth edition, Pearson, 2013.

Reference Books:

1. Behrouz A Forouzan, Data and Communications and Networking, Fifth Edition, McGraw Hill, Indian Edition
2. Larry L Peterson and Brusce S Davie, Computer Networks, fifth edition, ELSEVIER
3. Andrew S Tanenbaum, Computer Networks, fifth edition, Pearson
4. Mayank Dave, Computer Networks, Second edition, Cengage Learning

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	Demonstrate the use of computer networking and layering concept	L3
2.	Explain principles of application layer protocols	L2
3.	Recognize transport layer services and infer UDP and TCP protocols	L2
4.	Classify routers, IP and Routing Algorithms in network layer	L3
5.	Performing error detection and correction at link layer	L4

Program Outcome of this course (POs)	PO No.
1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	1
2. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs	3

with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

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

Course delivery methods		Assessment methods	
1.	Lecture	1.	Internal Assessment
2.	PPT	2.	Assignment
3.	Demonstration	3.	Quiz
4.	Video Lectures	4.	Course project

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Average of two assignments	Quiz/Seminar/Course Project	Total Marks
Maximum Marks: 50	15+15 = 30	10	10	50

- **Writing two IA tests is compulsory.**
- **Minimum marks required to qualify for SEE : 20 out of 50**

Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2.	**Minimum marks required in SEE to pass: 40 (out of 100)**
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.

Numerical Methods and Probability
Note: This course is only for Diploma Students

Subject Code:	**18DMATCS51**	**Credits:**	4
Course Type:	BS	**CIE Marks:**	50
Hours/week: L – T – P	4–0– 0	**SEE Marks:**	50
Total Hours:	50	**SEE Duration:**	3 Hours

Course Learning Objectives (CLOs)

1. Apply the numerical techniques to real world problems.
2. Understand the concept of numerical integration techniques and use to engineering problems.
3. Understand the concept of Probability and its various rules.
4. Understand types of random variables and their probability distributions.
5. Extend the concept of probability to Joint PDF.
6. Get acquainted with basic concepts of stochastic process and their applications.

Prerequisites: Basic differentiation and Basic Integration

Unit – I **10 Hours**

Finite Differences and Interpolation: Forward and Backward differences, Newton's Forward and Backward Interpolation Formulae, Divided Difference, Newton's Divided Difference Formula (without proof). Lagrange's Interpolation Formula. Illustrative examples. Numerical Integration: Trapezoidal rule, Simpsons 1/3rd rule, Simpsons 3/8th rule, Weddle's rule. Practical Examples.

Unit – II **10 Hours**

Basic Probability: Definitions, Addition theorem, Multiplication law. Problems. Conditional probability Examples. Baye's theorem Examples.

Unit – III **10 Hours**

Random Variable and probability distributions: Random Variables (RV), Discrete and Continuous Random variables, (DRV,CRV) Probability Distribution Functions (PDF) and Cumulative Distribution Functions(CDF), Expectations, Mean, Variance. Binomial, Poisson, Exponential and Normal Distributions.

Unit – IV **10 Hours**

Joint PDF: Discrete Joint PDF, conditional Joint PDF, Expectations (Mean, Variance and Covariance).

Unit – V **10 Hours**

Stochastic Processes: Definition and classification of stochastic processes. Discrete state and discrete parameter stochastic process, Unique fixed probability vector, Regular Stochastic Matrix, Transition probability, Markov chain.

Books

Text Books:

1. B.S. Grewal – Higher Engineering Mathematics, Khanna Publishers, 42nd Edition, 2012.
2. B. V. Ramana- Higher Engineering Mathematics, Tata McGraw-Hill Publishing Company Ltd.

Reference Books:

1. 1. Erwin Kreyszig –Advanced Engineering Mathematics, John Wiley & Sons Inc., 9th Edition, 2006.
2. Peter V. O' Neil – Advanced Engineering Mathematics, Thomson Brooks/Cole, 7th Edition, 2011.
3. Glyn James – Advanced Modern Engineering Mathematics, Pearson Education, 4th Edition, 2010.
4. Mayank Dave, Computer Networks, Second edition, Cengage Learning

Course Outcome (COs)

At the end of the course, the student will be able to		**Bloom's Level**
1.	1. **Use** Numerical methods to study interpolation and extrapolation.	L3
2.	2. Use different rules of numerical integration for some problems.	L2
3.	3. Understand the basic probability concepts with applications in practical problems.	L3
4.	4. **Understand** the concept of Random variables, PDF, CDF and its applications.	L2
5.	5**. Extend** the basic probability concept to Joint Probability Distribution.	L2
6.	6. **Understand** the Stochastic processes and applications**.**	L3

Program Outcome of this course (POs)	**PO No.**
1. An ability to **apply knowledge** of mathematics, science and engineering.	**1**
2. **Identify**, formulate, research literature and analyze complex engineering problems, reaching substantiated conclusions using first principles of mathematics, natural Sciences and Engineering. Sciences	**2**
3. **Create, select and apply appropriate techniques**, resources and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.	**5**

Course delivery methods		**Assessment methods**	
1.	Black board teaching	1.	Internal Assessment Tests
2.	Power point presentation	2.	Assignments
3.	Scilab/ Matlab/ R-Software	3.	Quizes

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Average of two assignments	Quiz/Seminar/Course Project	Total Marks
Maximum Marks: 50	15+15 = 30	10	10	50

- **Writing two IA tests is compulsory.**
- **Minimum marks required to qualify for SEE : 20 out of 50**

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2.	**Minimum marks required in SEE to pass: 40 (out of 100)**
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.

Object Oriented Modeling and Design

Course Code	**18CS52**	**Credits**	03
Course type	PC	**CIE Marks**	50 marks
Hours/week: L-T-P	3 – 0 – 0	**SEE Marks**	50 marks
Total Hours	39	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. To bring out the importance of object oriented software development.
2. To study and understand the UML notations as applicable to different stages of software development.
3. To model given real world problem using object oriented concepts and notations.

Pre-requisites : Basics of object oriented programming and Software Engineering

Unit – I 8 Hours

Introduction, Modeling Concepts, Class Modeling: Introduction to Object Orientated (OO) development. OO themes; OO modeling history. Modeling as Design Technique: Modeling; abstraction; The three models.
Class Modeling: Object and class concepts; Link and associations concepts; Generalization and Inheritance. Introduction to association and aggregation.

Unit – II 8 Hours

State Modeling, Advanced State Modeling: State Modeling: Events, States, Transitions and Conditions; State diagrams; State diagram behavior; Advanced State Modeling: Nested state diagrams; Nested states.

Unit – III 7 Hours

Interaction Modeling, Advanced interaction Modeling: Interaction Modeling: Use case models; Sequence models; Activity models. Use case relationships; Procedural sequence models; Special constructs for activity models.

Unit – IV 8 Hours

Domain Analysis: Overview of domain analysis; Domain class model; Domain state model; Domain interaction model; Iterating the analysis.

Unit – V **8 Hours**

Application Analysis: Application interaction model; Application class model; Overview of class design.

Books

Text Books:

1. Michael Blaha, James Rumbaugh: Object-Oriented Modeling and Design with UML, Pearson Education, 2nd Edition and onwards
2. Grady Booch, James Rumbaugh, Ivar Jacobson, "Unified Modeling Language User Guide", Publisher: Addison Wesley.

Reference Books:

1. Grady Booch et al: Object-Oriented Analysis and Design with Applications, 3rd Edition, Pearson Education, 2007 and onwards
2. Brahma Dathan, SarnathRamnath: Object-Oriented Analysis, Design, and Implementation, Universities Press, 2009 and onwards.
3. Grady Booch, James Rumbaugh, Ivar Jacobson, "Unified Modeling Language Reference Manual", Publisher: Addison Wesley.

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	Identify and explain different UML notations for a given problem statement	L2
2.	Apply UML notations to model real world problems at different stages of software development	L3
3.	Perform domain and application Analysis for a given real world problems	L4

Program Outcome of this course (POs)		PO No.
1.	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	2
2.	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations	3
3.	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations	5
4.	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	11

Course delivery methods		Assessment methods	
1.	Chalk and board	1.	Internal assessment
2.	PPT	2.	Assignment
3.	Video lectures	3.	Quiz
4.		4.	Seminar / project

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Average of two assignments	Quiz/Seminar/Course Project	Total Marks
Maximum Marks: 50	15+15 = 30	10	10	50

- **Writing two IA tests is compulsory.**
- **Minimum marks required to qualify for SEE : 20 out of 50**

Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2.	**Minimum marks required in SEE to pass: 40 (out of 100)**
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.

Unix System Programming

Course Code	18CS53	Credits	4
Course type	PC	CIE Marks	50 marks
Hours/week: L-T-P	4-0-0	SEE Marks	50 marks
Total Hours:	50	SEE Duration	3 Hours for 100 marks

Course learning objectives

1. To introduce POSIX and UNIX standards as applicable to files and processes.
2. To develop the ability to handle processes and its related functionalities.
3. To apply inter process communication using various methods of inter process communication.
4. To give basic knowledge about UNIX signals handling.

Pre-requisites: Operating System, Computer Organization

Unit – I **10 Hours**

Introduction to UNIX and its Commands: UNIX and ANSI Standards: The ANSI C Standard, The ANSI/ISO C++ Standards, Difference between ANSI C and C++, The POSIX Standards, The POSIX.1 FIPS Standard. UNIX and POSIX APIs: The POSIX APIs, The UNIX and POSIX Development Environment, API Common Characteristics, The File System: The File, What's in a (File)name, The Parent-Child relationship, The UNIX File System, pwd, Absolute pathnames, cd, Relative pathnames, mkdir, rmdir, cp, rm, mv, cat, ls.

Unit – II **10 Hours**

UNIX Files: File Types, The UNIX and POSIX File System, The UNIX and POSIX File Attributes, Inodes in UNIX System V, Application Program Interface to Files, UNIX Kernel Support for Files, General File APIs, Directory File APIs , Device File APIs, FIFO File APIs , Symbolic Link File APIs, File and Record Locking.

Unit – III **10 Hours**

UNIX Processes: The Environment of a UNIX Process: Introduction, main function, Process Termination, Command-Line Arguments, Environment List, Memory Layout of a C Program, Shared Libraries, Memory Allocation, Environment Variables, setjmp and longjmp Functions, getrlimit, setrlimit Functions, UNIX Kernel Support for Processes.

Unit – IV **10 Hours**

Signals and Daemon Processes: Signals: The UNIX Kernel Support for Signals, signal, Signal Mask, sigaction, The SIGCHLD Signal and waitpid API, The sigsetjmp and siglongjmp Functions, kill, alarm, Interval Timers.

Daemon Processes: Introduction, Daemon Characteristics, Coding Rules, Error Logging, Client-Server Model.

Unit – V **10 Hours**

Inter-process Communication: Introduction, Pipes, popen and pclose Functions, Co-processes, FIFOs, Message Queues, Semaphores, Shared Memory.

Books

Text Books:

1. Terrence Chan: UNIX System Programming Using C++, Prentice Hall India, 1999 and onwards.
2. W. Richard Stevens, "Advanced Programming in the UNIX Environment" , Pearson Education, 2nd Edition and onwards.
3. Sumitabha Das: "YOUR UNIX – The Ultimate Guide", Tata McGraw Hill, 23rd reprint, 2012 and onwards.

Reference Books:

1. W. Richard Stevens, Bill Fenner, Andrew M. R., "UNIX® Network Programming The Sockets Networking API", Volume 1, Prentice Hall India, 2nd edition and onwards.

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	**Describe** the features of POSIX and UNIX standards as applicable to files and processes using programming.	L2
2.	**Analyze** and implement programs for various configuration limits using APIs and constants.	L4
2.	**Design** and implement programs for inter process communication using pipes.	L4
3.	**Implement** and demonstrate the concept of UNIX signals and daemon processes.	L3

	Program Outcome of this course (POs)	PO No.
1.	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	1
2.	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	2
3.	**Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations	3

Course delivery methods		Assessment methods	
1.	Chalk and board	1.	Internal assessment
2.	PPT	2.	Assignment
3.	Video lectures	3.	Quiz
		4.	Seminar / project

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Average of two assignments	Quiz/Seminar/Course Project	Total Marks
Maximum Marks: 50	15+15 = 30	10	10	50

- **Writing two IA tests is compulsory.**
- **Minimum marks required to qualify for SEE : 20 out of 50**

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2.	**Minimum marks required in SEE to pass: 40 (out of 100)**
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.

Formal languages and Automata Theory

Course Code	**18CS54**	**Credits**	4
Course type	PC	**CIE Marks**	50 marks
Hours/week: L-T-P	3-2-0	**SEE Marks**	50 marks
Total Hours:	50	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. To study abstract computing machines, Language representation techniques, Regular Expressions, Grammar constructions and associated theories and tools to realize formal language.
2. Employ finite state machines to solve problems in computing.
3. Discuss the hierarchy of problems arising in the computer science.
4. Understand the Turing theory and its significance.

Pre-requisites: Basic knowledge of problem solving and Discrete mathematics

Unit – I **10 Hours**

Introduction to Finite Automata: Introduction to Finite Automata, Structural Representation. The central concepts of Automata theory – Alphabet, Strings & Languages. Deterministic Finite Automata (DFA), Non-Deterministic and Equivalence of NFA and DFA,

Self learning: FA with Epsilon (ε) transitions and Applications of Finite automata.

Unit – II **10 Hours**

Regular Expressions and languages: Regular Expressions, Finite Automata and Regular Expressions, Properties of Regular Languages (RL): Proving Languages not to be Regular. Equivalence and Minimization of Automata.

Self learning : Closure properties of Regular Languages and Applications of Regular Expressions

Unit – III **10 Hours**

Context-Free Grammars (CFG) and Languages (CFL): Context-Free Grammars, Parse Trees, Applications of Context-Free Grammars, Ambiguity in Grammars and Languages. Normal forms for Context Free Grammar.

Self learning: Closure properties and Pumping lemma for Context Free Languages.

Unit – IV **10 Hours**

Pushdown Automata (PDA): Definition of Pushdown Automata, The languages of a PDA: Acceptance by Final state & Empty stack.

Introduction to Turing Machines (TM): Turing Machine model: Definition of Turing Machine, Transition Function, Instantaneous Description & Moves, Programming a Turing Machine, Language recognition by Turing Machine.

Self learning: Deterministic Pushdown Automata,Turing Machine as a acceptors,Turing Machine as Transducers.

Unit – V **10 Hours**

LEX and YACC Tools: The Simplest Lex Program, Recognizing Words with Lex. Grammars: Parser-lexer communication, A Yacc Parser, Rules section. Running Lex and Yacc and examples

Using Lex: Regular Expressions and examples.

Using Yacc: Shift reduce parsing, Arithmetic Expressions and Ambiguity.

Books

Text Books

1. John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, "Introduction to Automata Theory, Languages and Computation", Pearson Education, 3/E, 2013.
2. John R. Levine and Tony Mason and Doug Brown, Lex and Yacc, "UNIX programming tools", 2/E, 1992.
3. S . P. Euguene Xavier"Theory of Automata , Formal Languages and Computation ", 5/ E 2008.

Reference Books

1. Alfred V Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman , "Compilers *Principles, Techniques and Tools",*Pearson Education , 2 / E,2008
2. Peter Linz, "An Introduction to Formal Languages and Automata",Narosa Publishing House, 5/E, 2011.

Course Outcome (COs)

At the end of the course, the student will be able to	**Bloom's Level**
1. **Explain** the concepts & properties of automata and **Design** the optimized DFA for the given problem description.	L3
2. Explain the properties of RE **and Design** the Regular Expressions for the given pattern.	L3
3. Explain the properties of Languages and **Write** the Grammar for the given language description.	L4
4. Explain the properties of PDA , Turing Machine & **Design** PDA , Turing Machine for the given problem description	L4
5. Write programs to implement lexical analyzer & parsers using software tools.	L3

Program Outcome of this course (POs)	**PO No.**
1. Graduates will **demonstrate** the knowledge of mathematics, basic sciences, logical reasoning and engineering.	1
2. Graduates will **identify**, formulate, review research literature & analyze complex Engineering problems.	2
3. Graduates will **Design** solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations	3
4. Graduates will **recognize** the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	12

Course delivery methods(planned)		Assessment methods(planned)	
1.	Chalk and board	1.	Internal assessment
2.	PPT	2.	Assignment
3.	Video lectures	3.	Quiz
		4.	Seminar / project

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of Two IA tests	Average of Two assignments	Quiz/Seminar /course project	Total Marks
Maximum Marks: 50	15+15 = 30	10	10	50

- **Writing two IA tests is compulsory.**
- **Minimum marks required to qualify for SEE : 20 out of 50**

Self-Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2.	**Minimum marks required in SEE to pass: 40 (out of 100)**
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.

Advanced Web Programming

Course Code	**18CS551**	**Credits**	3
Course type	PE	**CIE Marks**	50 marks
Hours/week: L-T-P	3-0-0	**SEE Marks**	50 marks
Total Hours	39	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. To understand the concept of Ajax and write applications
2. To utilize JavaScript for the entire development cycle from front end to back end, database and deployment.
3. To learn to write responsive code that can be deployed on any device.
4. To understand usage of document databases.
5. To design and develop full stack applications.

Pre-requisites: Computer Concepts and C Programming, Database Management Systems, Web Programming

Unit – I **09 Hours**

An Ajax Overview: Introducing Ajax, Examples of real world Applications, Back to the joke of the day application. Understanding the Document Object Model: The ajax story of the day application, An introduction to the document Object model, The Dom tree, Walking the DOM tree, Dynamically updating the Page content. Ajax Basics: Connecting your application to web servers, working with the XMLHttpRequest Object, Managing the current XMLHttpRequests. Important Ajax design Issues: Programming hurdles that all Ajax developers face.

Self learning topics: project preview : The joke of the day application , The Ajax story of the day application, Ajax Typing challenge,

Unit – II **07 Hours**

Introducing Full Stack Development: Node.js, Express, MongoDB, AngularJS, Supporting cast; Designing a MEAN stack architecture: Planning a real application, breaking the development into stages, Hardware Architecture

Unit – III **08 Hours**

Building Node Application: A brief look at Express, Node and npm, Create Express Project, Modifying Express for MVC, Import Bootstrap for responsive layout, Setting up Heroku, Building a static site with Node and Express: Defining routes in Express, Building basic controllers, Creating views.

Unit – IV **07 Hours**

Connecting Express application to MongoDB, **why model data?**, Defining Mongoose schemas, Database development with MongoDB and Mongoose, **Getting our database live** ,Installing the stack and supporting softwares.

Unit – V **08 Hours**

Rules of REST API, Setting up the API in Express, GET, POST,PUT and DELETE methods; Consuming a REST API: Call an API from Express, Using Lists of data from API, Getting single documents from API, Adding data to the database via API, Protecting data Integrity with data validation, writing modular JavaScript and JavaScript callbacks.

Books

Text Books:

1. Jerry Lee Ford, Jr , Ajax programming for the absolute beginner, Stacy L. Hiquet
2. Simon Holmes, Getting MEAN: Mongo, Express, Angular, Node, Dreamtech press, 2015, 1st Edition and onwards.

Reference Books:

1. Nicholas Zakas et al, Professional Ajax, Wrox Publications, 2006 and onwards.

Course Outcome (COs)

At the end of the course, the student will be able to	**Bloom's Level**
1. **Explain** basic principles and usage of Ajax for application development	L2
2. **Describe** usage MEAN stack architecture	L2
3. **Implement** Fullstack development using MEAN and host on live platform	L3
4. **Use** Document database to work with data.	L3
5. **Illustrate** use of REST APIs to access data	L3

Program Outcome of this course (POs)	**PO No.**
1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	1
2. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	3
3. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	12

Course delivery methods		**Assessment methods**	
1.	Lecture	1.	Internal Assessment Test
2.	Demonstration	2.	Assignment
3.	Hands on	3.	Quiz
4.	Presentation	4.	Programming Exercises

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Average of two assignments	Quiz/Seminar/Course Project	Total Marks
Maximum Marks: 50	15+15 = 30	10	10	50

- **Writing two IA tests is compulsory.**
- **Minimum marks required to qualify for SEE : 20 out of 50**

Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2.	**Minimum marks required in SEE to pass: 40 (out of 100)**
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.

Advanced Java

Course Code	**18CS552**	**Credits**	3
Course type	PE	**CIE Marks**	50
Hours/week: L-T-P	2-0-2	**SEE Marks**	50
Total Hours	40	**SEE Duration**	03 hours

Course learning objectives (CLOs)

1. Understand the different ways of handling I/O in Java, including file I/O.
2. Demonstrate the multithreading concepts and develop multithreaded applications.
3. Build Java applications using Java Data Base Connectivity (JDBC) to interact with databases
4. Build server-side programs using Servlets.

Pre-requisites: Java programming concepts

Unit – I 08 Hours

Java I/O: Byte streams and Character streams, The Byte Stream classes, The Character Stream classes, Predefined streams, Using Byte Streams, Using Java's Type Wrappers to Convert Numeric Strings.

Unit – II 08 Hours

File I/O: Reading and Writing Files using Byte Streams, Automatically closing a file, Reading and Writing Binary data, Random-Access Files, Using Java's Character-based Streams, File I/O using Character Streams

Unit – III 08 Hours

Multithreaded Programming: Multithreading Fundamentals, The Thread class and Runnable interface, Creating a thread, Creating multiple threads, Determining when a thread ends, Thread Priorities, Synchronization, Using Synchronized Methods, The synchronized statement, Thread communication using notify(), wait() and notifyall(), Suspending, Resuming and Stopping threads

Unit – IV 08 Hours

JDBC: The Concept of JDBC; JDBC Driver Types; JDBC Packages; A Brief Overview of the JDBC process; Database Connection; Associating the JDBC/ODBC Bridge with the Database; Statement Objects; ResultSet; Transaction Processing - commit(), rollback(), SavePoint.

Unit – V **08 Hours**

Servlets: Background; The Life Cycle of a Servlet; Using Tomcat for Servlet Development; A simple Servlet; The Servlet API; The Javax.servlet Package; Reading Servlet Parameter; The Javax.servlet.http package; Handling HTTP Requests and Responses; Using Cookies; Session Tracking.

Books

Text Books:

1. Herbert Schildt and Dale Skrien, "Java Fundamentals A Comprehensive Introduction", TMH. Specia Indian edition.
2. Jim Keogh, J2EE: The Complete Reference, TMH Edition 2002 onwards.

Reference Books:

1.Kathy Sierra & Bert Bates, "Head First Java", O'Reilly, 2nd Edition and onwards.
2.Y. Daniel Liang , "Introduction to JAVA Programming", Pearson's , Seventh Edition onwards.

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	Identify the different ways of handling I/O and file I/O in Java	L2
2.	Write Java programs to demonstrate multithreading concepts.	L3
3.	Apply Java Data Base Connectivity (JDBC) concepts to write applications that interact with databases	L3
4.	Demonstrate server-side programs using Servlets	L3

Program Outcome of this course (POs)		PO No.
1.	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	1
2.	**Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	3
3.	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	9
4.	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	12

Course delivery methods		**Assessment methods**	
1.	Lecture & Board	1.	Assignments
2.	Power-point Presentation	2.	Quizzes
3.	Online Videos / Learning	3.	Internal Assessment Tests
4.	Class Room Exercises	4.	Course Activity

Scheme of Continuous Internal Evaluation (CIE):

Components	IA Test(s)	Experiments/Journal Submission	Course Activity	Total Marks
Maximum Marks: 50	30M	10M	10M	50M

Scheme of Semester End Examination (SEE):
It will be conducted for 50 marks of 3 hours duration.
Minimum marks required in SEE to pass: 20 out of 50
• Student has to execute one experiment based on lots. • Change of experiment is permitted only once and within the first half an hour of the commencement of the exam. A student cannot revert to the original experiment after change. 20% of the marks would be deducted for change of experiment.

NOTE:

1) A team of three students needs to formulate a problem definition in consultation with the guide for the **Course Activity** component and work towards completion after approval.

2) Experiments from the approved list need to be executed by the students for the **Experiments**/**Journal Submission** Component.

Advanced Algorithms

Course Code	**18CS553**	**Credits**	3
Course type	PE	**CIE Marks**	50 marks
Hours/week: L-T-P	3-0-0	**SEE Marks**	50 marks
Total Hours	40	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. To introduce various algorithm analysis techniques.
2. To formulate solutions for graph based problems in algorithmic form.
3. To understand fundamentals of number theory and their application in cryptography
4. To study and compare various string search algorithms.
5. To understand and appreciate probabilistic and randomized algorithms.

Pre-requisites: Design and Analysis of Algorithms

Unit – I 8 Hours

Review of Analysis Techniques: Standard notations and common functions; Recurrences and Solution of Recurrence equations- The substitution method, The recurrence – tree method, The master method; Amortized Analysis: Aggregate, Counting and Potential method.

Unit – II 8 Hours

Graph Algorithms: Johnson‘s Algorithm for sparse graphs; Detecting Negative Cycle-Floyd Warshal Algorithm. Single source shortest path in DAG. Flow networks and Ford-Fulkerson method. Graph coloring Algorithm.

Unit – III 8 Hours

Number-Theoretic Algorithms: Theoretic Algorithms: Elementary notions; GCD, Extended Euclid; Solving modular linear equations; Powers of an element; Modular Inverse, Chinese Remainder theorem, Fermat‘s theorem, Miller-Rabin for primality test. RSA cryptosystem.

Unit – IV 8 Hours

String-Matching Algorithms: Naïve string Matching; Rabin - Karp algorithm; String matching with finite automata and its time complexity; Knuth-Morris-Prat Algorithm and its time complexity, Boyer – Moore algorithms.

Unit – V 8 Hours

Probabilistic and Randomized Algorithms: Deterministic and Non-deterministic algorithms, Concept of NP-Hard and NP-Complete. TSP example. Probabilistic algorithms; Randomizing deterministic algorithms, Monte Carlo and Las Vegas algorithms.

Books

Text Books:

1. T. H Cormen, C E Leiserson, R L Rivest and C Stein: Introduction to Algorithms, Prentice-Hall of India, 3rd Edition and onwards.
2. Kenneth A. Berman, Jerome L. Paul: Algorithms, Cengage Learning, 2002 and onwards.

Reference Books:

1. Ellis Horowitz, Sartaj Sahni, S.Rajasekharan: Fundamentals of Computer Algorithms, Universities press, 2007, 2nd Edition

Course Outcome (COs)

At the end of the course, the student will be able to		**Bloom's Level**
1.	Apply masters theorem for given recurrence relation and compute complexity.	L3
2.	Apply standard graph algorithms to compute shortest distance, max flow in a network	L3
3.	Apply Number theoretic algorithms to solve the numeric problems.	L3
4.	Apply Fermat's theorem/Miller-Rabin algorithm to test Primality.	L3
5.	List and analyze/compare string matching algorithms	L4
6.	Explain and compare / contrast randomized algorithms	L3

Program Outcome of this course (POs)	**PO No.**
1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	1
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	2
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	3

Course delivery methods		**Assessment methods**	
1.	Lecture & Board	1.	Assignments
2.	Power-point Presentation	2.	Quiz
3.	Online Videos / Learning	3.	Internal Assessment Tests

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Average of two assignments	Quiz/Seminar/Course Project	Total Marks
Maximum Marks: 50	15+15 = 30	10	10	50

- **Writing two IA tests is compulsory**
- **Minimum marks required to qualify for SEE : 20 out of 50**

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2.	**Minimum marks required in SEE to pass: 40 (out of 100)**
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.

Data Warehousing and Data Mining

Course Code	**18CS554**	**Credits**	3
Course type	PE	**CIE Marks**	50 marks
Hours/week: L-T-P	3 – 0 – 0	**SEE Marks**	50 marks
Total Hours	40	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. To introduce the fundamental concepts of data mining and Recognize various types of data mining tasks.
2. To introduce mathematical and statistical models used in data Classification.
3. To define, understand and interpret association rules.
4. Discuss the clustering algorithms to solve real-world problems

Pre-requisites : Data Base Management Systems, Design and Analysis of Algorithms

Unit – I **8 Hours**

Data Mining: Introduction, What is Data Mining?, Data Mining – on what kind of Data? Data Mining Functionalities-What kinds of patterns can be mined?, Classification of Data mining systems, Major issues in Data Mining.

Unit – II **8 Hours**

Data Warehouse and OLAP Technology: What is Data Warehouse? A multidimensional Data model, Data Warehouse architecture**.** From data warehouse to Data mining**.**
Self learning topics: Weka tool

Unit – III **8 Hours**

Cluster Analysis: What is cluster Analysis? Types of data in cluster analysis, Categorization of major clustering methods. Partitioning methods**.**
Self learning topics: Weka tool for Analysis

Unit – IV **8 Hours**

Classification and Prediction: What is Classification and Prediction? Issues regarding classification and prediction. Classification by Decision Tree Induction. Bayesian Classification. Backpropagation.

Unit – V **8 Hours**

Data Warehouse and OLAP Technology: What is Data Warehouse? A multidimensional Data model, Data Warehouse architecture**.** From data warehouse to Data mining**.**

Books

Text Books:

1. Jiawei Han, Micheline Kamber , Jian Pei: Data Mining - Concepts and Techniques , 3rd Edition, Morgan Kaufmann Publishers, 2011.

Reference Books:

1. Pang-Ning Tan, Michael Steinbach, Vipin Kumar: Introduction to Data Mining, Addison-Wesley, 2007.
2. G. K. Gupta: Introduction to Data Mining with Case Studies, 3rd Edition, PHI, New Delhi, 2014.

Course Outcome (COs)

At the end of the course, the student will be able to		**Bloom's Level**
1.	**Explain** the basic steps in data-mining.	L2
2.	**Classify** data by applying various clustering algorithms.	L3
3.	**Evaluate** the performance of various Classification algorithms	L5
4.	**Illustrate** the application of Data Warehouse and data mining to real-world problems.	L2

	Program Outcome of this course (POs)	**PO No.**
1.	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	1
2.	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	4
3.	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.	5
4.	Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	12

Course delivery methods		**Assessment methods**	
1.	Class Teaching	1.	Quiz
2.	PPT	2.	Assignments
3.	Video Lecture	3.	Internal Assessment
		4.	Course Activity(Mini-Project)

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Average of two assignments	Quiz/Seminar/Course Project	Total Marks
Maximum Marks: 50	15+15 = 30	10	10	50
➢ **Writing two IA tests is compulsory.** ➢ **Minimum marks required to qualify for SEE : 20 out of 50**				

Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2.	**Minimum marks required in SEE to pass: 40 (out of 100)**
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.

NoSQL

Course Code	**18CS561**	**Credits**	3
Course type	OE	**CIE Marks**	50 marks
Hours/week: L-T-P	3-0-0	**SEE Marks**	50 marks
Total Hours:	40	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. To study and use various types of Data Models.
2. Employ and evaluate NoSQL database development tools .
3. Discuss the usage of MongoDB to solve problems arising in the computer science.
4. Understand the Cassandra and Redis with its significance.

Pre-requisites: Basic knowledge of problem solving and Mathematics

Unit – I **08 Hours**

Why NoSQL? Aggregate Data Models, More Details on Data Models, Distribution Models, Consistency, Version Stamps, Map-Reduce.

Unit – II **08 Hours**

Implement: Key-Value Databases, Document Databases, Column-Family Stores, Graph Databases, Choosing Your Database.

Unit – III **08 Hours**

MongoDB: Introduction, Creating, Updating, and Deleting Documents, Querying

Unit – IV **08 Hours**

Introduction to Cassandra: The Cassandra Data Model, Reading and Writing Data: Query Basic write properties, basic read properties, Deleting.

Unit – V **08 Hours**

Redis: Getting to know Redis: What is redis? , What does Redis data structures look like, Anatomy of Redis Web Application, Commands in Redis, Building a simple social network.

Books

Text books

1. NoSQL Distilled, Pramod J. Sadalage&Martin Fowler, Addison-Wesley
2. MongoDB: The Definitive Guide,Kristina Chodorow and Michael Dirolf, O'Reilly
3. Cassandra: The Definitive Guide, Eben Hewitt, O'Reilly
4. Redis in Action, Josiah L.Carlson(1.1, 1.2,2.1 to 2.4,3.1 to 3.6 , 8.1 to 8.4)

Course Outcome (COs)

At the end of the course, the student will be able to	**Bloom's Level**
1. **Explain** the various types of Data Models and **Design** the NoSQL database management systems for the given problem description.	L2, L3
2. **Explain** the competency in describing how NoSQL databases differ from relational databases from a theoretical perspective.	L2
3. **Explain** the usuage of MongoDB to **Design** new types of applications for mobile, cloud, e-commerce and social technologies.	L3
4. **Explain** the properties of Cassandra and Redis	L2

Program Outcome of this course (POs)	**PO No.**
1. Graduates will **demonstrate** the knowledge of mathematics, basic sciences, logical reasoning and engineering.	1
2. Graduates will **identify**, formulate, review research literature & analyze complex Engineering problems.	2
3. Graduates will **demonstrate** an ability to analyze the given problems and design solutions, as per the needs and specifications.	4
4. Graduates will **recognize** the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	12

Course delivery methods(planned)		**Assessment methods(planned)**	
1.	Chalk and board	1.	Internal assessment
2.	PPT	2.	Assignment
3.	Video lectures	3.	Quiz
		4.	Seminar / project

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Average of two assignments	Quiz/Seminar/Course Project	Total Marks
Maximum Marks: 50	15+15 = 30	10	10	50

- **Writing two IA tests is compulsory.**
- **Minimum marks required to qualify for SEE : 20 out of 50**

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2.	**Minimum marks required in SEE to pass: 40 (out of 100)**
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.

Enterprise Resource Planning

Course Code	18CS562	Credits	3
Course type	OE	CIE Marks	50 marks
Hours/week: L-T-P	3-0-0	SEE Marks	50 marks
Total Hours	40	SEE Duration	3 Hours for marks

Course learning objectives

1. To introduce foundational methodology, techniques and tools for understanding the successful implementation of enterprise resource planning (ERP) systems.
2. To focus on integrating business processes in an enterprise resource planning (ERP) system.
3. To experience the end-user and configuration perspectives of an ERP system implementation.
4. To realize future Directions in quality management and trends in ERP.

Pre-requisites: Knowledge of Business management Process, Data Warehousing, on–line Analytical Processing and Supply Chain Management.

Unit – I 08 Hours

Introduction to ERP: Overview, Business Processes, Introduction to ERP, Benefits of ERP, ERP and Related Technologies, Business Process Reengineering, Data Warehousing, Data Mining, On–line Analytical Processing, Supply Chain Management.

Unit – II 08Hours

ERP Implementation: Implementation Life Cycle, Implementation Methodologies, Hidden Costs, Vendors and Consultants, Contracts with Vendors, Consultants, and Employees, Project Management and Monitoring.

Unit – III 08 Hours

Business Modules: Business Modules in an ERP Package, Financials, Manufacturing, Human Resource Management, Plant Maintenance, Materials Management, Quality Management, Sales, Distribution, and Service.

Unit – IV 08 Hours

ERP Market Dynamics: ERP Market Place and marketplace dynamics, ERP Vendors.
Two case studies such as Data Span, LG Electronics, Tata Motors.
Self learning topics: System Software Associates

Unit – V **08 Hours**

ERP –Present and Future: Turbo Charge the ERP System, EIA, ERP and E–Business, ERP,Internet,and www-ERP II ,ERP and Total Quality Management.

Self learning topics: Future Directions and trends in ERP, Working of GOOGLE search engine.

Books

Text Books:

1. Alexis Leon, "ERP Demystified", 3rd Edition Tata McGraw Hill, 2014

Reference Books:

1. N Joseph A. Brady, Ellen F. Monk, Bret J. Wangner, "Concepts in Enterprise Resource Planning", Thomson Learning, 2001.
2. Vinod Kumar Garg and N.K .Venkata Krishnan, "Enterprise Resource Planning concepts and Planning", Prentice Hall, 1998

Course Outcome (COs)

At the end of the course, the student will be able to		**Bloom's Level**
1.	Demonstrate the knowledge of basic structure of an Enterprise Resource Planning system.	L 2
2.	Design common business transactions as an end-user in an ERP system.	L3
3.	Use the skills to analyze the critical stage of implementation in the development of enterprise wide systems.	L4

	Program Outcome of this course (POs)	**PO No.**
1.	Students will demonstrate knowledge of computer applications, and management.	1
2.	Students will demonstrate an ability to design and conduct experiments, analyze and interpret data.	2
3.	students will demonstrate skills to use modern software tools and technology to build and test applications.	3

Course delivery methods		**Assessment methods**	
1.	Lecture	1.	Internal Assessment Test
2.	Power-Point Presentation	2.	Quiz
3.	Video	3.	Assignment/Seminar/Project

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Average of two assignments	Quiz/Seminar/Course Project	Total Marks
Maximum Marks: 50	15+15 = 30	10	10	50

- **Writing two IA tests is compulsory.**
- **Minimum marks required to qualify for SEE : 20 out of 50**

Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2.	**Minimum marks required in SEE to pass: 40 (out of 100).**
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.

Project Management

Course Code	18CS563	Credits	3
Course type	OE	CIE Marks	50 marks
Hours/week: L-T-P	3 – 0 – 0	SEE Marks	50 marks
Total Hours	40	SEE Duration	3 Hours for 100 marks

Course learning objectives

1. To be acquainted with methods of project evaluation and project management.
2. To learn and understand risk management, resource allocation, monitoring and contract management during project execution.
3. To understand organizational behaviour and team structures and learn to work in teams.
4. To understand software quality attributes.

Pre-requisites: Software Engineering, Management and Entrepreneurship

UNIT I 8 hours

Introduction to software project management: Introduction ,why is software project management important, what is project, software projects versus other types of project, contract management and technical project management, Activities covered by software project management, plans methods and methodologies some ways of categorizing software projects, stakeholders, selling objectives, the business case, project success and failure, what is management, management control, traditional versus modern project management practices

Project Evaluation and Programme Management: Introduction, A business case, project portfolio management, evaluation of individual projects. Cost benefit evaluation technique, risk evaluation, programme management, managing the allocation of resources within programme, strategic programme management, creating a programme, aids to programme management, some reservations about programme management, benefit management

UNIT II 8 hours

Risk Management: Introduction, Risk, categories of risk, A framework for dealing with risk, risk identification, risk Assessment, Risk planning, Risk management, Evaluating risks to the schedule, Applying the PERT technique, Monte carlo simulation, critical chain concepts.

Resource Allocation: Introduction, The Nature of resources, Identifying Resource Requirements, scheduling Resources, Creating critical paths, counting the cost, being specific, publishing the resource schedule, cost schedules, The Scheduling sequence.

UNIT III 8 Hours

Monitoring and control: Introduction**,** Creating the framework, collecting the data, review, Project termination review, visualising progress, cost monitoring, earned value analysis, Prioritizing

monitoring, Getting the project back to target, change control, software configuration management(SCM).

Managing Contracts: Introduction, types of contracts, stages in Contract placement, typical terms of a contract, Contract management, Acceptance.

UNIT IV **8 Hours**

Managing people in software environment: Introduction, Understanding Behaviour, Organizational Behaviour: A background, selecting the right person for job, instruction in the best methods, motivation, The Oldham-Hackman job characteristics model, stress, Health and safety, Some ethical and professional concerns

Working in teams: Introduction, Becoming a team, decision making, organization and team structures, Coordination Dependencies, Dispersed and virtual Teams, Communication Genres, Communication Plans, Leadership

UNIT V **8 hours**

Software Quality: Introduction, the place of software quality in project planning, the importance of software quality, defining software quality, ISO 9126, product and process metrics, product versus process quality management, quality management systems, process capability models, techniques to help enhance software quality, testing, software reliability, quality plans

Books

Text Books:

1. Bob Hughes, Mike Cottrell and Rajib Mall "SOFTWARE PROJECT MANAGEMENT" Mc Graw Hill, 5th Edition.

Reference Books:

1. Project Management – A Systems approach to Planning Scheduling and controlling – Harold Kerzner.
2. Project Management - S Choudhury – Mc Graw Hill Education, New Delhi 2016.

Course Outcomes (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	Identify and evaluate the requirements of software project management	L2
2.	Plan schedule and execute a project considering the risk management	L2
3.	Apply quality attributes in software project development	L3

Program Outcome of this course (POs)	PO No.
1. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	10
2. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multi-disciplinary environments.	11

3. **Lifelong learning:** Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change 12

Course delivery methods		Assessment methods	
1.	Lecture Chalk and board	1.	Internal Assessment
2.	Seminar/project	2.	Assignment
3.	Video Lectures	3.	Quiz

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Average of two assignments	Quiz/Seminar/Course Project	Total Marks
Maximum Marks: 50	15+15 = 30	10	10	50

- **Writing two IA tests is compulsory.**
- **Minimum marks required to qualify for SEE : 20 out of 50**

Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2.	**Minimum marks required in SEE to pass: 40 (out of 100)**
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.

Principles of Cyber Security

Subject Code:	**18CS564**	**Credits:**	3
Course Type:	OE	**CIE Marks:**	50
Hours/week: L – T – P	3 – 0 – 0	**SEE Marks:**	50
Total Hours:	40	**SEE Duration:**	3 Hours

Course learning objectives

1. To understand key issues plaguing the information security world
2. To understand Social Engineering techniques
3. To perform vulnerability analysis to identify security loopholes in the target organization's network
4. To understand different types of attacks

Prerequisites: Networks, Information Security, Operating Systems

Unit – I — 8 Hours

Ethical Hacking: Overview of Ethics, Overview of Ethical Hacking, Methodology of Ethical Hacking, Networking
Foundations: Communications Models, Topologies, Physical Networking, IP, TCP, UDP, Internet Control Message Protocol, Network Architectures, Cloud Computing,

Unit – II — 8 Hours

Security Foundations: The Triad, Risk, Policies, Standards, and Procedures, Security Technology, Being Prepared;
Footprinting and Reconnaissance: Open-Source Intelligence, Domain Name System, Passive Reconnaissance, Website Intelligence, Technology Intelligence,

Unit – III — 8 Hours

Scanning Networks: Ping Sweeps, Port Scanning, Vulnerability Scanning
Enumeration: Service Enumeration, Remote Procedure Calls, Server Message Block, Web-Based Enumeration

Unit – IV — 8 Hours

System Hacking: Searching for Exploits, System Compromise, Gathering Passwords, Password Cracking, Client-Side Vulnerabilities, Post Exploitation
Malware: Malware Types, Malware Analysis, Antivirus Solutions, Spoofing Attacks

Unit – V **8 Hours**

Social Engineering: Social Engineering, Physical Social Engineering, Phishing Attacks, Website Attacks

Cryptography: Basic Encryption, Symmetric Key Cryptography, Asymmetric Key Cryptography,

Books

Text Books

1. Ric Messier, CEH v10 Certified Ethical Hacker Study Guide, Sybex, 2019
2. Michael Gregg, Omar Santos, Certified Ethical Hacker (CEH) Version 10 Cert Guide, Pearson IT Certification, 3rd Edition, 2019

Reference Books

1. Matt Walker, CEH Certified Ethical Hacker All-in-One Exam Guide, Fourth Edition, McGraw-Hill, 4th Edition, 2019

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	Perform vulnerability **analysis** to **identify** security loopholes in the target organization's network, communication infrastructure, and end systems.	L4
2.	**Understand** mobile platform attack vector, android vulnerabilities, mobile security guidelines, and tools.	L2

	Program Outcome of this course (POs)	PO No.
1.	**Scholarship of Knowledge:** Acquire in-depth knowledge of specific disciplineor professional area, including wider and global perspective, with an ability to discriminate, evaluate, analyse and synthesise existing and new knowledge, and integration of the same for enhancement of knowledge.	1
2.	**Life-long Learning:** Recognise the need for, and have the preparation and ability to engage in life-long learning independently, with a high level of enthusiasm and commitment to improve knowledge and competence continuously.	9

Course delivery methods		Assessment methods	
1.	Chalk and talk	1.	Quiz
2.	Power Point Presentations	2.	Assignment
3.	Demos	3.	IA Test
4.	Audio and Videos		

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Average of two assignments	Quiz/Seminar/Course Project	Total Marks
Maximum Marks: 50	15+15 = 30	10	10	50
1. Writing two IA tests is compulsory **2. Minimum marks required to qualify for SEE : 20 out of 50**				

Self-Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2.	**Minimum marks required in SEE to pass: 40 out of 100**
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.

UNIX System Programming Laboratory

Course Code	**18CSL57**	**Credits**	1.5
Course type	LAB	**CIE Marks**	25 marks
Hours/week: L-T-P	0 – 0 – 3	**SEE Marks**	25 marks
Total Hours:	36	**SEE Duration**	3 Hours for 50 marks

Course learning objectives

1. To demonstrate UNIX system programming API's.
2. To get acquainted with knowledge of UNIX operating system environment like race condition, zombie.
3. To demonstrate the implementation of real-time clock interval timer

Pre-requisites : C Programming, Computer Organization, Basic UNIX Commands

List of experiments

1. Write a C/C++ POSIX compliant program to check the following limits:
   (i) No. of clock ticks (ii) Max. no. of child processes (iii) Max. path length
   (iv) Max. no. of characters in a file name (v) Max. no. of open files/ process
2. Write a C/C++ POSIX compliant program that prints the POSIX defined configuration options supported on any given system using feature test macros.
3. Consider the last 100 bytes as a region. Write a C/C++ program to check whether the region is locked or not. If the region is locked, print pid of the process which has locked. If the region is not locked, lock the region with an exclusive lock, read the last 50 bytes and unlock the region.
4. Write a C/C++ program which demonstrates interposes communication between a reader process and a writer process. Use mkfifo, open, read, write and close APIs in your program.
5. a) Write a C/C++ program that outputs the contents of its Environment list
   b) Write a C / C++ program to emulate the unix ln command
6. Write a C/C++ program to illustrate the race condition.
7. Write a C/C++ program that creates a zombie and then calls system to execute the ps command to Verify that the process is zombie.
8. Write a C/C++ program to avoid zombie process by forking twice.
9. Write a C/C++ program to implement 'system' function.
10. Write a C/C++ program to set up a real-time clock interval timer using the alarm API.

Books

1. Terrence Chan: UNIX System Programming Using C++, Prentice Hall India, 1999 and onwards.
2. W. Richard Stevens, "Advanced Programming in the UNIX Environment" , Pearson Education, 2nd Edition and onwards.

Course Outcome (COs)

At the end of the course, the student will be able to		**Bloom's Level**
1.	Demonstrate the working of different API's of Unix system.	L2
2.	Apply Unix system calls for several level tasks.	L3

Program Outcome of this course (POs)		**PO No.**
1.	Graduates will demonstrate the knowledge of mathematics, basic sciences, logical reasoning and engineering.	1
2.	Graduates will demonstrate the ability to identify, formulate and solve computer systems engineering problems.	2
3.	Graduates will demonstrate the ability to analyze the given problems and design solutions, as per the needs and specifications.	4

Assessment methods	
1.	Experiments
2.	Viva-Voce
3.	Lab Journal Evaluation

Scheme of Continuous Internal Evaluation (CIE):

Components	Conduct of the lab	Journal submission	Lab project	Total Marks
Maximum Marks:25	10	10	5	25

- **Submission and certification of lab journal is compulsory to qualify for SEE.**
- **Minimum marks required to qualify for SEE : 10 marks out of 25**

Scheme of Semester End Examination (SEE):			
1.	It will be conducted for 50 marks of 3 hours / 2 hrs duration. It will be reduced to 25 marks for the calculation of SGPA and CGPA.		
2.	Only one experiment to be conducted.		
3.	Minimum marks required in SEE to pass: **20 (out of 50) or 10 (out of 25)**		
4.	Initial write up	10 marks	50 marks
	Conduct of experiments, results and conclusion	20 marks	
	One mark question	10 marks	
	Viva- voce	10 marks	
5.	Viva-voce shall be conducted for individual student and not in a group.		

Software Design and Modeling Laboratory

Course Code	**18CSL58**	**Credits**	1.5
Course type	LAB	**CIE Marks**	25 marks
Hours/week: L-T-P	0 – 0 – 3	**SEE Marks**	25 marks
Total Hours	36	**SEE Duration**	3 Hours for 50 marks

Course learning objectives

1. To introduce software development processes
2. To prepare the students to learn the steps involved in SRS document preparation
3. To familiarize the fundamentals of software engineering design
4. To understand the use of UML diagrams in the software development process

URL: http://vlabs.iitkgp.ernet.in/se/ : URL of Virtual Lab

Syllabus:

For any given application scenario,

1. Identifying the Requirements from Problem Statements Requirements | Characteristics of Requirements | Categorization of Requirements | Functional Requirements | Identifying Functional Requirements.
2. Modeling UML Use Case Diagrams and Capturing Use Case Scenarios Use case diagrams | Actor | Use Case | Subject | Graphical Representation | Association between Actors and Use Cases | Use Case Relationships | Include Relationship | Extend Relationship | Generalization Relationship | Identifying Actors | Identifying Use cases | Guidelines for drawing Use Case diagrams.
3. E-R Modeling from the Problem Statements Entity Relationship Model | Entity Set and Relationship Set | Attributes of Entity | Keys | Weak Entity | Entity Generalization and Specialization | Mapping Cardinalities | ER Diagram | Graphical Notations for ER Diagram | Importance of ER modeling.
4. Design a relational database for an application involving at-least 5 tables and build GUI using Java-Swing/Web/any other… to perform functional operations of the application.
5. Statechart and Activity Modeling Statechart Diagrams | Building Blocks of a Statechart Diagram | State | Transition | Action | Guidelines for drawing Statechart Diagrams | Activity Diagrams | Components of an Activity Diagram | Activity | Flow | Decision | Merge | Fork | Join | Note | Partition | A Simple Example | Guidelines for drawing an Activity Diagram.
6. Modeling UML Class Diagrams and Sequence diagrams Structural and Behavioral aspects | Class diagram | Elements in class diagram | Class | Relationships | Sequence diagram | Elements in sequence diagram | Object | Life-line bar | Messages.
7. Modeling Data Flow Diagrams Data Flow Diagram | Graphical notations for Data Flow Diagram | Explanation of Symbols used in DFD | Context diagram and leveling DFD.
8. 8 Designing Test Suites Software Testing | Standards for Software Test Documentation | Testing Frameworks | Need for Software Testing | Test Cases and Test Suite | Types of Software Testing | Unit Testing | Integration Testing | System Testing | Example | Some Remarks.

Course Outcome (COs)

At the end of the course, the student will be able to	Bloom's Level
1. **Demonstrate** the preparation of SRS document for a given application scenario.	L3
2. **Construct** various software design artifacts using software design tools.	L5
3. **Demonstrate** the design of Database for a given application scenario.	L3
4. **Design and Implement** GUI for a given application scenario.	L5
5. **Design** the complete class diagram for the stated applications functional requirements.	L5
6. **Demonstrate** the use of various test cases using a standard testing tool.	L3

Program Outcome of this course (POs)	PO No.
Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	1
Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences	2
Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	4

Scheme of Continuous Internal Evaluation (CIE):

Student has to do any one out of eight experiments based on chits drawn from a lot.

Components	Conduct of the lab	Journal submission	Lab project	Total Marks
Maximum Marks:25	10	10	5	25

- **Submission and certification of lab journal is compulsory to qualify for SEE.**
- **Minimum marks required to qualify for SEE : 10 marks out of 25**

<table>
<tr><td colspan="4">Scheme of Semester End Examination (SEE):</td></tr>
<tr><td>1.</td><td colspan="3">It will be conducted for 50 marks of 3 hours / 2 hrs duration. It will be reduced to 25 marks for the calculation of SGPA and CGPA.</td></tr>
<tr><td>2.</td><td colspan="3">Only one experiment to be conducted.</td></tr>
<tr><td>3.</td><td colspan="3">Minimum marks required in SEE to pass: 20 (out of 50) or 10 (out of 25)</td></tr>
<tr><td rowspan="4">4.</td><td>Initial write up</td><td>10 marks</td><td rowspan="4">50 marks</td></tr>
<tr><td>Conduct of experiments, results and conclusion</td><td>20 marks</td></tr>
<tr><td>One mark question</td><td>10 marks</td></tr>
<tr><td>Viva- voce</td><td>10 marks</td></tr>
<tr><td>5.</td><td colspan="3">Viva-voce shall be conducted for individual student and not in a group.</td></tr>
</table>

Employability Skills - I

Course Code		**Credits**	
Course type	MNC	**CIE Marks**	50 marks
Hours/week: L-T-P	3 – 0 – 0	**SEE Marks**	
Total Hours:	30	**SEE Duration**	3 Hours for 100 marks

Course learning objective

The course is designed to develop the employability skills of a student.

Unit – I — 6 Hours

Quantitative Aptitude: Number System (3 Hours)
Soft Skills: Body Language (1.5), Grooming and Etiquette (1.5)

Unit – II — 6 Hours

Quantitative Aptitude: Ratio, Proportion & Partnership (1.5), Average(1.5)
Logical Reasoning: Number Series (1)
Verbal Ability: Comprehension (2)

Unit – III — 6 Hours

Quantitative Aptitude: Percentages (2)
Logical Reasoning: Blood Relations (1), Letter Series (1)
Verbal Ability: Sentence Correction (2)

Unit – IV — 6 Hours

Quantitative Aptitude: Profit and Loss (2)
Logical Reasoning: Seating Arrangement (1), Data Arrangement (1)
Verbal Ability: Ordering of Sentences (2)

Unit – V — 6 Hours

Quantitative Aptitude: Time & Work (2)
Logical Reasoning: Analogy (1), Direction Sense Test (1.5)
Soft Skills: Group Discussions (1.5)

Books

Text Books:

1. How to prepare for Quantitative Aptitude for CAT & other Management Examinations, Arun Sharma, McGraw Hill Education(India) Private Limited, 4th Edition, 2018.
2. How to prepare for Logical Reasoning for CAT & other Management Examinations, Arun Sharma, McGraw Hill Education(India) Private Limited, 8th Edition, 2018.

3. How to prepare for Verbal Ability and Reading Comprehension for CAT & other Management Examinations, Arun Sharma, McGraw Hill Education(India) Private Limited, 8th Edition, 2018.
4. How to prepare for Data Interpretation for CAT & other Management Examinations, Arun Sharma, McGraw Hill Education(India) Private Limited, 5th Edition, 2018.

Course Outcome (COs)

At the end of the course, the student will be able to		**Bloom's Level**
1.	Clear the Aptitude round of recruiters during placements	3
2.	Perform confidently during the GD and Interview process	3
3.	Develop behaviors that are appropriate for a professional	5

Course delivery methods		**Assessment methods**	
1.	Black Board Teaching	1.	Internal Assessment
2.	Power Point Presentation	2.	Assignment
3.	Class Room Exercise	3.	Quiz

Scheme of Continuous Internal Evaluation (CIE):

Components	Average of best two IA tests out of three	Average of two Online Tests	Class Participation	Total Marks
Maximum Marks: 50	25	15	10	50

- **Writing two IA tests is compulsory.**
- **Minimum marks required to qualify for SEE : 20 out of 50**

Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2.	**Minimum marks required in SEE to pass: 40 (out of 100)**
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.

6th Semester Detailed Syllabi

Artificial Intelligence and Machine Learning

Course Code	**18CS61**	**Credits**	4
Course type	PC	**CIE Marks**	50 marks
Hours/week: L-T-P	3-2-0	**SEE Marks**	50 marks
Total Hours	Lecture = 36Hrs; Tutorial = 14Hrs Total = 50Hrs	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. To understand various artificial intelligence techniques
2. To understand different logical systems for inference over formal domain representations
3. To understand basic concepts of machine learning
4. To apply artificial intelligence and machine learning techniques to real world problems

Pre-requisites: Discrete Mathematical Structures, Probability

Unit – I **10 Hours**

Introduction to Artificial Intelligence: Introduction, what is AI, Strong Methods and weak Methods. Uses and Limitations:

Knowledge Representation: Need for good representation, semantic nets, Frames, , Search Spaces, Semantics Tress, Search Trees, Combinatorial Explosion, Problem reduction, Goal Trees, Combinatorial Explosion

Self-learning topics: Inheritance, Object oriented programming

Unit – II **10 Hours**

Search Methodologies: Introduction, Problem solving as search, Data driven or goal driven search, Generate and test, Properties of search methods, Depth First Iterative Deepening, Using Heuristics for Search, Hill Climbing, Best-First Search, Identifying Optimal Paths, Constraint Satisfaction search, Forward Checking, Local Search and Meta heuristics, Simulated Annealing. Genetic Algorithms for search, Real time A*, Bidirectional search, Nondeterministic search, non-chronological backtracking

Self-learning topics: Depth First Search, Breadth First Search, Implementing Depth-First and Breadth-First Search

Unit – III **10 Hours**

Game Playing: Game Trees, Minimax, Alpha beta pruning

Prepositional and Predicate Logic: Introduction, what is Logic, Why Logic is used in Artificial Intelligence, Logical Operators, translating between English and Logic Notation, The deduction Theorem, Soundness, Completeness, Decidability, Monotonicity, Abduction and Inductive reasoning, Modal logics and possible worlds, Dealing with change.

Inference and Resolution for Problem Solving: Introduction, Resolution in prepositional logic: Applications of Resolution, Resolution in Predicate Logic, Normal forms for predicate logic, Skolemization, Resolution Algorithms, Resolution for problem solving,

Self-learning topics: Truth Tables: Not, And, Or, Implies, if, Complex Truth Tables, Tautology, Equivalence

Unit – IV **10 Hours**

Introduction to Machine Learning: Introduction, Training Rote Learning, Learning Concepts, General-to-Specific Ordering, Version Spaces, Candidate Elimination, Inductive Bias, Decision-Tree Induction, The Problem of Overfitting, The Nearest Neighbor Algorithm, Backpropagation algorithms, Reinforcement Learning.

Neural Networks: Introduction, Neurons, Perceptrons, Multilayer Neural Networks, Recurrent Networks, Unsupervised Learning Networks, Evolving Neural Networks.

Self-learning topics: Supervised Learning, Unsupervised Learning

Unit – V **10 Hours**

Probabilistic Reasoning and Bayesian Belief Networks: Introduction, Probabilistic Reasoning, Joint Probability Distributions, Bayes' Theorem, Simple Bayesian Concept Learning, Bayesian Belief Networks, The Noisy-V Function, Bayes' Optimal Classifier, The Naïve Bayes Classifier

Self-learning topics: Collaborative Filtering

Books

Text Books

1. Ben Coppin, Artificial Intelligence Illuminated, Jones and Bartlett, 2004
2. Tom M. Mitchell, "Machine Learning", Mcgraw-Hill Education (Indian Edition),2013.

Reference Books

1. Elaine Rich Kevin Knight, Shivashankar B Nair: Artificial Intelligence, Tata McGraw Hill 3rd edition 2013.
2. Stuart Russel, Peter Norvig: Artiificial Intelligence A Modern Approach, Pearson 3rd edition 2013.
3. Ethem Alpaydin, "Introduction to Machine Learning", 2nd Edition, PHI Learning Pvt. Ltd., 2013.
4. T Hastie, R. Tibshirani, J.H.Fiedman, "The Elements of statistical learning", Springer, 1st Edition 2001.

E-resources (NPTEL/SWAYAM, Any Other)- mention links

1. http://www.manning.com/books

Course Outcome (COs)

At the end of the course, the student will be able to:	**Bloom's Level**
1. **Demonstrate** ability for problem solving, knowledge representation, reasoning and learning	L2
2. **Select** appropriate AI techniques for the given application	L3
3. **Apply** effectively machine learning algorithms for real world applications.	L3

	Program Outcome of this course (POs)	PO No.
1.	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	1
2.	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	2
3.	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.	5

Course delivery methods		Assessment methods	
1.	Chalk and talk	1.	Internal Assessment
2.	PPTs and videos	2.	Assignment
		3.	Seminars
		4.	Projects

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Average of two assignments	Quiz/Seminar/Course Project	Total Marks
Maximum Marks: 50	15+15 = 30	10	10	50

- **Writing two IA tests is compulsory**
- **Minimum marks required to qualify for SEE : 20 out of 50**

Self-Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2.	**Minimum marks required in SEE to pass: 40 out of 100**
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.

Compiler Design

Course Code	**18CS62**	**Credits**	04
Course type	PC	**CIE Marks**	50 marks
Hours/week: L-T-P	3 – 2 – 0	**SEE Marks**	50 marks
Total Hours	50	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. To familiarize the structure of a compiler and activities of different phases of compilation process
2. To provide an insight into the design strategy for front end of a compiler
3. To get acquainted with the techniques to optimize and to build efficient target code

Pre-requisites: Basic knowledge of programming, Finite Automata and Formal languages

Unit – I 10 Hours

Introduction and Lexical Analysis:

Introduction: **Language Processor, Structure of Compiler:** Lexical Analysis, Syntax Analysis, Semantic Analysis, Intermediate Code Generation, Code Optimization, Code Generation, Symbol-Table Management, The Grouping of Phases into Passes, Compiler-Construction Tools

Lexical Analysis: The Role of Lexical Analyzer: Lexical Analysis Versus Parsing, Tokens, Patterns, and Lexemes, Attributes for Tokens, Lexical Errors; **Input Buffering:** Buffer pairs, Sentinels; **Specification of Tokens:** Strings and Languages, Operations on Languages, Regular Expressions, Regular Definitions, Extensions of Regular Expressions; **Recognition of Tokens:** Transition Diagrams, Recognition of Reserved Words and Identifiers, Completion of the Running Example, Architecture of a Transition-Diagram-Based Lexical Analyzer

Tutorial: Exercises on Specification and Recognition of Tokens

Self-learning: Applications of Compiler Technology

Unit – II 10 Hours

Syntax Analysis-1:

Introduction: The Role of the Parser, Representative Grammars, Syntax Error Handling, Error-Recovery Strategies; **Context-Free Grammars:** The Formal Definition of a Context-Free Grammar, Notational Conventions, Derivations, Parse Trees and Derivations, Ambiguity, Verifying the Language Generated by a Grammar, Context-Free Grammars Versus Regular Expressions; **Writing a Grammar:** Lexical Versus Syntactic Analysis, Eliminating Ambiguity, Elimination of Left Recursion, Left Factoring; **Top-Down Parsing:** Recursive-Descent Parsing, FIRST and FOLLOW, LL(l) Grammars, Non-recursive Predictive Parsing, Error Recovery in Predictive Parsing

Tutorial: Exercises on Top down Parsing

Unit – III **10 Hours**

Syntax Analysis-2:

Bottom-up Parsing: Reductions, Handle Pruning, Shift-Reduce Parsing, Conflicts During Shift-Reduce Parsing; **Introduction to LR Parsing: Simple LR:** Items and the LR(O) Automaton, The LR-Parsing Algorithm, Constructing SLR-Parsing Tables, Viable Prefixes; **More Powerful LR Parsers:** Canonical LR(l) Items, Constructing LR(l) Sets of Items, Canonical LR(l) Parsing Tables, Constructing LALR Parsing

Tutorial: Exercises on Bottom up Parsing

Self-learning: Using Ambiguous Grammars

Unit – IV **10 Hours**

Syntax-Directed Definitions and Syntax-Directed Translation Schemes:

Inherited and Synthesized Attributes, Evaluating an SDD at the Nodes of a Parse Tree; **Evaluation Orders for SDD's:** Dependency Graphs, Ordering the Evaluation of Attributes, S-Attributed Definitions, L-Attributed Definitions; **Applications of Syntax-Directed Translation:** Construction of Syntax Trees (Only S-Attributed)

Syntax-Directed Translation Schemes: Postfix Translation Schemes, Parser-Stack Implementation of Postfix SDT's

Unit – V **10 Hours**

Intermediate Code Generation and Code Generation:

Variants of Syntax Trees: Directed Acyclic Graphs for Expressions, The Value-Number Method for Constructing DAG's; **Three-Address Code:** Addresses and Instructions, Quadruples, Triples, Static Single-Assignment Form; **Translation of Expressions:** Operations Within Expressions; **Control Flow:** Boolean Expressions, Short-Circuit Code, Flow-of-Control Statements

Code Generation: Issues in the design of Code Generator, The Target language, Basic blocks and Flow graphs; Optimization of basic blocks; A Simple Code Generator

Self-learning: Control-Flow Translation of Boolean Expressions

Books

Text Book

1. Alfred V Aho, Monica S. Lam, Ravi Sethi, Jeffrey D Ullman- Compilers- “Principles, Techniques and Tools”, 2/E, Addison-Wesley, 2007

Reference Book

1. D. M. Dhamdhere, “System Programming and Operating Systems”, 2nd revised edition, Tata McGraw - Hill, 2009 reprint

Course Outcome (COs)

At the end of the course, the student will be able to:	**Bloom’s Level**
1. **Build** a lexical analyzer for a given lexical specification.	L6
2. **Analyze** and categorize the given grammar to build suitable parser	L4
3. **Apply** the concept of syntax directed translation to aid intermediate code generation.	L3
4. **Develop** intermediate code for any high level construct and generate optimized target code.	L3

Program Outcome of this course (POs)	PO No.
1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	1
2. **Problem Analysis:** Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and Engineering sciences.	2
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	3
4. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.	5
5. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	12

Course delivery methods		**Assessment methods**	
1.	Chalk and board	1.	Internal assessment
2.	PPT	2.	Assignment
		3.	Quiz
		4.	Project

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Average of two assignments	Quiz/Seminar/Course Project	Total Marks
Maximum Marks: 50	15+15 = 30	10	10	50

- **Writing two IA tests is compulsory**
- **Minimum marks required to qualify for SEE : 20 out of 50**

Self-Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2.	**Minimum marks required in SEE to pass: 40 out of 100**
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.

Embedded Systems and IoT

Course Code	**18CS63**	**Credits**	3
Course type	PC	**CIE Marks**	50 marks
Hours/week: L-T-P	3-0-0	**SEE Marks**	50 marks
Total Hours	38	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. To introduce the concepts of Embedded systems using the microcontroller and peripheral circuits
2. To introduce 8051 microcontroller, Architecture and programming in Embedded 'C'
3. To present the techniques of interfacing LCD, DAC and Sensors with 8051 Microcontroller
4. To give an insight into Internet of Things, its associated components, IoT Architecture and Protocols

Pre-requisites: Basic Electronics, Computer Organization, Digital Electronics

Unit – I 8 Hours

Embedded Computing: Introduction, Complex systems and microprocessors, Embedding computers, Characteristics of embedded computing applications, Why use microprocessors, Challenges in embedded computing system design, Performance of embedded computing systems.
The embedded system design process: Requirements, Specification, Architecture design, Designing hardware and software components, System integration.

Unit – II 8 Hours

The 8051 Microcontrollers: Microcontrollers and embedded processors, Overview of the 8051 family.
8051 Programming in C: Data types and time delay in 8051 C, I/O programming in 8051 C, Logic operations in 8051 C, Data conversion programs in 8051 C.

Unit – III 8 Hours

Programming timers 0 and 1 in 8051 C, Basics of serial communication, Serial port programming in C, LCD interfacing, DAC interfacing, and Sensor interfacing.

Unit – IV 7 Hours

Introduction to Internet of Things: Introduction, Definition and Characteristics of IoT, Physical design of IoT, Things in IoT, IoT Protocols, Logical Design of IoT, IoT functional blocks, IoT Communication Models, IoT Communication APIs, IoT Enabling Technologies, IoT levels and Deployment Templates.
Domain Specific IoTs: Introduction, Home Automation, Environment.

Unit – V **7 Hours**

IoT Physical Devices and Endpoints: What is an IoT Device, Basic building blocks of an IoT Device, Exemplary Device: Raspberry Pi, About the board, Linux on Raspberry Pi, Raspberry Pi interfaces, Programming Raspberry Pi with Python, Other IoT Devices.

Books

Text Books

1. Marilyn Wolf, Computers as Components Principles of Embedded Computing System Design, Morghan Kaufmann Elsevier, Third Edition onwards.
2. Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin D. McKinlay, The 8051 Microcontroller and Embedded Systems: Using Assembly and C, Pearson, Second Edition onwards.
3. Arshdeep Bagha, Vijay Madishetti, Internet of Things A Hands- on Approach, Universities Press, 2014.

Reference Book

1. David Hanes, Gonzalo S, Patrick G, Rob Barton, Jermone Henry, Rowan T, IoT Fundamentals Networking Technologies, Protocols, and Use Cases for the Internet of Things, Pearson (Cisco press) 2018.

Course Outcome (COs)

At the end of the course, the student will be able to**:**		**Bloom's Level**
1.	**Analyze** the given design problem and choose the various hardware components including microcontroller and peripheral components.	L4
2.	**Design** and write 'C' programs for Timers and Serial ports using 8051 Microcontroller.	L3
3.	**Demonstrate** the ability to write and develop 'C' programs to interface LCD, DAC and Sensors with 8051 Microcontroller.	L3
4.	**Illustrate** the overview of Internet of Things, its associated components, IoT Architecture and Protocols.	L3

Program Outcome of this course (POs)		**PO No.**
1.	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	1
2.	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	2
3.	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.	5

4.	**Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	12

Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	Internal assessment
2.	Power Point Presentations	2.	Assignment
3.	Demonstration	3.	Quiz
		4.	Seminar / project

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Average of two assignments	Quiz/Seminar/Course Project	Total Marks
Maximum Marks: 50	15+15 = 30	10	10	50

- **Writing two IA tests is compulsory**
- **Minimum marks required to qualify for SEE : 20 out of 50**

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2.	**Minimum marks required in SEE to pass: 40 out of 100**
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.

Computer Graphics

Course Code	**18CS641**	**Credits**	3
Course type	PE	**CIE Marks**	50 marks
Hours/week: L-T-P	3-0-0	**SEE Marks**	50 marks
Total Hours	40	**SEE Duration**	3 Hours for 100 marks

Course Learning Objectives

1. To present the computer graphics fundamentals and all aspects of computer picture formation.
2. To introduce the graphics programming using OpenGL graphics standard.
3. To present the concept of transformations and simple animations.
4. To familiarize the techniques of visualization for both 2D and 3D objects.

Pre-requisites: C Programming, Linear Algebra and Geometry

Unit – I 8 Hours

Introduction: A graphics system, Images: Physical and synthetic, The synthetic camera model, The programmer's interface, Graphics architectures, The Sierpinski gasket, Programming 2D Applications, The OpenGL API, Primitives and attributes.

Unit – II 8 Hours

Introduction: Color, Viewing, Control functions, The Gasket program, Polygons and recursion, The three-dimensional gasket**.**

Input and Interaction: Interaction, Input devices, Programming Event Driven Input, Menus, A simple CAD program, Building Interactive Models, Animating Interactive Program, Design of Interactive Programs, Logic Operations.

Unit - III 8 Hours

Geometric Objects and Transformations : Three-dimensional Primitives, Coordinate Systems and Frames, Frames in Open GL, Modeling a Colored Cube, Affine Transformations, Rotation, Translation and Scaling, Transformation in Homogeneous Coordinates, Concatenation of Transformations, 3D Transformations, OpenGL Transformation Matrices.

Unit - IV 8 Hours

Viewing: Classical and computer viewing, Viewing with a Computer; Positioning of the camera, Simple projections, Projections in OpenGL, Hidden-surface removal.

Lighting: Light and Matter, Light Sources, The Phong Lighting model, Computation of vectors.

Unit - V 8 Hours

Shading: Polygonal Shading, Approximation of a sphere by recursive subdivisions, Light sources in OpenGL, Specification of materials in OpenGL, Shading of the sphere model, Global Illumination.

Implementation: Clipping, Line-segment clipping, Polygon clipping.

Books

Text Books:

1. Edward Angel: Interactive Computer Graphics A Top-Down Approach with OpenGL, 5th Edition & above, Pearson Education, 2008

Reference Books:

1. Donald Hearn and Pauline Baker: Computer Graphics- OpenGL Version, 3rd Edition, Pearson Education, 2004.
2. F.S. Hill Jr.: Computer Graphics Using OpenGL, 3rdEdition, PHI, 2009.

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	**Explain** the typical graphics system hardware and all aspects computer image generation.	L2
2.	**Apply** OpenGL graphics interface to develop and write simple 2D & 3D graphics applications.	L3
3.	**Make use of** OpenGL functions to apply transformation and simple animation of 2D and 3D graphical objects.	L3

Program Outcome of this course (POs)		PO No.
1.	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	1
2.	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences	2
3.	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	3

Course delivery methods		Assessment methods	
1.	Chalk and talk	1.	Quiz
2.	Power Point Presentations	2.	Assignment
3.	Demos	3.	IA Test
4.	Audio and Videos		

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Average of two assignments	Quiz/Seminar/Course Project	Total Marks
Maximum Marks: 50	15+15 = 30	10	10	50
➢ **Writing two IA tests is compulsory.** ➢ **Minimum marks required to qualify for SEE : 20 out of 50**				

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2.	**Minimum marks required in SEE to pass: 40 (out of 100)**
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.

Big Data Management

Course Code	18CS642	Credits	3
Course type	PE	CIE Marks	50 marks
Hours/week: L-T-P	3 – 0 – 0	SEE Marks	50 marks
Total Hours:	40	SEE Duration	3 Hours for 100 marks

Course learning objectives

1. To understand Big data dimensions, its applications and analyze business case studies in Big Data Analytics
2. To explore Hadoop framework and architecture
3. To understand the importance of MapReduce framework.
4. To understand basics of NoSQL
5. To explore Apache Spark

Pre-requisites: Database Management System, Unix Shell Programming

Unit – I 8 Hours

Introduction: Big Data Definition, History of Data Management-Evolution of Big Data, Structuring Big Data, Elements of Big Data, Big Data Analytics, Careers in Big Data, Future of Big Data, Use of Big Data in Social Networking, Use of Big Data in Preventing Fraudulent Activities; Use of Big Data in Retail Industry

Unit – II 8 Hours

Hadoop Ecosystem: Understanding Hadoop Ecosystem, Hadoop Distributed File System:HDFS Architecture,Concept of Blocks in HDFS Architecture, NameNodes and Data Nodes, The Command-Line Interface, Using HDFS Files, Hadoop-Specific File System Types, HDFS Commands, The org.apache.hadoop.io package,HDFS High availability:Features of HDFS.

Unit – III 8 Hours

Understanding MapReduce: The MapReduce Framework: Exploring the Features of MapReduce, Working of MapReduce, Exploring Map and Reduce Functions, Uses of MapReduce.
YARN Architecture: Background; Advantages of YARN; YARN Architecture

Unit – IV 8 Hours

Apache Spark: Overview - What Apache Spark is? Features of apache spark, Spark programming languages, Spark's built-in libraries; Spark History - Limitations of Map Reduce in Hadoop, Creation history of Spark; Why Use Spark - Comparison of Spark and Map Reduce, Reasons for choosing Spark; Spark architecture and its advantages; Data sharing using Spark RDD; iterative operations on Spark RDD; interactive operations on Spark RDD; Spark –installation.

Unit – V 8 Hours

NoSQL: Introduction to NoSQL: Why NoSQL, Characteristics of NoSQL, History of NoSQL, Types of NoSQL Data Models: Key-Value Data Model, Column-Oriented Data Model, Document Data Model, Graph Databases, Schemaless Databases, Materialized views, Distribution Models: CAP Theorem, Sharding

Books

Text Book:

1. DT Editorial Services,"Big Data:Black Book ,Comprehensive Problem Solver", Dreamtech Press. 2016 Edition [Chapters - 1,2,4,5,11,12,13,15]

Reference Book:

1. Paul C. Zikopoulos, Chris Eaton, Dirk deRoos, Thomas Deutsch, George Lapis, Understanding Big Data – Analytics for Enterprise Class Hadoop and Streaming Data, McGraw Hill, 2012
2. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Addison-Wesley Professional, 2012.
3. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilly, 2012.
4. Llya ganelin, Ema orhian, Kai Sasaki, Brennon York "Spark: Big Data Cluster Computing in Production kindle edition" WELY 2016.
5. https://www.simplilearn.com/basics-of-apache-spark-tutorial

Course Outcome (COs)

At the end of the course, the student will be able to	Bloom's Level
1. **Identify** and understand the concepts of Big Data.	L2
2. **Explain** the ecosystem of Hadoop (HDFS and Map-Reduce)	L2
3. **Explain & illustrate** map reduce framework in analyzing the data and relate to YARN.	L2, L3
4. **Identify** the need for Spark and explain the various components of the Spark framework.	L2
5. **Identify** the need for NoSQL databases and different types of NoSQL databases.	L2

Program Outcome of this course (POs)	PO No.
1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	1
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	2
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	3

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

Course delivery methods		Assessment methods	
1.	Lecture & Board	1.	Assignments
2.	Power-point Presentation	2.	Quizzes
3.	Online Videos / Learning	3.	Internal Assessment Tests
		4.	Case Studies

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Average of two assignments	Quiz/Seminar/Course Project	Total Marks
Maximum Marks: 50	15+15 = 30	10	10	50

- **Writing two IA tests is compulsory.**
- **Minimum marks required to qualify for SEE : 20 out of 50**

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2.	**Minimum marks required in SEE to pass: 40 (out of 100)**
3.	Question paper contains 08 questions each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (any 2 units) and choice will be given in the remaining three units.

Note:

As a part of the Quiz/Seminar/Course Project component of CIE, the students should be given asked to mini-project to demonstrate how to extract intelligible data from very large amount to data using Face book data, Twitter data, Sensor data, etc. Further data visualization techniques such as charting etc may be incorporated as a part of the project.

Students may use free source tools in implementing the mini project.

System Software

Course Code	**18CS643**	**Credits**	3
Course type	PE	**CIE Marks**	50 marks
Hours/week: L-T-P	3 – 0 – 0	**SEE Marks**	50 marks
Total Hours	40	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. To introduce the basic concepts of SIC and SIC/XE machine architecture.
2. To design and implement one pass and two pass assemblers.
3. To design and implement loaders and linkers.
4. To design and implement macro processors.

Pre-requisites : Basics of Computer Organization

Unit – I **8 Hours**

Machine Architecture: Introduction, System Software and Machine Architecture, Simplified Instructional Computer (SIC) - SIC Machine Architecture, SIC/XE Machine Architecture, SIC and SIC/XE Programming Examples. Case Study UltraSPARC architecture

Self-learning topics: PowerPC Architecture

Unit – II **8 Hours**

Assemblers -1: Basic Assembler Function - A Simple SIC Assembler, Assembler Algorithm and Data Structures, Machine Dependent Assembler Features - Instruction Formats and Addressing Modes, Program Relocation

Unit – III **8 Hours**

Assemblers -2: Machine Independent Assembler Features – Literals, Program Blocks, Control Sections and Programming Linking, Assembler Design Operations – One Pass Assembler, Multi-Pass Assembler. Case Study MASM Assembler.

Self-learning topics: SPARC Assembler.

Unit – IV **8 Hours**

Loaders and Linkers: Basic Loader Functions - Design of an Absolute Loader, A Simple Bootstrap Loader, Machine-Dependent Loader Features – Relocation, Program Linking, Algorithm and Data Structures for a Linking Loader; Machine-Independent Loader Features - Automatic Library Search, Loader Options. Case Study MS-DOS Linker,

Self-learning topics: Case Study Sun OS Linker

Unit – V **8 Hours**

Macro Processor: Basic Macro Processor Functions - Macro Definitions and Expansion, Macro Processor Algorithm and Data Structures, Machine Independent Macro Processor Features - Concatenation of Macro Parameters, Generation of Unique Labels, Conditional Macro Expansion, Keyword Macro Parameters, Case Study: MASM Macro Processor. ANSI C Macro language.

Books

Text Book:

1. Leland. L. Beck: System Software, 3rd Edition, Pearson Education, 2012. (Chapters 1.1 to 1.3,1.5, 2 (except2.3.2,2.3.3, and 2.5.3), 3 (except 3.4, and 3.5.3), 4 (except4.3 and 4.4.3))

Reference Book:

1. D. M. Dhamdhere: System Programming and Operating Systems, 2nd Edition, Tata McGraw - Hill, 1999.

Course Outcome (COs)

At the end of the course, the student will be able to:	Bloom's Level
1. **Design** and **implement** one pass and two pass assemblers	L3
2. **Design** and **implement** loaders and linkers.	L3
3. **Design** and **implement** macro processors	L3

Program Outcome of this course (POs)	PO No.
1. **Problem analysis:** Identify, formulate, review literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	2
2. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	12

Course delivery methods		Assessment methods	
1.	Class Teaching	1.	Quiz
2.	PPT	2.	Assignments
		3.	Internal Assessment

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Average of two assignments	Quiz/Seminar/Course Project	Total Marks
Maximum Marks: 50	15+15 = 30	10	10	50

- **Writing two IA tests is compulsory.**
- **Minimum marks required to qualify for SEE : 20 out of 50**

Self-Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2.	**Minimum marks required in SEE to pass: 40 out of 100**
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.

Software Testing

Course Code	**18CS644**	**Credits**	3
Course type	PE	**CIE Marks**	50 marks
Hours/week: L-T-P	3-0-0	**SEE Marks**	50 marks
Total Hours	40	**SEE Duration**	3 Hours for 100 marks

Course Learning Objectives

1. To introduce the terminology, testing, test-case, pseudo-codes algorithms /flowcharts of Triangle, Next Date & Commission programs.
2. To develop the skill of analyzing the Triangle, Next Date & Commission programs, with the perspective of Boundary Value Analysis, Equivalence Class & Decision Table Testing paradigms.
3. To practice quality assurance related processes/methods / standards.

Pre-requisites: Software Engineering, Graph Theory, C Programming

Unit – I 8 Hours

A perspective on Testing

Basic definitions, Test cases, Insights from Venn diagram, Identifying Test Cases, Error and fault taxonomy, Levels of Testing.

Examples: Generalized pseudocode, The Triangle problem, The Next Date function, The Commission Problem, The SATM (Simple Automatic Teller Machine) system, The currency convertor, Saturn Windshield Wiper Controller.

Unit – II 8 Hours

Boundary Value Testing

Boundary Value Analysis, Robustness Testing, Worst Case Testing, Special Value Testing, Examples, Random Testing, Guidelines for Boundary Value Testing.

Case Study: Analysis of Banking application using Boundary Value Analysis

Unit – III 8 Hours

Equivalence Class Testing:

Equivalence classes, Equivalence Class Test Cases for the Triangle Problem, Equivalence Class Test Cases for the NextDate Function, Equivalence Class Test Cases for the Commission Problem, Guidelines and Observations.

Case Study: Analysis of Amazon E-Commerce application by using Equivalence class testing.

Unit – IV 8 Hours

Path Testing: DD Paths, Test Coverage Matrix, Basis Path Testing, Guidelines and Observations.

Unit – V 8 Hours

Data Flow Testing:

Define/use Testing, Slice Based Testing, Guidelines and Observations.

Case Study: Selenium and J automated testing tools.

Books

Text Books:

1. Paul C. Jorgensen: Software Testing, ACraftsman's approach, 3rd Edition, Auerbach Publications, 2008.

Reference Books:

1. Aditya P. Mathur: Foundations of Software Testing, Pearson Education, 2008.
2. Srinivasan Desikan, Gopalaswamy Ramesh, : Software Testing Principles and Practices, 2nd Edition, Pearson Education, 2007.

Course Outcome (COs)

At the end of the course, the student will be able to	Bloom's Level
1. **Define** the test case, testing and error taxonomy.	L1
Illustrate Test Cases for Triangle, Next Date and Commission Problem for Boundary Value Analysis.	L2
3. **Design** Test Cases for Triangle, Next Date and Commission Problem for Equivalence Class Testing , Decision Table Testing.	L3
4. **Demonstrate** the importance of Verification and Validation in improving the process of software development.	L3
5. **Examine** the testing, verification and validation for an application.	L4

Program Outcome of this course (POs)	PO No.
1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	1
2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences	2
3. **Modern Tool Usage:** Create, Select and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.	5
4. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams and in multidisciplinary settings.	9

Course delivery methods		Assessment methods	
1.	Chalk and talk	1.	Assignment, IA Tests
2.	Power Point Presentations	2.	Quizzes
3.	NPTEL , EDUSAT	3.	Course Seminar
4.	Class Room Exercise	4.	Course Activity

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Average of two assignments	Quiz/Seminar/Course Project	Total Marks
Maximum Marks: 50	15+15 = 30	10	10	50

- **Writing two IA tests is compulsory**
- **Minimum marks required to qualify for SEE : 20 out of 50**

Case Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2.	**Minimum marks required in SEE to pass: 40 (out of 100)**
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.

Robotic Process Automation

(Industry supported elective)

Course Code	**18CS645**	**Credits**	3
Course type	PE	**CIE Marks**	50 marks
Hours/week: L-T-P	3-0-0	**SEE Marks**	50 marks
Total Hours	40	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. To understand Basic Programming concepts and the underlying logic/structure
2. To Describe RPA , where it can be applied and how its implemented
3. To Describe the different types of variables, Control Flow and data manipulation techniques
4. To Understand Image, Text and Data Tables Automation
5. To Describe automation to Email and various types of Exceptions and strategies to handle

Pre-requisites: Unix system Programming and Computer Networks

Unit – I **8 Hours**

PROGRAMMING BASICS & RECAP

Programming Concepts Basics - Understanding the application - Basic Web Concepts - Protocols - Email Clients -. Data Structures - Data Tables - Algorithms - Software Processes - Software Design - Scripting - .Net Framework - .Net Fundamentals - XML - Control structures and functions - XML - HTML - CSS - Variables & Arguments

Unit – II **8 Hours**

RPA CONCEPTS

RPA Basics - History of Automation - What is RPA - RPA vs Automation - Processes & Flowcharts - Programming Constructs in RPA - What Processes can be Automated - Types of Bots - Workloads which can be automated - RPA Advanced Concepts - Standardization of processes - RPA Developemt methodologies - Difference from SDLC - Robotic control flow architecture - RPA business case - RPA Team - Proccess Design Document/Solution Design Document - Industries best suited for RPA - Risks & Challenges with RPA - RPA and emerging ecosystem.

Unit – III **8 Hours**

RPA TOOL INTRODUCTION & BASICS

Introduction to RPA Tool - The User Interface - Variables - Managing Variables - Naming Best Practices - The Variables Panel - Generic Value Variables - Text Variables - True or False Variables - Number Variables - Array Variables - Date and Time Variables - Data Table Variables - Managing Arguments - Naming Best Practices - The Arguments Panel - Using Arguments - About Imported Namespaces - Importing New Namespaces- Control Flow - Control Flow Introduction - If Else Statements - Loops - Advanced Control Flow - Sequences - Flowcharts - About Control Flow - Control Flow Activities - The Assign Activity - The Delay Activity - The Do While Activity - The If Activity - The Switch Activity - The While Activity - The For Each Activity - The Break Activity -

Data Manipulation - Data Manipulation Introduction - Scalar variables, collections and Tables - Text Manipulation - Data Manipulation - Gathering and Assembling Data

Unit – IV **8 Hours**

ADVANCED AUTOMATION CONCEPTS AND TECHNIQUES

Recording and Advanced UI Interaction - Recording Introduction - Basic and Desktop Recording - Web Recording - Input/Output Methods - Screen Scraping - Data Scraping - Scraping advanced techniques - Selectors - Selectors - Defining and Assessing Selectors - Customization - Debugging - Dynamic Selectors - Partial Selectors - RPA Challenge - Image, Text & Advanced Citrix Automation - Introduction to Image & Text Automation - Image based automation - Keyboard based automation - Information Retrieval - Advanced Citrix Automation challenges - Best Practices - Using tab for Images - Starting Apps - Excel Data Tables & PDF - Data Tables in RPA - Excel and Data Table basics - Data Manipulation in excel - Extracting Data from PDF - Extracting a single piece of data - Anchors - Using anchors in PDF.

Unit – V **8 Hours**

EMAIL AUTOMATION & EXCEPTIONAL HANDLING

Email Automation - Email Automation - Incoming Email automation - Sending Email automation - Debugging and Exception Handling - Debugging Tools - Strategies for solving issues - Catching errors.

Books

Text Book

1. Alok Mani Tripathi, Learning Robotic Process Automation, Publisher: Packt Publishing
Release Date: March 2018ISBN: 9781788470940

Reference Books

1. Frank Casale (Author), Rebecca Dilla (Author), Heidi Jaynes (Author), Lauren Livingston (Author), Introduction to Robotic Process Automation: a Primer, Institute of Robotic Process Automation.
2. Richard Murdoch, Robotic Process Automation: Guide To Building Software Robots, Automate Repetitive Tasks & Become An RPA Consultant
3. Srikanth Merianda, Robotic Process Automation Tools, Process Automation and their benefits: Understanding RPA and Intelligent Automation
4. https://www.uipath.com/rpa/robotic-process-automation

Course Outcome (COs)

At the end of the course, the student will be able to	**Bloom's Level**
1. **Apply** and Implement RPA.	L3
2. **Explain** Image, Text and Data Tables Automation	L2
3. **Explain** automation to Email and various types of Exceptions and strategies to handle.	L2

Program Outcome of this course (POs)	PO No.
1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	1
2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences	2

Course delivery methods		Assessment methods	
1.	Chalk and talk	1.	Quiz
2.	Power Point Presentations	2.	Assignment
3.	Demos	3.	IA Test
4.	Audio and Videos		

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Average of two assignments	Quiz/Seminar/Course Project	Total Marks
Maximum Marks: 50	15+15 = 30	10	10	50

- **Writing two IA tests is compulsory**
- **Minimum marks required to qualify for SEE : 20 out of 50**

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2.	**Minimum marks required in SEE to pass: 40 out of 100**
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.

Digital Image Processing

Course Code	**18CS651**	**Credits**	3
Course type	PE	**CIE Marks**	50 marks
Hours/week: L-T-P	3-0-0	**SEE Marks**	50 marks
Total Hours	40	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. To introduce the Digital Image Processing fundamentals
2. To present the different techniques of image enhancement in spatial domain.
3. To present the different techniques of image enhancement in frequency domain
4. To present the different techniques of image segmentation

Pre-requisites: Engineering Mathematics, Digital Logic

Unit I **8 Hours**

Introduction What is Digital Image Processing, The origin of digital Image Processing Examples of fields that use Image processing**,** Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Image Sampling and Quantization, Some Basic Relationships between Pixels-Neighbors and Connectivity of pixels in image.

Unit II **8 Hours**

Image Enhancement In The Spatial Domain: Some Basic Gray Level Transformations, Histogram Processing, Enhancement Using Arithmetic/Logic Operations, Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters, Combining Spatial Enhancement Methods.

Unit III **8 Hours**

Image Enhancement In Frequency Domain: Introduction to Fourier Transform & frequency domain, One dimensional & two dimensional Discrete Fourier Transform (DFT) and its inverse, Image filtering in frequency domain. Correspondence between filtering in spatial & frequency domain. Smoothing Frequency domain filters, Sharpening Frequency domain filters

Unit IV **8 Hours**

Image Enhancement In Frequency Domain contd..: Smoothing Frequency domain filters: Ideal low pass filter, Butterworth low pass, Gaussian low pass, Sharpening Frequency domain filters: Ideal high pass filter, Butterworth high pass, Gaussian high pass, The Laplacian in the frequency domain

Unit V **8 Hours**

Image Segmentation: Introduction, Detection of Discontinuities, Point Detection, line detection, Edge detection, Thresholding: Fondation, Role of illumination, Basic Global & Adaptive thresholding, Region based segmentation- Region growing, Region splitting and merging

Books

Text Books:

1. Rafael C Gonzalvez., Woods R E. and Eddins S L, Digital Image Processing, Prentice Hall, 2nd edition onwards.

Reference Books:

1. Milan Sonka,"Image Processing, analysis and Machine Vision", Thomson Press India Ltd, Fourth Edition.
2. Fundamentals of Digital Image Processing- Anil K. Jain, 2nd Edition, Prentice Hall of India
3. Jayaraman S, Veerakumar T, Esakkirajan S , Digital Image Processing, MGH, 2017.

Course Outcome (COs)

At the end of the course, the student will be able to	**Bloom's Level**
1. **Explain** the fundamentals of image processing.	L2
2. **Analyze** the different techniques of Image enhancement.	L4
3. **Illustrate** the different techniques of image segmentation.	L2

Program Outcome of this course (POs)	**PO No.**
1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	1
2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences	2
3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	3

Course delivery methods		**Assessment methods**	
1.	Chalk and talk	1.	Quiz
2.	Power Point Presentations	2.	Assignment
3.	Demos	3.	IA Test
4.	Audio and Videos		

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Average of two assignments	Quiz/Seminar/Course Project	Total Marks
Maximum Marks: 50	15+15 = 30	10	10	50

- **Writing two IA tests is compulsory**
- **Minimum marks required to qualify for SEE : 20 out of 50**

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2.	**Minimum marks required in SEE to pass: 40 (out of 100)**
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.

Information and Network Security

Course Code	**18CS652**	**Credits**	3
Course type	PE	**CIE Marks**	50 marks
Hours/week: L-T-P	3 – 0 – 0	**SEE Marks**	50 marks
Total Hours	40	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. Understand standard algorithms used to provide confidentiality, integrity and authenticity
2. Understand standard asymmetric encryption algorithms.
3. Distinguish key distribution and management schemes
4. Demonstrate encryption techniques to secure data in transit across data networks
5. Apply security applications in the field of Information technology

Pre-requisites: Fundamentals of Computer Networks

Unit – I **8 Hours**

Classical Encryption Techniques Symmetric Cipher Model:
Symmetric cipher model, security attacks, security services, security mechanisms, Substitution Techniques, transposition techniques The data encryption standard, Feistal cipher structure, Block cipher design Principles
Self-study: AES traditional block cipher.

Unit – II **8 Hours**

Public-Key Cryptography and RSA:
Principles of public-key cryptosystems. Publickey cryptosystems. Applications for public-key cryptosystems, requirements for publickey cryptosystems. Public-key cryptanalysis. The RSA algorithm, description of the algorithm, computational aspects, the security of RSA.
Self-study: Other Public-Key Cryptosystems: Diffie-hellman key exchange, The algorithm, key exchange protocols, man in the middle attack

Unit – III **8 Hours**

Key management and distribution
Symmetric key distribution using Symmetric encryption, Symmetric key distribution using asymmetric encryption, distribution of public keys, x.509 certificates.
Self-Study: Kerberos Motivation, Kerberos Version 4, Kerberos Version 5

8 Hours

Unit – IV

Wireless network security and Transport layer security

Wireless security, mobile device security, IEEE 802.11 Wireless LAN overview, Web Security Considerations, Secure Sockets Layer and transport layer security.

Self-Study: HTTPS Connection Initiation, Connection Closure. Secure Shell (SSH).

Unit – V **8 Hours**

Electronic Mail Security:

Pretty good privacy, notation, operational; description, S/MIME, RFC5322, Multipurpose internet mail extensions, S/MIME functionality, S/MIME messages, S/MIME certificate processing, enhanced security services, Domain keys identified mail, internet mail architecture, E-Mail threats, DKIM strategy, DKIM functional flow.

Books

Text Books

1. William Stallings, Cryptography and Network Security, Pearson 6th edition onwards.
2. William Stallings, Network Security Essentials, Pearson 3 rd edition onwards.

Reference Book

1. Atul Kahate: Cryptography and Network Security McGraw-Hill Second edition onwards.

Course Outcome (COs)

At the end of the course, the student will be able to	**Bloom's Level**
1. **Explain** different symmetric encryption techniques	L2
2. **Describe** different asymmetric encryption techniques	L2
3. **Identify** the security issues in the network and resolve it.	L3
4. **Apply** appropriate key distribution technique for symmetric and asymmetric encryption algorithms. And apply appropriate security model for wireless network security.	L3
5. **Describe** the functionalities of S/MIME and roll of DKIM.	L1

Program Outcome of this course (POs)	**PO No.**
1. **Engineering knowledge:** Apply the knowledge of mathematics science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problem.	1
2. **The Engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.	6
3. **Life Long learning:** Recognize the need for and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.	12

Course delivery methods		**Assessment methods**	
1.	Chalk and board	1.	Internal assessment
2.	PPT	2.	Assignment
3.	Video lectures	3.	Quiz
		4.	Seminar / project

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Average of two assignments	Quiz/Seminar/Course Project	Total Marks
Maximum Marks: 50	15+15 = 30	10	10	50

- **Writing two IA tests is compulsory**
- **Minimum marks required to qualify for SEE : 20 out of 50**

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2.	**Minimum marks required in SEE to pass: 40 (out of 100)**
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.

Introduction to Salesforce
(Industry Supported Elective)

Course Code	**18CS653**	**Credits**	3
Course type	PE	**CIE Marks**	50 marks
Hours/week: L-T-P	2-0-2	**SEE Marks**	50 marks
Total Hours	40	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. To introduce fundamentals of Salesforce and its components used for multiple domains.
2. To gain an understanding of the Salesforce terminologies and the different operations involved in constructing an informative system
3. To develop ability to access or populate tables as an object in Salesforce database to create new processes based on the demands by users.
4. To provide a solution to real world problems with the help of lightning tools and extensions using reusable components.

Pre-requisites: Software Industry and common sales parameters, Web Programming, basics of object-oriented Programming techniques

Unit – I **8 Hours**

Introduction: Getting Around the App, Salesforce Platform Basics: Get started with salesforce platform. Discover Use Cases for the Platform, Understand the Salesforce Architecture, Navigate Setup, Power Up with AppExchange, Data Model: Understand Custom & Standard Objects, Create Object Relationships, Work with Schema Builder, Lightning Experience: Get Your Bearings, Navigate Around, Work with List Views, Work with Your Data, Company-Wide Org Settings: Learn About Regional Settings, Discover Multiple Currency Settings

Unit – II **8 Hours**

Getting Your Organization Ready for Users: Lightning Experience Productivity: Elevate Your Daily Productivity, Work with Notes and Files, Manage Your Tasks, Events, and Email, Find Your Stuff with Search, Collaborate with Feeds and Groups, Analyze Your Data with Reports and Dashboards, Configuring Search Settings: Choose the Right Search Solution, Optimize Search Results, Setting Up Chatter (Classic): Get Started with Chatter, Enable Feed Tracking, Create Publisher Actions, Approve Records from the Feed, Develop a Rollout Strategy, Support a New Business Unit: Manage User Access, Manage Chatter, Modify Your Data Model, Configure an Email Letterhead and Template, Automate Your Business Process, Mobile Access with Salesforce1.

Unit – III **8 Hours**

Elementary SCTP Sockets: Interface Models, shutdown function, Notifications.
Setting Up and Managing Users: Managing Users and Introduction to Data Security, Activity Management: Activities: Tasks, Events, and Calendars Documentation.
Security and Data Access: Data Security, Who Sees What.

Object Customizations: Creating Picklist and Picklist Administration, Creating Formula Fields and Validation Rule, Working with Page Layouts, Working with Record Types, Introduction to Business Process, Maintaining Data Quality.
Managing Data: Import Wizards, Export Wizards, Use Data Loader To Export Data, Data Loader To Import.

Unit – IV **8 Hours**

Lightning Experience Customization: Customize the Lightning Experience user interface without writing any code, Reports and Dashboards: Introduction to Reports and Dashboards, Creating New Reports with the Report Builder, Running and Modifying Reports, Format Reports with Summary, Tabular, Matrix and Joined, Building Dashboards, Email Templates and Letterheads: Email Templates and LetterHeads, Automation: Difference Between Workflow Rules and Process Builder, Process Builder, Lead Automation.

Unit – V **8 Hours**

Managing the Support Process: Managing and Resolving Cases, Customizing a Support Process, Automating Support, Understanding the Salesforce Console for Service, Collaborating in the Service Cloud, Analyzing Support Data, Lightning App Builder: Build custom pages for Lightning Experience and the Salesforce mobile app quickly with point-and-click tools.

Books

Text Book

1. Salesforce CRM - The Definitive Admin Handbook,4th Edition, Paul Goodey, Copyright © 2016 Packt Publishing

Reference Books

1. Basics of salesforce- Salesforce Docs @salesforcedocs 19 Dec 2019
2. Best Practices for Implementing Salesforce CRM- SalesforceDocs @ salesforcedocs Dec 2019
3. Salesforce Solutions Help & Training by Bruce F. Magwn © 2012 Integration Technologies, Inc.

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	**Understand** the Salesforce terminologies to make use for products of different commodity	L1
2.	**Describe** the uses of Salesforce in the business world as a good promotional means for marketing the products.	L2
3.	**Apply** the techniques to retrieve the customer needs by means of Salesforce designs and options	L3
4.	**Categorize** and **build** the solutions with suitable mode of representation for the domain requirements using the lightning trends.	L3, L4

Program Outcome of this course (POs)	PO No.
1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	1
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	2
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	3
4. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.	6
5. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	10

Course delivery methods		Assessment methods	
1.	Lecture	1.	Assignments
2.	PPT	2.	Internal Tests
3.	Workshop-1– Salesforce (3 days)	3.	Quiz
4.	Workshop-2-Lightning (2 days)	4.	Course Activity

Scheme of Continuous Internal Evaluation (CIE):

The Total marks of CIE shall be 50 (Two tests of 30 marks (15 Marks Descriptive + 15 Marks Objective) each, Course project of 20 marks). The weight-age of CIE is as shown in the table below.

Component	2 IA-Tests (30 marks each) Average of two IA	Course Project (Assignment)	Total Marks
Maximum marks	30	20	50

- **Writing two IA tests is compulsory.**
- **Minimum qualifying marks for CIE: 20 marks.**

Scheme of Semester End Examination (SEE):	
1.	Industry Project Evaluation for 100 Marks. Examination of 100 marks for 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2.	Minimum marks required in SEE to pass:40 marks
3.	Industry project marks calculated by taking an average of both internal and industry side guides assessments.

CIE	SEE	TOTAL
50 Marks (30 IA Avg + 20 Course Project)	50 Marks (Industry assigned Project evaluation for 100 Marks which will be reduced to 50 Marks)	100 MARKS

Mobile Computing

Course Code	18CS654	Credits	3
Course type	PE	CIE Marks	50 marks
Hours/week: L-T-P	3-0-0	SEE Marks	50 marks
Total Hours	40	SEE Duration	3 Hours for 100 marks

Course Learning Objectives

1. To introduce the fundamental concepts of wireless networks and design considerations of mobile computing environment.
2. To familiarize with the concepts of location management, mobility management and tracking management of Cellular networks.
3. To familiarize with SMS, GSM and GPRS Technologies and Smart client Architecture

Pre-requisites: Fundamentals of Computer Networks

Unit – I 8 Hours

Introduction: PCS Architecture, Cellular Telephony: Advanced Mobile phone service, Global system for mobile communication, Cordless telephone and low tier PCS: Cordless Telephone, 2nd generation, Digital European Cordless Telephone, Personnel handy phone system, personnel access communication system, mobility management: Handoff, Intersystem handoff, Roaming management.
Self learning topics: Roaming management under SS7

Unit – II 8 Hours

GSM System: Overview, Architecture: Mobile Station, Base Station System, Network and switching Subsystem, Radio Interface, Location Tracking, Security, Data Services: GPRS, Mobility Management, GSM Location Update, Failure Restoration
Self learning topics: VLR Identification Algorithm.

Unit – III 8 Hours

GSM Short Message Service: SMS Architecture, SMS Protocol Hierarchy: Short message transfer layer, Short Message Relay Layer, connection sublayer, Mobile originated messaging, Mobile Terminated Messaging, DTE- DCE interface

Unit – IV 8 Hours

GPRS: Procedures, Billing, Wireless application Protocol, WAP UAprof, caching, 3rd Generation Mobile Services, WCDMA, DMA 2000, WAP Developer Toolkit, Wireless OS for 3G handset, 3rd generation systems.

Unit – V 8 Hours

Cellular Communication: The 3rd Generation(3G), The 3.5 Generation, 4th Generation, WLAN Standard, Physical Layer, MAC Layer, Frame Structure, Services, Bluetooth: Advantages, Applications, Protocol Stack, Tracking Services, Frame Structure, Hyperlan.

Books

Text Books:

1. Yi-Bing Lin, Imrich Chlamtac, Wireless and Mobile Architectures, Wiley Computer Publishing, Wiley Student Edition 2005 and onwards
2. Kumkum Garg, Mobile Computing Theory and Practice, Pearson Edition 2010 onwards.

Reference Books:

1. Martyn Mallick, Mobile and Wireless Design Essentials, Wiley Publications- 2016 print and onwards.
2. Jochen Schiller- Mobile communications, Pearson Education Publications, 2nd Edition onwards.

Course Outcome (COs)

At the end of the course, the student will be able to	Bloom's Level
1. **Explain** the architecture for mobile computing and its design considerations.	L2
2. **Describe** the working of SMS computing, its service and GPRS network architecture and its operations.	L2
3. **Compare** the different mobile technological concepts learnt to prepare a survey report on their performance analysis parameters.	L4

Program Outcome of this course (POs)	PO No.
1. Identify the different mobile technologies used in the present context and understand their working.	1,2
2. Understand and appreciate the use of mobile and its architectures in mobile applications development.	1,2

Course delivery methods		Assessment methods	
1.	Lecture & Board	1.	Assignments
2.	Power-point Presentation	2.	Quizzes
3.	Class Room Discussion	3.	Internal Assessment Tests
		4.	Course Seminar/Activity

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Average of two assignments	Quiz/Seminar/Course Project	Total Marks
Maximum Marks: 50	15+15 = 30	10	10	50

- **Writing two IA tests is compulsory**
- **Minimum marks required to qualify for SEE : 20 out of 50**

Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2.	**Minimum marks required in SEE to pass: 40 (out of 100)**
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.

Python Programming

Course Code	**18CS661**	**Credits**	3
Course type	OE	**CIE Marks**	50 marks
Hours/week: L-T-P	3 – 0 – 0	**SEE Marks**	50 marks
Total Hours	39	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. To acquire programming skills in core Python
2. To acquire Object Oriented Skills in Python
3. To develop the skill of designing Graphical user Interfaces in Python
4. To develop the ability to write database applications in Python

Pre-requisites: Computer Concepts and C Programming

Unit – I 8 Hours

Introduction to Python: Use IDLE to develop programs, Basic coding skills, working with data types and variables, working with numeric data, working with string data, Python functions, Boolean expressions, selection structure, iteration structure, Illustrative Programs, Exercises.

Unit – II 8 Hours

Other constructs: Define and use functions and modules, working with recursion, Basic skills for working with lists, work with a list of lists, work with tuples, work with dates and times, get started with dictionaries, Illustrative programs, Exercises.

Unit – III 7 Hours

Files and Exceptions: An introduction to file I/O, use text files, use CSV files, use binary files, Handle a single exception, handle multiple exceptions, Illustrative programs, Exercises

Unit – IV 8 Hours

Object Oriented Programming: Object Oriented Programming, An introduction to classes and objects, define a class, work with object composition, work with encapsulation, work with inheritance, override object methods, Illustrative programs, Exercises

Unit –V 8 Hours

Databases and GUI: An introduction to relational databases, SQL statements for data manipulation, Using SQLite Manager to work with a database, Using Python to work with a database, Creating a GUI that handles an event, working with components, Illustrative programs, Exercises

Books

Text Books:

1. Michael Urban and Joel Murach, Python Programming, Shroff/Murach, 2016

Reference Books:

1. Mark Lutz, Programming Python, O`Reilly, 4th Edition, 2010.

Course Outcomes (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	**Explain** basic principles of Python programming language.	L2
2.	**Apply** mechanisms of file and exception handling.	L3
3.	**Build** object oriented application for a given scenario.	L3
4.	**Develop** database and GUI solutions to address real world problems.	L3

	Program Outcomes of this course (POs)	**PO No.**
1.	**Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	3
2.	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.	5
3.	**Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	12

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Average of two assignments	Quiz/Seminar/Course Project	Total Marks
Maximum Marks: 50	15+15 = 30	10	10	50

- **Writing two IA tests is compulsory**
- **Minimum marks required to qualify for SEE : 20 out of 50**

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2.	**Minimum marks required in SEE to pass: 40 (out of 100)**
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.

Database Management System

Course Code	**18CS662**	**Credits**	3
Course type	OE	**CIE Marks**	50 marks
Hours/week: L-T-P	3 – 0 – 0	**SEE Marks**	50 marks
Total Hours	40	**SEE Duration**	3 Hours for 100 marks

Course Learning Objectives

1. To discuss and realize the importance of Database Architecture Design notations, ER Modeling, Mapping and Schema design.
2. To gain the knowledge Relational algebra and learn the use of SQL.
3. To introduce formal database design approach through normalization and discuss various normal forms.

Pre-requisites: Basic programming concepts

Unit – I 8 Hours

Introduction: Introduction to database, Characteristics of Database approach, Advantages of using DBMS approach, When not to use a DBMS; Actors on the scene, Workers behind the scene; Three-schema architecture and data independence.

Unit – II 8 Hours

Entity-Relationship Model: Using High-Level Conceptual Data Models for Database Design; An Example Database Application; Entity Types, Entity Sets, Attributes and Keys; Relationships, Relationship types, Roles and Structural Constraints; Weak Entity Types; ER-Relational mapping.

Unit – III 8 Hours

Relational Model and Relational Algebra: Relational Model Concepts; Relational Model Constraints and Relational Database Schemas; Update Operations, Dealing with constraint violations; Unary Relational Operations: SELECT and PROJECT; Relational Algebra Operations from Set Theory; Binary Relational Operations: JOIN and DIVISION;

Unit – IV 8 Hours

Database Design: Informal Design Guidelines for Relation Schemas; Functional Dependencies; Normal Forms Based on Primary Keys; General Definitions of Second and Third Normal Forms.

Unit – V 8 Hours

SQL: SQL Data Definition and Data Types; Specifying basic constraints in SQL; Schema change statements in SQL; Basic queries in SQL; More complex SQL Queries. Insert, Delete and Update statements in SQL.

Books

Text Books:

1. Elmasri and Navathe: Fundamentals of Database Systems, Addison-Wesley, 3rd edition and onwards.

2. Raghu Ramakrishnan and Johannes Gehrke: Database Management Systems, McGraw-Hill, 2nd edition and onwards.

Reference Books::

1. Silberschatz, Korth and Sudharshan: Data base System Concepts, Mc-GrawHill, 3rd edition and onwards.
2. C.J. Date, A. Kannan, S. Swamynatham: A Introduction to Database Systems, Pearson education, 5th edition and onwards.

Course Outcome (Cos)

At the end of the course, the student will be able to	Bloom's Level
1. **Explain** the basic concepts of Database systems and discuss DBMS architectures	L2
2. **Apply** the ER-Modelling concepts and design an ER-Model for given application scenario.	L3
3. **Apply** the concepts of Normalization and design database which eliminates all anomalies.	L3
4. **Demonstrate** knowledge of SQL in the form of Creating, Populating, Updating, Querying the database and Database connection and exception handling.	L5

Program Outcome of this course (POs)	PO No.
1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.	1
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	2
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	3
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	4
5. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	10

Course delivery methods		Assessment methods	
1.	Lecture & Board	1.	Assignments
2.	Power-point Presentation	2.	Quizzes
3.	Online Videos / Learning	3.	Internal Assessment Tests
4.	NPTEL / Edusat	4.	Course Seminar
5.	Class Room Exercises	5.	Course Project (Mini project)
		6.	Case Studies

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Average of two assignments	Quiz/Seminar/Course Project	Total Marks
Maximum Marks: 50	15+15 = 30	10	10	50

- **Writing two IA tests is compulsory**
- **Minimum marks required to qualify for SEE : 20 out of 50**

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2.	**Minimum marks required in SEE to pass: 40 (out of 100)**
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.

Data Structures

Course Code	**18CS663**	**Credits**	3
Course type	OE	**CIE Marks**	50 marks
Hours/week: L-T-P	3– 0 – 0	**SEE Marks**	50 marks
Total Hours:	38	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. To bring out the importance of data structures in a variety of applications.
2. To introduce linear (arrays, linked list, doubly linked list) and non linear data structures (Binary Tree, Heap).
3. To present the advantages and applications of hashing.

Pre-requisites: Basic computer concepts & C programming

Unit – I **8 Hours**

Basic Concepts: Pointers and Dynamic Memory Allocation, Recursion, Arrays, Dynamically Allocated Arrays, Structures and Unions, Recursion, Program examples

Self learning topics:Enumaration

Unit – II **7 Hours**

Stacks and queues: Stacks, Implementation of basic stack operations, Queues, Queues operations Converting infix to postfix expressions, Evaluation of Expressions.

Self learning topics: Applications of stack and Queues

Unit – III **8 Hours**

Linked lists: Singly Linked lists and Chains, Representing Chains in C, Additional List operations, Circular Linked Lists.

Unit – IV **8 Hours**

Trees: Introduction, Binary trees, Properties, Height of a binary tree, binary tree traversals, heaps, binary search trees, BST operations.

Self learning topics: Applications of Trees

Unit – V **7 Hours**

Hashing: Introduction, Hashing methods, Collision Resolution Techniques.

Books

Text Books:

1. Horowitz, Sahni, Anderson-Freed: Fundamentals of Data Structures in C, 2nd Edition, Universities Press, 2007 and onwards.
2. Data Structures: A Pseudocode Approach with C by Richard.F.Gilberg, Behrouz.A.Forouzan, 2nd edition 2007 and onwards.

Reference Books:

1. Yedidyah, Augenstein, Tannenbaum: Data Structures Using C and C++, 2nd Edition, Pearson Education, 2003 and onwards.
2. Debasis Samanta: Classic Data Structures, 2nd Edition, PHI, 2009 and onwards.

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	**Identify** the appropriate and optimal data structure for a specified application.	L1
2.	**Employ** the benefits of dynamic and static data structures implementations.	L3
3.	**Illustrate** the use of different non-linear data structures and their applications.	L3
4.	**Demonstrate** the use of techniques like hashing, trees and heaps in a variety of applications.	L3

Program Outcome of this course (POs)		PO No.
1.	**Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and Engineering sciences.	2
2.	**Design/Development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	3
3.	**Life-long learning:** Recognize the need for and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.	12

Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	Internal Assessment
2.	PPT Presentation	2.	Quiz
		3.	Assignment
		4.	Course Project/ Seminar

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Average of two assignments	Quiz/Seminar/Course Project	Total Marks
Maximum Marks: 50	15+15 = 30	10	10	50

- **Writing two IA tests is compulsory**
- **Minimum marks required to qualify for SEE : 20 out of 50**

Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2.	**Minimum marks required in SEE to pass: 40 (out of 100)**
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.

Object Oriented Programming with Java

Course Code	18CS664	Credits	3
Course type	OE	CIE Marks	50 marks
Hours/week: L-T-P	3-0-0	SEE Marks	50 marks
Total Hours	40	SEE Duration	3 Hours for 100 marks

Course Learning Objectives

1. Learn fundamental features of object oriented language and JAVA.
2. Demonstrate the features of object oriented programming such as encapsulation, inheritance and polymorphism to design and develop programs in Java
3. Understand exception handling mechanism supported in Java to handle run time errors.
4. Understand the concept of packages and interfaces in Java.
5. Understand string handling fundamentals in Java.

Pre-requisites: Basic programming concepts

Unit – I 8 Hours

An Overview of Java: Object-Oriented Programming, A First Simple Program, A Second Short Program, Two Control Statements, Using Blocks of Code, Lexical Issues, The Java Class Libraries, Data Types, Variables, and Arrays: Java Is a Strongly Typed Language, The Primitive Types, Integers, Floating-Point Types, Characters, Booleans, A Closer Look at Literals, Variables, Type Conversion and Casting, Automatic Type Promotion in Expressions, Arrays, A Few Words About Strings.

Unit – II 8 Hours

Operators: Arithmetic Operators, The Bitwise Operators, Relational Operators, Boolean Logical Operators, The Assignment Operator, The ? Operator, Operator Precedence, Using Parentheses, Control Statements: Java's Selection Statements, Iteration Statements, Jump Statements.

Unit – III 8 Hours

Introducing Classes: Class Fundamentals, Declaring Objects, Assigning Object Reference Variables, Introducing Methods, Constructors, The this Keyword, Garbage Collection, The finalize( ) Method, A Stack Class, A Closer Look at Methods and Classes: Overloading Methods, Using Objects as Parameters, A Closer Look at Argument Passing, Returning Objects, Recursion.

Unit – IV 8 Hours

Inheritance: Inheritance, Using super, Creating a Multilevel Hierarchy, When Constructors Are Called, Method Overriding, Dynamic Method Dispatch, Using Abstract Classes, Using final with Inheritance, The Object Class.

Interfaces: interface fundamentals, creating, implementing and using interfaces.

Packages: Package fundamentals, packages and member access, importing packages

Unit – V 8 Hours

Exception handling: the exception hierarchy, exception handling fundamentals, uncaught exceptions, handle errors gracefully, multiple catch, catching subclass exceptions, nested try, throwing exception,

throwable, using finally and throws, built-in exceptions, new exception features in JDK7, creating exception subclasses.

String Handling: String fundamentals, constructors, String related language features, length(), obtaining characters within a String, String comparison, indexOf() and lastIndexOf(), obtaining a modified String, Changing Case

Books

Text Books:

1. Herbert Schildt& Dale Skrien, "Java Fundamentals A Comprehensive Introduction", TMH. Special Indian edition.

Reference Books:

1. Kathy Sierra & Bert Bates, "Head First Java", O'Reilly, 2nd Edition and onwards.
2. E Balagurusamy, Programming with Java A primer, Tata McGraw Hill

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	**Identify** classes, objects, members of a class and relationships among them needed for a specific problem	L2
2.	Write Java application programs using OOP principles and proper program structuring	L3
3.	**Demonstrat**e the concepts of polymorphism and inheritance	L3
4.	Write Java programs to implement error handling techniques using exception handling	L3
5.	Write Java programs to implement string handling.	L3

	Program Outcome of this course (POs)	PO No.
1.	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	1
2.	**Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	3
3.	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	12

Course delivery methods		Assessment methods	
1.	Lecture & Board	1.	Assignments
2.	Power-point Presentation	2.	Quizzes
3.	Online Videos / Learning	3.	Internal Assessment Tests
4.	Class Room Exercises		

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Average of two assignments	Quiz/Seminar/Course Project	Total Marks
Maximum Marks: 50	15+15 = 30	10	10	50
➢ **Writing two IA tests is compulsory** ➢ **Minimum marks required to qualify for SEE : 20 out of 50**				

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2.	**Minimum marks required in SEE to pass: 40 (out of 100)**
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.

Machine Learning Laboratory

Course Code	**18CSL67**	**Credits**	1.5
Course type	LAB	**CIE Marks**	25 marks
Hours/week: L-T-P	0-0-3	**SEE Marks**	25 marks
Total Hours:	36	**SEE Duration**	3 Hours for 50 marks

Course learning objectives

1. Make use of data sets in implementing the machine learning algorithms
2. Implement the machine learning concepts and algorithms

Pre-requisites: Probability, Python Programming

List of experiments

PART-A (Core Concepts)

1. Implement DFID algorithm and compare its performance with DFS and BFS algorithm
2. Implement Best-First Search algorithm
3. Implementation of AND/OR/NOT Gate using single layer perceptron.
4. Implementation of XOR Gate using
    a) Multi-layer perceptron/Error back propagation
    b) Radial Basis Function Network
5. Implement Hebbian learning rule and Correlation learning rule

PART-B (Applications)

1 Implement Find-S and candidate elimination algorithms
2 Build a linear regression model housing prices
3 Implement spam detection using Naïve Bayes Algorithm
4 Implement hand writing classification using Support Vector Machines
5 Implement FP-tree for finding co-occurring words in a twitter feed

Books

1. Ben Coppin, Artificial Intelligence Illuminated, Jones and Bartlett, 2004
2. Peter Harrington, Machine Learning in Action, Manning, 2012
3. Luis G. Serrano, Grokking Machine Learning, Manning, 2020
4. Mostafa Samir Abd El-Fattah, How Machine Learning Works, Manning, 2020

E-Resources

1. www.manning.com/books

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	**Demonstrate** the implementation procedures for the machine learning algorithms.	2
2.	**Apply** appropriate data sets to the Machine Learning algorithms.	3
3.	Identify and **apply** Machine Learning algorithms to solve real world problems.	3

	Program Outcome of this course (POs)	PO No.
1.	**Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems	1
2.	**Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and Engineering sciences.	2
3.	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.	5

Assessment methods	
1.	Conduct of the lab
2.	Journal Evaluation
3.	Course Project Evaluation

Scheme of Continuous Internal Evaluation (CIE):

Components	Conduct of the lab	Journal submission	Lab project	Total Marks
Maximum Marks:25	10	10	5	25
➢ Submission and certification of lab journal is compulsory to qualify for SEE. ➢ **Minimum marks required to qualify for SEE : 10 marks out of 25**				

Scheme of Semester End Examination (SEE):			
1.	It will be conducted for 50 marks of 3 hours / 2 hrs duration. It will be reduced to 25 marks for the calculation of SGPA and CGPA.		
2.	Only one experiment to be conducted.		
3.	**Minimum marks required in SEE to pass: 20/50 (10/25)**		
4.	Initial write up	10 marks	50 marks
	Conduct of experiments, results and conclusion	20 marks	
	One mark question	10 marks	
	Viva- voce	10 marks	
5.	Viva-voce shall be conducted for individual student and not in a group.		

Embedded Systems and IoT Laboratory

Course Code	**18CSL68**	**Credits**	1.5
Course type	LAB	**CIE Marks**	25 marks
Hours/week: L-T-P	0-0-3	**SEE Marks**	25 marks
Total Hours:	36	**SEE Duration**	3 Hours for 50 marks

Course learning objectives

1. To present the techniques of interfacing LED, LCD, DAC and Sensors with 8051 Microcontroller
2. To present the techniques of interfacing DHT11, LDR and Relay with Arduino/ Raspberry Pi SBC

Pre-requisites: Basic Electronics, Computer Organization, Digital Electronics

List of experiments

1. Develop a 8051 'C' program to implement MOD-4 counter on LEDs connected to Port 2 using
   i) Software delay
   ii) Hardware delay

   to generate some delay.
2. Develop 8051 'C' program to generate the following waveforms using DAC interface
   i) Square/ Rectangular
   ii) Triangular
3. Develop 8051 'C' program to interface 2x16 LCD display and to display two strings.
4. Develop 8051 'C' program to display the temperature sensor output from ADC 0809 on the LCD.
5. Develop an Embedded 'C' program to blink the LED connected to Arduino SBC upon pressing a push button and to control the relay through Arduino SBC.
6. Develop an Embedded 'C' program to interface the sensors DHT11 and LDR to Arduino SBC and display the data acquired from sensors on 16 × 4 LCD.
7. Develop a Python program to interface the sensors DHT11 to Raspberry Pi SBC and upload the acquired data from sensors to Thingspeak cloud.
8. Develop a Python program to retrieve data from the Thingspeak cloud using Raspberry Pi SBC and display the same on Monitor.

Books

1. Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin D. McKinlay, The 8051 Microcontroller and Embedded Systems: Using Assembly and C, Pearson, Second Edition onwards.
2. Arshdeep Bagha, Vijay Madishetti, Internet of Things A Hands- on Approach, Universities Press, 2014.
3. David Hanes, Gonzalo S, Patrick G, Rob Barton, Jermone Henry, Rowan T, IoT Fundamentals Networking Technologies, Protocols, and Use Cases for the Internet of Things, Pearson (Cisco press) 2018.

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	**Demonstrate** the ability to develop 8051 'C' program for interfacing LED, LCD, DAC and Sensors with 8051 Microcontroller.	L3
2.	**Demonstrate** the ability to develop simple IoT applications using Arduino/ Raspberry Pi SBC.	L3

	Program Outcome of this course (POs)	**PO No.**
1.	**Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	3
2.	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.	5
3.	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	10

Assessment methods	
1.	Conduct of the lab
2.	Journal Evaluation
3.	Course Project Evaluation

Scheme of Continuous Internal Evaluation (CIE):

Components	Conduct of the lab	Journal submission	Lab project	Total Marks
Maximum Marks:25	10	10	5	25
➢ Submission and certification of lab journal is compulsory to qualify for SEE. ➢ **Minimum marks required to qualify for SEE : 10 marks out of 25**				

Scheme of Semester End Examination (SEE):			
1.	It will be conducted for 50 marks of 3 hours / 2 hrs duration. It will be reduced to 25 marks for the calculation of SGPA and CGPA.		
2.	Only one experiment to be conducted.		
3.	**Minimum marks required in SEE to pass: 20/50 (10/25)**		
4.	Initial write up	10 marks	50 marks
	Conduct of experiments, results and conclusion	20 marks	
	One mark question	10 marks	
	Viva- voce	10 marks	
5.	Viva-voce shall be conducted for individual student and not in a group.		

Employability Skills – II

Course Code		**Credits**	
Course type	MNC	**CIE Marks**	50 marks
Hours/week: L-T-P	3 – 0 – 0	**SEE Marks**	
Total Hours:	30	**SEE Duration**	3 Hours for 100 marks

Course learning objective

The course is designed to develop the employability skills of a student.

Unit – I **6 Hours**

Quantitative Aptitude: Time, Speed and Distance (3)
Verbal Ability: Change of Speech and Voice (3)

Unit – II **6 Hours**

Quantitative Aptitude: Permutation and Combination (2)
Logical Reasoning: Coding and Decoding (1), Syllogisms (1.5)
Soft Skills: Interview Skills (1.5)

Unit – III **6 Hours**

Quantitative Aptitude: Probability (2),
Logical Reasoning: Data Sufficiency (1), Clocks (1.5), Calendars (1.5)

Unit – IV **6 Hours**

Quantitative Aptitude: Alligation and Mixtures (2), Data Interpretation (1)
Logical Reasoning: Cubes (1)
Verbal Ability: Closet Test (2)

Unit – V **6 Hours**

Quantitative Aptitude: Simple and Compound Interest (2), Ages (1)
Soft Skills: Resume Writing (1.5), Group Discussions – Mock (1.5)

Books

Text Books:

1. How to prepare for Quantitative Aptitude for CAT & other Management Examinations, Arun Sharma, McGraw Hill Education(India) Private Limited, 4th Edition, 2018.
2. How to prepare for Logical Reasoning for CAT & other Management Examinations, Arun Sharma, McGraw Hill Education(India) Private Limited, 8th Edition, 2018.
3. How to prepare for Verbal Ability and Reading Comprehension for CAT & other Management Examinations, Arun Sharma, McGraw Hill Education(India) Private Limited, 8th Edition, 2018.

4. How to prepare for Data Interpretation for CAT & other Management Examinations, Arun Sharma, McGraw Hill Education(India) Private Limited, 5th Edition, 2018.

Course Outcomes (COs)

At the end of the course, the student will be able to		**Bloom's Level**
1.	Clear the Aptitude round of recruiters during placements	L3
2.	Perform confidently during the GD and Interview process	L4
3.	Develop resumes that are grammatically correct and written in Business English	L5
4.	Develop behaviors that are appropriate for a professional	L5

Course delivery methods		**Assessment methods**	
1.	Black Board Teaching	1.	Internal Assessment
2.	Power Point Presentation	2.	Assignment
3.	Class Room Exercise	3.	Quiz

Scheme of Continuous Internal Evaluation (CIE):

Components	Average of best two IA tests out of three	Average of two Online Tests	Class Participation	Total Marks
Maximum Marks: 50	25	15	10	50

- **Writing two IA tests is compulsory.**
- **Minimum marks required to qualify for SEE : 20 out of 50**

Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2.	**Minimum marks required in SEE to pass: 40 (out of 100)**
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.

7th Semester Detailed Syllabi

Entrepreneurship and Management

Course Code	**18CS71**	**Credits**	03
Course type	HS	**CIE Marks**	50 marks
Hours/week: L-T-P	3–0–0	**SEE Marks**	50 marks
Total Hours:	40	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. To understand the Characteristics of management, Role of Management, Importance and Purpose of Planning, Organizing, Staffing, directing and Controlling
2. To understand Meaning of entrepreneur, Development of Entrepreneurship.
3. To understand Source of New Idea, Ideas into Opportunities. Creative Problem Solving
4. To apply the aggregate planning strategies.
5. Understanding of the different Schemes like Make in India, Start Up India, Digital India

Unit - I — 8 Hours

Management: Introduction, nature and characteristics of Management, Scope and Functional areas of management, Levels of management.

Planning: Nature, importance and purpose of planning process, Types of plans, Decision making, Importance of planning, steps in planning

Organizing: Nature and purpose of organization, Principles of organization, Types of organization, Span of control.

Self-learning topics: Management as a science, art of profession

Unit - II — 8 Hours

Staffing: Nature and importance of staffing, Process of Selection & Recruitment, Training Methods.

Directing: Meaning and nature of directing, Leadership styles, Motivation Theories, Communication-Meaning and importance.

Controlling: Meaning and steps in controlling, Essentials of a sound control system, Methods of establishing control.

Unit - III — 8 Hours

Entrepreneur: Meaning of entrepreneur: Evolution of the concept: Functions of an Entrepreneur, Types of Entrepreneur, Concept of Entrepreneurship, Evolution of Entrepreneurship, The Entrepreneurial Culture and Stages in entrepreneurial process.

Creativity and Innovation: Creativity, Source of New Idea, Ideas into Opportunities, Creative Problem Solving: Heuristics, Brainstorming, Synectics, Significance of Intellectual Property Rights.

Self-learning topics: Case studies of Entrepreneurs

Unit - IV **8 Hours**

Micro, Small and Medium Enterprises [MSMEs] and Institutional Support: Business environment in India**,** Role of MSMEs**,** Government policies towards MSMEs, Impact of Liberalization, Privatization and Globalization on MSMEs.

Institutional support: NSIC, TECKSOK, KIADB, KSSIDC, SIDBI; KSFC

Self-learning topics: Make in India, Start Up India, Digital India

Unit - V **8 Hours**

Preparation of project: Meaning of project, project identification, project selection, project report, need and significance of project report, contents, formulation, guidelines by planning commission for project report.

Enterprise Resource Planning: Meaning and Importance- ERP and Functional areas of Management – Marketing / Sales- Supply Chain Management – Finance and Accounting – Human Resources – Types of reports and methods of report generation

Books

1. Henry Koontz: ―Essentials of Management‖ Latest Edition
2. Poornima.M. Charantimath: Entrepreneurship Development – Pearson Education – 2014 Edition
3. Donald Kuroki and Richard ―Entrepreneurship in new Millennium‖ South Western Carnage Learning
4. N V R Naidu, ―Management & Entrepreneurship‖- IK International, 2008
5. P.C. Tripathi, P.N. Reddy ―Principles of Management‖ — Tata McGraw Hill.
6. Dr.M.M. Munshi, Prakash Pinto and Ramesh Katri ―Entrepreneurial Development‖ Himalaya Publishing House, 2016.

Course Outcome (COs)

At the end of the course, the student will be able to	**Bloom's Level**
1. To explain the Functions of management, Characteristics of Management, Importance and Purpose of Planning, organizing, staffing, directing and controlling	L1
2. To explain Meaning of entrepreneur, Development of Entrepreneurship and steps in developing entrepreneurship.	L2, L3
3. To describe Source of New Idea, Ideas into Opportunities. Creative Problem Solving etc.	L4
4. Describe the different Schemes like TECKSOK, KIADB etc. and also Make in India, Start Up India, Digital India concepts	L2, L3

Program Outcome of this course (POs)	**PO No.**
1. An ability to communicate effectively.	7
2. A recognition of the need for and an ability to engage in lifelong learning.	9
3. An ability to use the techniques, skills, and modern engineering tools necessary for	11

	Course delivery methods		Assessment methods
1.	Lecture	1.	Quiz
2.	Videos	2.	IA
3.	PPT	3.	Assignment/case study presentation
4.	Field study		

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Average of two assignments	Quiz/Seminar/Course Project	Total Marks
Maximum Marks: 50	15+15 = 30	10	10	50

- **Writing two IA tests is compulsory**
- **Minimum marks required to qualify for SEE : 20 out of 50**

Self-Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2.	**Minimum marks required in SEE to pass: 40 out of 100**
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.

Network Programming

Course Code	18CS72	Credits	3
Course type	PC	CIE Marks	50 marks
Hours/week: L-T-P	3-0-0	SEE Marks	50 marks
Total Hours	40	SEE Duration	3 Hours for 100 marks

Course learning objectives

1. Illustrate working with Network Programming on Unix compliant operating systems.
2. Demonstrate programming with TCP, UDP and SCTP.
3. Evaluate advanced Socket Programming APIs.

Pre-requisites: Unix system Programming and Computer Networks

Unit – I — 8 Hours

Introduction: Introduction, Client/server communication, OSI Model, BSD Networking history, Test Networks and Hosts, Unix Standards, 64-bit architectures.
Transport Layer: TCP, UDP and SCTP, TCP Connection Establishment and Termination.

Self learning topics: TCP/IP Protocols in nut shell.

Unit – II — 8 Hours

Sockets Introduction: Introduction, Socket Address Structures, Value-Result Arguments, Byte Ordering and Manipulation Functions.
Elementary TCP Sockets: socket, connect, bind, listen, accept, fork and exec, Concurrent Server design, getcsockname and getpeername functions.
Self learning topics: TCP Echo Client/Server Functions.

Unit – III — 8 Hours

Elementary UDP Sockets: recvform and sendto Functions, UDP Echo Client/Server- main, dg_echo and dg_cli Functions, Lost Datagrams, Verifying received Responses, Server Not Running, connect Function with UDP, Lack of Flow control with UDP, Determining Outgoing Interface with UDP, TCP and UDP Echo Server using select.
Elementary SCTP Sockets: Interface Models, shutdown function, Notifications.
Self learning topics: STCP One-to-Many-Style Streaming Echo Client and Server main Functions.

Unit – IV — 8 Hours

Advanced Sockets 1
Ipv4 and IPv6 Interoperability: IPv4 Client and IPv6 Server, IPV6 Client ad IPv4 Server, IPv6 Address-Testing Macros, Source Code Portability
Daemon Processes: syslogd Daemon , syslog Function.
Self learning topics: daemon_init Function, inetd Daemon daemon_inetd Function.

Unit – V — 8 Hours

Advanced Sockets 2
Broadcasting: Introduction, Broadcast Addresses, Unicast vs Broadcast, dg_cli Function using Broadcasting, Race Conditions.
Multicasting: Introduction, Multicast Addresses, Multicast vs Broadcast on a LAN, Multicast on a WAN, Source-Specific Multicast.

Self learning topics: Multicast Socket Options , SNTP

Books

Text Book

1. W. Richard Stevens, Bill Fenner, Andrew M. Rudoff: "UNIX Network Programming". Volume 1, Third Edition, Pearson 2004 and onwards.

Reference Books

1. Barry Nance: "Network Programming in C", PHI 2002 3.Bob Quinn, Dave Shute: "Windows Socket Network Programming", Pearson 2003 and onwards.
2. Richard Stevens: "UNIX Network Programming". Volume 2, Second Edition 2006 and onwards.

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	**Explain** the basics of Unix Network Programming.	L2
2.	**Develop** networking applications that communicate with each other using TCP, UDP and SCTP.	L3
3.	**Demonstrate** use of APIs for advanced socket programming concepts.	L3

Program Outcome of this course (POs)		PO No.
1.	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	1
2.	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences	2
3.	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	3

Course delivery methods		Assessment methods	
1.	Chalk and talk	1.	Quiz
2.	Power Point Presentations	2.	Assignment
3.	Demos	3.	IA Test
4.	Audio and Videos		

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Average of two assignments	Quiz/Seminar/Course Project	Total Marks
Maximum Marks: 50	15+15 = 30	10	10	50

- **Writing two IA tests is compulsory**
- **Minimum marks required to qualify for SEE : 20 out of 50**

Self-Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2.	**Minimum marks required in SEE to pass: 40 out of 100**
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.

Distributed Computing

Course Code	18CS73	Credits	04
Course type	PC	CIE Marks	50 marks
Hours/week: L-T-P	3-2-0	SEE Marks	50 marks
Total Hours	50	SEE Duration	3 Hours for 100 marks

Course learning objectives

1. To learn Basic Concepts of Distributed Systems
2. To understand File Sharing, Distributed File System implementation
3. To understand the concepts of Cryptanalysis, Access control
4. To learn Basic concepts of Cloud Computing

Pre-requisites: Basic Computer Concepts, Operating Systems.

Unit – I 10 Hours

Characterization of Distributed Systems: Introduction, Examples of Distributed Systems, Challenges: Heterogeneity, Openness, Security, Scalability, Failure Handling.
System Model: Architectural Models, Fundamental models.
Self-learning topics: Security Models

Unit – II 10 Hours

Inter Process Communication: Introduction, API for Internet Protocols, External Data Representation and Marshalling, Client – Server Communication.
Distributed Object and RMI: Introduction, Communication between Distributed Objects, RPC, Events and Notifications.

Unit – III 10 Hours

Distributed File System: Introduction, File Service architecture.
Security in distributed systems: Introduction, Overview of security techniques: Cryptography, Certificates, Access control. Cryptographic Algo: Symmetric: Ex Substitution algo. , Asymmetric: RSA.

Unit – IV 10 Hours

Time and Global States: Introduction, Clocks, events and process status, Synchronizing physical clocks, Logical time and logical clocks, Global states.
Coordination and Agreement: Introduction, Distributed mutual exclusion, Elections.

Unit – V 10 Hours

Introduction to Cloud Computing: Introduction, Network Centric computing and Network Centric Content, Peer to Peer Systems, Cloud Computing: An old idea Whose Time has Come,
Cloud Computing: Delivery Models and Services, Ethical Issues in Cloud Computing, Cloud Vulnerabilities, Major Challenges Faced by Cloud Computing.
Self-learning topics: Case Studies: Amazon Web Studies

Books

Text Books

1. George Coulouris, Jean Dollimore, Tim Kindberg: Distributed Systems Concepts and Design, Pearson Education, Third edition
2. Dan Marinescu : Cloud Computing Theory and Practice, ELSEVIER

Reference Books

1. Kai Hwang, Geofrey C, Fox, Jack J, Dongarra: Distributed and Cloud Computing From Parallel processing to the Internet of Things.
2. Sunita Mahajan, Seema Shah: Distributing Computing, Published by Oxford University press 2010.

Course Outcome (COs)

At the end of the course, the student will be able to**:**		**Bloom's Level**
1.	**Explain** the Shared memory concepts.	L2
2.	**Explain** the advantages of Distributed File Systems.	L2
3.	**Analyze** mechanisms to manage security in Distributed systems.	L4

	Program Outcome of this course (POs)	**PO No.**
1.	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	1
2.	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	2
3.	**Design/Development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	3

Course delivery methods		**Assessment methods**	
1.	Lecture	1.	Assignments
2.	PPT	2.	Internal Tests
		3.	Quiz
		4.	Course Activity

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Average of two assignments	Quiz/Seminar/Course Project	Total Marks
Maximum Marks: 50	15+15 = 30	10	10	50

- **Writing two IA tests is compulsory**
- **Minimum marks required to qualify for SEE : 20 out of 50**

Self-Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2.	**Minimum marks required in SEE to pass: 40 out of 100**
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.

Cloud Computing

Course Code	**18CS741**	**Credits**	03
Course type	PE	**CIE Marks**	50 marks
Hours/week: L-T-P	3 – 0 – 0	**SEE Marks**	50 marks
Total Hours	40	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. To understand various basic concepts related to cloud computing technologies
2. To learn how to use Cloud Services and provide solutions for business process management
3. To understand the concepts related to virtualization technology
4. To get acquainted with various cloud simulation tools

Pre-requisites: Distributed Computing

Unit – I 8 Hours

Introduction: Business and IT perspective, Cloud and virtualization, Cloud services requirements, cloud and dynamic infrastructure, cloud computing characteristics, cloud adoption.
Cloud Deployment models: Cloud characteristics, Measured Service, Cloud deployment models, security in a public cloud, public verses private clouds, cloud infrastructure self-service.

Unit – II 8 Hours

Cloud as a service: Gamut of cloud solutions, principal technologies, cloud strategy, cloud design and implementation using SOA, Conceptual cloud model, cloud service defined.
Cloud solutions: Cloud ecosystem, cloud business process management, cloud service management, cloud stack, computing on demand, cloud sourcing.

Unit – III 8 Hours

Cloud virtualization technology: Virtualization defined, virtualization benefits, server virtualization, virtualization for x86 architecture, Hypervisor management software, Logical partitioning, VIO server, Virtual infrastructure requirements. Storage virtualization, storage area networks, network attached storage, cloud server virtualization.

Unit – IV 8 Hours

Cloud Management: Resiliency, Provisioning, Asset management, cloud governance, high availability and disaster recovery, charging models, usage reporting, billing and metering.

Unit – V 8 Hours

Cloud Computing with the Titans: Google, EMC, NetApp. Microsoft, Amazon, Salesforce.com, IBM.

Books

Text Book

1. Cloud Computing by Dr. Kumar Saurabh, Wiley India, 2011 and onwards.

2. Cloud Computing a practical Approach by Anthony T. Velte, Tobe J. Velte and Robert Elsenpeter, McGrawHill 2010 and onwards.

Reference Book

1. Cloud Computing Principles and Paradigms by RajkumarBuyya, Wiley India 2011 and onwards.

Course Outcome (COs)

At the end of the course, the student will be able to	**Bloom's Level**
1. **Discuss** cloud computing and control considerations within cloud computing environments.	L2
2. **Identify** various cloud services.	L2
3. **Explain** various concepts related to virtualization.	L2
4. **Demonstrate** of various cloud simulation tools.	L3

Program Outcome of this course (POs)	**PO No.**
1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	1
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	2
3 **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.	8

Course delivery methods		**Assessment methods**	
1.	Chalk and board	1.	Internal assessment
2.	PPT	2.	Assignment
3.	Video lectures	3.	Quiz
		4.	Seminar / project

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Average of two assignments	Quiz/Seminar/Course Project	Total Marks
Maximum Marks: 50	15+15 = 30	10	10	50

- **Writing two IA tests is compulsory**
- **Minimum marks required to qualify for SEE : 20 out of 50**

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2.	**Minimum marks required in SEE to pass: 40 out of 100**
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.

Soft Computing

Course Code	18CS742	Credits	03
Course type	PE	CIE Marks	50 marks
Hours/week: L-T-P	3-0-0	SEE Marks	50 marks
Total Hours:	40	SEE Duration	3 Hours for 100 marks

Course learning objectives

1. To introduce the principles behind soft computing techniques.
2. To design and develop system that use Neural Network and Fuzzy Logic.
3. To introduce genetic approach in solving computationally hard problems.

Pre-requisites: Discrete Mathematical Structures, Probability and Statistics

Unit – I 08 Hours

Introduction: Neural networks, Application Scope of Neural Networks, Fuzzy Logic, Genetic Algorithm, Hybrid Systems, Soft Computing.

Artificial Neural Network: An Introduction, Fundamental Concepts, Evolution of Neural Networks, Basic Models of Artificial Neural Networks, Important Terminologies of ANNs, McCulloch- Pitts Neuron, Linear Separability, Hebb Network.

Unit – II 08 Hours

Supervised Learning Network: Perceptron Networks: Perceptron Learning Rule, Perceptron Training Algorithm for single Output Classes, Adaptive Linear Neuron (Adaline): Delta Rule for Single Output Unit, Back-Propagation Network..

Associative Memory Networks: Bidirectional Associative Memory (BAM), Hopfield Networks.

Unit – III 08 Hours

Introduction to Fuzzy Logic, Classical Sets and Fuzzy Sets: Introduction to Fuzzy Logic, Classical Sets (Crisp Sets), Fuzzy Sets, Properties of Fuzzy sets.

Classical Relations and Fuzzy Relations: Classical Relation: Operations on Classical Relations, Fuzzy Relations: Cardinality of Fuzzy Relations, Operations on Fuzzy Relations, Properties of Fuzzy Relations, Fuzzy Composition.

Unit – IV 08 Hours

Membership Functions: Features of the Membership Functions, Fuzzification, Methods of Membership Value Assignments.

Defuzzification: Defuzzification Methods.

Unit – V 08 Hours

Genetic Algorithm: Introduction, What are Genetic Algorithm?, Why Genetic Algorithms?, Genetic Algorithm and Search Space: Evolution and Optimization, Basic Terminologies in Genetic Algorithms, Operators in Genetic Algorithms: Encoding, Selection, Crossover (Recombination), Mutation.

Books

Text Book

1. S.N. Sivanandam, S.N. Deepa , Principles of Soft Computing, 2nd Edition Wiley Publisher.

Reference Book

1. Patnaik, Srikanta, Zhong, Baojiang (Eds.), Soft Computing Techniques in Engineering Applications, Springer 2014.

Course Outcome (COs)

At the end of the course, the student will be able to**:**	**Bloom's Level**
1. Design Neural Network to solve problems in a variety of engineering domains.	L6
2. Design systems that employ fuzzy control approach.	L6
3. Device systems that employ genetic algorithm and demonstrate their working.	L3

Program Outcome of this course (POs)	**PO No.**
1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	1
2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	2

Course delivery methods		**Assessment methods**	
1.	Lecture	1.	Assignments
2.	PPT	2.	Internal Tests
		3.	Quiz
		4.	Course Activity

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Average of two assignments	Quiz/Seminar/Course Project	Total Marks
Maximum Marks: 50	15+15 = 30	10	10	50

- **Writing two IA tests is compulsory**
- **Minimum marks required to qualify for SEE : 20 out of 50**

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2.	**Minimum marks required in SEE to pass: 40 out of 100**
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.

Block Chain Management

Course Code	18CS743	Credits	03
Course type	PE	CIE Marks	50 marks
Hours/week: L-T-P	3-0-0	SEE Marks	50 marks
Total Hours	40	SEE Duration	3 Hours for 100 marks

Course learning objectives

1. To introduce basics of blockchain
2. To create Smart contract with Ethereum
3. To design Web UI for decentralized apps
4. To implement Identity, privacy and security techniques

Pre-requisites: Distributed Systems

Unit – I 08 Hours

On Decentralization: Why decentralization matters Examples of failures due to centralized systems Some of the half-measures used to fix centralization

Docker and Cryptography: Fundamental cryptography concepts: symmetric keys, asymmetric keys and hashes, Utilizing OpenSSL to understand cryptography concepts,Using Docker and Docker Compose to deploy simple applications

Blockchain Revolution: Public blockchains, and the problem they solve Shortcomings of public blockchains addressed by permissioned blockchains, Components of a typical blockchain

Unit – II 08 Hours

Blockchain basics: From Bitcoin to Blockchain; Blockchain programming; UML blockchain design models; Blockchain node installation and management

Smart contracts: The concept of a smart contract; Design of a smart contract; Development of smart contract code; Deploying and testing the smart contract; Decentralized airline system use case; Airlines smart contract; Motivating decentralized scenarios; Smart contract design considerations; Best practices

Unit – III 08 Hours

Techniques for trust and integrity: Essentials of trust and integrity; Implementing trust intermediation; Testing; Establishing trust with modifiers, require(), revert(), and assert(); Best practices

From smart contracts to Dapps: Preliminary concepts; Dapp development using the Truffle IDE; Installing the Ganache test chain; Smart contract development; Dapp web application development; Introspection; Best practices

Unit – IV 08 Hours

Security and privacy: Deploying smart contracts on Ropsten; Cryptography basics; Application of public key cryptography; Hashing basics; Application of secure hashing; Introspection; Best practices

On-chain and off-chain data: On-chain data; Blind auction use case; Off-chain data: External data sources; ASK airline system; Introspection; Best practices

Unit – V 08 Hours

Web3 and a channel Dapp; Going public with infura; decentralized file systesm(IPFS)

Blockchain data analytics; Blockchain protocols and platforms; Blockchain business use cases

Books

Text Book

1. Bina Ramamurthy, Blockchain in Action, Manning, 1st Edition, 2020
2. Mansoor Ahmed-Rengers, Marta Piekarska-Geater, Permissioned Blockchain in Action, Manning, 1st Edition, 2021

Reference Book

1. Roberto Infante, Exploring Ethereum Dapps, Manning, 1st Edition, 2019

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	**Compare** and contrast blockchain with other distributed systems	L2
2.	**Build** Smart contract with Ethereum and the Solidity language	L3
3.	**Develop** Web UI for decentralized apps	L3
4.	**Apply** Identity, privacy and security techniques	L3
5.	**Understand** On-chain and off-chain data storage	L2

	Program Outcome of this course (POs)	PO No.
1.	**Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and Engineering sciences.	2
2.	**Design/Development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations	3
3.	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.	5

Course delivery methods		Assessment methods	
1.	Chalk and talk	1.	Quiz
2.	Power Point Presentations	2.	Assignment
		3.	IA Test

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Average of two assignments	Quiz/Seminar/Course Project	Total Marks
Maximum Marks: 50	15+15 = 30	10	10	50

- **Writing two IA tests is compulsory**
- **Minimum marks required to qualify for SEE : 20 out of 50**

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2.	**Minimum marks required in SEE to pass: 40 out of 100**
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.

Ad-Hoc Sensor Networks

Course Code	**18CS744**	**Credits**	3
Course type	PE	**CIE Marks**	50 marks
Hours/week: L-T-P	3-0-0	**SEE Marks**	50 marks
Total Hours	40	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. Understand how the wireless medium impacts design of ad-hoc sensor network protocols, and the specific challenges that need to be solved
2. Classify and compare MAC layer protocols for Ad Hoc networks, and WSNs
3. Analyze the design of routing protocols for Ad Hoc Sensor Networks for different objectives
4. Introduce modifications necessary to classical TCP and QoS models for Ad-Hoc networks.

Pre-requisites: Computer Networks, Layered Design, MAC Protocols – CSMA/CD, Transport Protocols – TCP Flow and Congestion Control

Unit – I 8 Hours

Introduction: Application examples, Types of applications, Challenges for WSNs, Why are sensor networks different – MANETs and WSNs, Energy scavenging, Microcontroller energy consumption, Relationship between computation and communication, Some examples of sensor nodes.

Unit – II 8 Hours

MAC Protocols: Introduction, Issues, Design goals, Classifications, Contention-Based Protocols – MACAW, Contention-Based Protocols with Reservation Mechanism – D-PRMA, Low duty cycle protocols and wakeup concepts – S-MAC, Schedule-based protocols – LEACH

Self-learning topics: IEEE 802.11 DCF Back off mechanism

Unit – III 8 Hours

Routing Protocols: Introduction, Issues, Classifications, Table-Driven Routing Protocols – DSDV, On-Demand Routing Protocols – DSR, AODV, Hybrid Routing Protocols – ZRP, Routing Protocols with efficient flooding mechanism – OLSR, Hierarchical Routing Protocols – FSR

Self-learning topics: Localization and Positioning, Topology control

Unit – IV 8 Hours

Transport Protocols: Introduction, Issues, Design goals, Classification, TCP over Ad Hoc Networks – A brief revisit, Why TCP does not perform well in Ad Hoc Networks, Feedback-based TCP, TCP with ELFN, Other Transport Layer Protocols – ACTP, Ad Hoc Transport Protocol.

Self-learning topics: Coverage and deployment problems

Unit – V 8 Hours

Quality of Service: Introduction, Issues and Challenges, Classifications, MAC layer solutions – IEEE 802.11e EDCF, Network layer solutions – Predictive Location-Based QoS Routing Protocol, QoS Frameworks – QoS Models, QoS Resource Reservation Signaling

Self-learning topics: QoS in Multihop Wireless Networks

Books

Text Book

1. C. Siva Ram Murthy and B.S. Manoj, Ad Hoc Wireless Networks – Architectures and Protocols, Pearson Education, Second Edition and onwards

Reference Book

1. Holger Karl and Andreas Willig, Protocols and Architectures for Wireless Sensor Networks, John Wiley & Sons Ltd, First Edition and onwards

E-resources

1. Jangeun Jun, M. L. Sichitiu, The Nominal Capacity of Wireless Mesh Networks, https://ieeexplore.ieee.org/document/1241089
   https://www.ab9il.net/wlan-projects/wireless-mesh-network-capacity.pdf

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	**Explain** why ad-hoc sensor networks are different, energy consumption challenges, and their applications.	L1, L2
2.	**Classify and Compare** different MAC layer protocols for Ad Hoc Networks, and Wireless Sensor Networks.	L2
3.	**Interpret** design of routing protocols for Ad Hoc Networks based on different objectives.	L2
4.	**Contrast** design of TCP over Ad Hoc Networks with classical design.	L2
5.	**Identify** QoS design challenges by the layer where it is implemented.	L3

	Program Outcome of this course (POs)	PO No.
1.	**Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.	1
2.	**Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and Engineering sciences.	2
3.	**Life-long learning:** Recognize the need for and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.	12

Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	Student Assignments
2.	Presentations	2.	Internal Assessment Test
3.	Remedial classes	3.	Semester End Examination
4.	Group assignments/seminars		

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Average of two assignments	Quiz/Seminar/Course Project	Total Marks
Maximum Marks: 50	15+15 = 30	10	10	50
➢ **Writing two IA tests is compulsory** ➢ **Minimum marks required to qualify for SEE: 20 out of 50**				

Self-Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2.	**Minimum marks required in SEE to pass: 40 out of 100**
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.

System Simulation and Modeling

Course Code	**18CS751**	**Credits**	3
Course type	PE	**CIE Marks**	50 marks
Hours/week: L-T-P	3 – 0 – 0	**SEE Marks**	50 marks
Total Hours	38	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. To bring out importance of simulation and simulation components in engineering problems
2. To introduce mathematical and statistical models in continuous and discrete distributions
3. To present random number generation methods and tests for random number
4. To realize the importance of analysis of simulation data and validation of simulation models

Pre-requisites: Engineering Mathematics, Discrete mathematics

Unit – I 8 Hours

Introduction: When simulation is the appropriate tool and when it is not appropriate, Advantages and disadvantages of Simulation, Systems and system environment; Components of a system; Discrete and continuous systems; Model of a system; Types of Models; Discrete-Event System Simulation; Simulation examples: Simulation of queuing systems(single server and two server), Simulation of (M,N) inventory system.

General Principles, Simulation Software: Concepts in Discrete-Event simulation: The event-scheduling / time-advance algorithm.

Unit – II 8 Hours

Statistical Models in Simulation: Review of terminology and concepts; Useful statistical models; Discrete distributions: Binomial distribution, Poisson distribution; Continuous distributions: Uniform distribution, Exponential distribution, Triangular distribution.

Unit – III 8 Hours

Random-Number Generation: Properties of random numbers; Generation of pseudo-random numbers; Techniques for generating random numbers; Tests for Random Numbers: frequency tests;

Random-Variate Generation: Inverse transform technique: Exponential distribution, Uniform distribution, Triangular distribution.

Unit – IV 8 Hours

Input Modeling: Data Collection; Identifying the distribution with data; Parameter estimation; Goodness of Fit Tests; Selecting input models without data.

Unit – V 6 Hours

Verification, Calibration, Validation and Optimization

Model building, verification and validation; Verification of simulation models; Calibration and validation of models, input-output validation using historical input data.

Books

Text Book

1. Jerry Banks, John S. Carson II, Barry L. Nelson, David M. Nicol: Discrete-Event System Simulation, 4th Edition onwards, Pearson Education, 2010.

Reference Books

1. Lawrence M. Leemis, Stephen K. Park: Discrete – Event Simulation: A First Course, Pearson Education, 2006
2. Averill M. Law: Simulation Modeling and Analysis, 4th Edition, Tata McGraw-Hill, 2007

Course Outcome (COs)

At the end of the course, the student will be able to		**Bloom's Level**
1.	**Classify** and compare simulation models.	3
2.	**Solve** simulation problems on queuing, inventory systems.	3
3.	**Identify** types of distribution and apply statistical models for simulation.	3
4.	**Construc**t random number generator and test for the random numbers	4
5	**Explain** validation and verification models	2

	Program Outcome of this course (POs)	**PO No.**
1.	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	1
2.	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	2
3.	**Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	3
4.	**Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	4

Course delivery methods		**Assessment methods**	
1.	Lecture & Board	1.	Assignments
2.	Power-point Presentation	2.	Quizzes
3.	Online Videos / Learning	3.	Internal Assessment Tests
4.	NPTEL / Edusat	4.	Course Seminar
5	Class Room Exercises	5.	Course Project (Mini project)

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Average of two assignments	Quiz/Seminar/Course Project	Total Marks
Maximum Marks: 50	15+15=30	10	10	50
➢ **Writing two IA tests is compulsory** ➢ **Minimum marks required to qualify for SEE : 20 out of 50**				

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2.	**Minimum marks required in SEE to pass: 40 out 0f 100**
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.

Storage Area Networks

Course Code	18CS752	Credits	3
Course type	PE	CIE Marks	50 marks
Hours/week: L-T-P	3 – 0 – 0	SEE Marks	50 marks
Total Hours:	40	SEE Duration	3 Hours for 100 marks

Course learning objectives

1. To study Storage Area Networks characteristics and its components.
2. Introduce storage virtualization and bring out its importance.
3. Analyse different networked storage options for different application environments

Pre-requisites: Basic knowledge of computer networks, Operating system

UNIT I 8 hours

Introduction to information storage and management: Information Storage, Evolution of Storage Technology and Architecture , Data Centre Infrastructure , Key Challenges in Managing Information , information lifecycle

Concepts of storage Networking: Data storage and data access problem

UNIT II 8 hours

Data Protection: RAID 5: Implementation of RAID, RAID Array Components , RAID Levels , RAID Comparison , RAID Impact on Disk Performance ,hot spares

UNIT III 8 Hours

Storage Area Networks: Fibre Channel,The SAN and Its Evolution , Components of SAN , FC Connectivity.

Network Attached Storage: General-Purpose Servers vs. NAS Devices , Benefits of NAS , NAS File I/O , Components of NAS

UNIT IV 8 Hours

Storage Virtualization: Definition of Storage virtualization, Implementation Considerations, Storage virtualization on Block or file level, Storage virtualization on various levels of the storage Network, Symmetric and Asymmetric storage virtualization in the Network

UNIT V 8 hours

Application and case studies of Storage Area Networks: Applying the SAN to OLT P workloads, Applying SAN to Web based applications, Applying SAN to Data ware house models. Case study: The import Auto industry

Books

Text Books

1. EMC Corporation, “Information Storage and Management”, Wiley India, 2nd Edition, 2011
2. Robert Spalding, “Storage Networks: The Complete Reference”, Tata McGraw Hill, Osborne, 2003

Reference Books

1. Richard Baker and Paul Masssiglia 2002 "Storage Area Networks Essential A complete guide to understanding and implementing SANS", John Wiley India
2. Marc Farley, "Building Storage Networks", Tata McGraw Hill, Osborne, 2nd Edition

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	**Describe** information storage and management	L2
2.	**Apply** storage area network solutions to enhance performance of the network	L3
3.	**Compare** performance of different RAID levels	L2

	Program Outcome of this course (POs)	PO No.
1.	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	1
2.	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	2
3.	**Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	3

Course delivery methods		Assessment methods	
1.	Lecture & Board	1.	Assignments
2.	Power-point Presentation	2.	Quizzes
3.	Online Videos / Learning	3.	Internal Assessment Tests
		4.	Course Seminar / Project

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Average of two assignments	Quiz/Seminar/Course Project	Total Marks
Maximum Marks: 50	15+15 = 30	10	10	50

- **Writing two IA tests is compulsory**
- **Minimum marks required to qualify for SEE : 20 out of 50**

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2.	**Minimum marks required in SEE to pass: 40 out 0f 100**
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.

Agile Software Development

Course Code	**18CS753**	**Credits**	**3**
Course type	PE	**CIE Marks**	50 marks
Hours/week: L-T-P	3-0-0	**SEE Marks**	50 marks
Total Hours	40	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. To bring the importance/need for Agile Software Development.
2. To apply the principles and practices of agile software development on a project of interest and relevance to the student.
3. To learn about user stories and agile estimation and planning techniques.

Pre-requisites: Software Engineering

Unit - I **8 Hours**

Introduction: Understanding Success, Beyond Deadlines, The Importance of Organizational Success, Enter Agility, Agile Methods, Don't Make Your Own Method, The Road to Mastery, Find a Mentor, The XP Lifecycle, The XP Team, XP Concepts, Adopting X.P

Unit - II **8 Hours**

Thinking: Pair Programming, Energized Work, Informative Workspace, Root-Cause Analysis, Retrospectives, Collaborating: Trust, Impressions, Sit Together, Real Customer Involvement, Ubiquitous Language, Stand-Up Meetings, Iteration Demo, Reporting.

Unit - III **8 Hours**

Releasing: NoBugs, Version Control, Ten-Minute Build, Continuous Integration, Collective Code Ownership and Documentation.

Unit - IV **8 Hours**

Planning: Vision, Release Planning, The Planning Game, Risk Management, Iteration Planning, Slack, Stories, Estimating.

Unit - V **8 Hours**

Developing: Incremental Requirements, Customer Tests, Test-Driven Development, Refactoring, Simple Design, Incremental Design and Architecture, Spike Solutions, Performance Optimization, Exploratory Testing

Books

Text Books:

1. The Art of Agile Development by James Shore and Shane Warden, O'Reilly, 2007 first edition onwards

Reference Books:

1. Succeeding with Agile : Software Development Using Scrum, Pearson (2010)
2. Robert C. Martin ,Agile Software Development, Principles, Patterns, and Practices

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	Apply a thorough understanding of Agile principles and specific practices	L3
2.	Judge and craft appropriate adaptations to existing practices or processes depending upon analysis of typical problems	L3
3.	Evaluate likely successes and formulate plans to manage likely risks or problems	L4

	Program Outcome of this course (POs)	PO No.
1.	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	1
2.	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	2
3.	**Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	3

Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	Quiz
2.	PPT	2.	Assignments
3.	Videos	3.	IA Test

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Average of two assignments	Quiz/Seminar/Course Project	Total Marks
Maximum Marks: 50	15+15 = 30	10	10	50

- **Writing two IA tests is compulsory**
- **Minimum marks required to qualify for SEE : 20 out of 50**

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2.	**Minimum marks required in SEE to pass: 40 (out of 100)**
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.

Service Oriented Architecture

Course Code	18CS754	Credits	3
Course type	PE	CIE Marks	50 marks
Hours/week: L-T-P	3-0-0	SEE Marks	50 marks
Total Hours	40	SEE Duration	3 Hours for 100 marks

Course learning objectives

1. To introduce the concepts of Service Oriented Architecture.
2. To introduce the key issues in SOA and architectural abstractions.
3. To present the technique of integrating SOA technologies with Web Services paradigms.
4. To give an insight into related technologies and implementation basics of SOA.

Pre-requisites: Web Programming

Unit – I 8 Hours

Introduction to SOA: Fundamental SOA- Common Misperceptions about SOA- Common tangible benefits of SOA- Common pitfalls of adopting SOA. The Evolution of SOA:-from XML to Web services to SOA, Comparing SOA with N-tier architecture, The continuing evolution of SOA, The roots of SOA

Unit – II 8 Hours

Web Services and Primitive SOA: The Web services framework- Services, Service descriptions, messaging with SOAP. Web Services and Contemporary SOA: Message exchange patterns- Service activity coordination- Atomic transactions- Business activities-Orchestration-Choreography.

Unit – III 8 Hours

Service orientation and security: Web Services and Contemporary SOA: Addressing- Reliable messaging- Correlation- Policies Metadata exchange- Security- Notification and eventing. SOA and Service-Orientation: Principles of Service-Orientation-Service-orientation. Anatomy of a service-oriented architecture- Common principle of service-orientation-Service Layers –Service orientation

Unit – IV 8 Hours

Building SOA: SOA Delivery Strategies- SOA delivery lifecycle phases. Service-Oriented Analysis: Introduction to service-oriented analysis- Benefits of a business-centric SOA Deriving business services- Service- Oriented Analysis: Service modeling, Service modeling guidelines- Classifying service model logic- Contrasting service modeling approaches

Unit – V 8 Hours

Service-oriented design: Introduction to service-oriented design- WSDL-related XML Schema language basics- WSDL language basics- SOAP language basics- Service interface, design tools. SOA Composition Guidelines: Steps to composing SOA Considerations for choosing service layers and SOA standards, positioning of cores and SOA extensions.

Books

Text Books

1. Thomas Erl , “Service-Oriented Architecture: Concepts, Technology & Design”, Pearson Education Pt. Ltd. 2008

2. Michael Rosen, Boris Lublin sky, Kevin T. Smith, Marc J. Balcer, "Applied SOA: Service Oriented Architecture and Design Strategies", Wiley, 2010.

Reference Books

1. Thomas Erl, "SOA Principles of Service Design" Pearson Exclusives 2007
2. Tomas Erl and Grady Booch, "SOA Design Patterns" Prentice Hall 2008

Course Outcome (COs)

At the end of the course, the student will be able to**:**	**Bloom's Level**
1. **Illustrate** the importance of SOA.	L2
2. **Illustrate** the significance of SOA primitives.	L2
3. **Analyze** the quality web services.	L4

Program Outcome of this course (POs)	**PO No.**
1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.	1
2. **Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and Engineering sciences.	2
3. **Life-long learning:** Recognize the need for and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.	12

Course delivery methods		**Assessment methods**	
1.	Chalk and Talk	1.	Internal assessment
2.	Power Point Presentations	2.	Assignment
3.	Demonstration	3.	Quiz
		4.	Seminar / project

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Average of two assignments	Quiz/Seminar/Course Project	Total Marks
Maximum Marks: 50	15+15 = 30	10	10	50

- **Writing two IA tests is compulsory**
- **Minimum marks required to qualify for SEE : 20 out of 50**

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2.	**Minimum marks required in SEE to pass: 40 out of 100**
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.

Software Testing

Course Code	**18CS761**	**Credits**	03
Course type	OE	**CIE Marks**	50 marks
Hours/week: L-T-P	3-0-0	**SEE Marks**	50 marks
Total Hours	40	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. To bring the importance/need for Software Engineering
2. To introduce the terminology, testing, test-case, pseudo-codes / algorithms / flowcharts of Triangle & Commission programs
3. To develop the skill of analyzing the Triangle & Commission programs, with the perspective of Boundary Value Analysis, Equivalence Class & Decision Table Testing paradigms
4. To practice quality assurance related processes / methods / standards

Pre-requisites: Database Management Systems, Software Engineering, Graph Theory

Unit - I **8 Hours**

Introduction: Professional Software Development: Software Engineering, Software Engineering Diversity, Software Engineering ethics. **Software Process**: Software Process models: The Waterfall model, Incremental development. Process activities: Software specification, Software design and implementation, Software validation.

Self-learning topics: Coping with Change: Prototyping, Incremental Delivery, Boehm's Spiral Model

Unit - II **8 Hours**

A Perspective on Testing:

Basic definitions, Test cases, Insights from a Venn diagram, Identifying test cases, Error and fault taxonomies, Levels of testing. **Examples:** Generalized pseudocode, The triangle problem,

Self-learning topics: The commission problem.

Unit - III **8 Hours**

The SATM (Simple Automatic Teller Machine) problem, The currency converter.

Boundary value analysis: Boundary value analysis: Generalizing Boundary Value Analysis, Limitations of Boundary Value Analysis, Robustness testing, Worst-case testing, Special value testing, Examples: Guidelines for Boundary Value Testing

Unit – IV **8 Hours**

Equivalence Class Testing: Equivalence classes, Equivalence test cases for the triangle problem and the commission problem, Guidelines and observations.

Decision Table–Based Testing: Decision tables, Test cases for the triangle problem.

Self-learning topics: Decision tables for the commission problem

Unit - V **8 Hours**

Path Testing, Data Flow Testing:

DD paths, Test coverage metrics: Metric Based Testing, Basis path testing: McCabe's Basis Path Method, guidelines and observations. Definition-Use testing. Guidelines and observations.

Self-learning topics: Observations on McCabe's Basis Path Method , Essential Complexity

Books

Text Books

1. Ian Sommerville: Software Engineering, Pearson Education, 9th Edition and onwards.
2. Paul C. Jorgensen: Software Testing, A Craftsman's Approach, 3rd Edition, Auerbach Publications, 2008.

Reference Books

1. Aditya P. Mathur: Foundations of Software Testing, Pearson Education, 2008.
2. Srinivasan Desikan, Gopalaswamy Ramesh: Software testing Principles and Practices, 2nd Edition, Pearson Education, 2007.

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom's Level
1.	**Recall** the professional & ethical responsibilities of Software Engineering.	L1
2.	**Define** the test-case, testing, error taxonomy	L1
3.	**Illustrate** test-cases for Triangle, NextDate & Commission programs, for boundary value analysis.	L2
4.	**Design** test-cases for Triangle, NextDate & Commission programs, for equivalence class testing, decision table testing.	L3
5.	**Demonstrate** the importance of verification & validation in improving the process of software development**.**	L3
6.	**Examine** the testing, verification and validation for an application.	L4

	Program Outcome of this course (POs)	PO No.
1.	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	1
2.	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	2
3.	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.	5
4.	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	9

Course delivery methods		Assessment methods	
1.	Lecture & Board	1.	Assignments
2.	Power-Point presentations	2.	Quizzes
3.	Online Videos/Learning	3.	Internal Assessment Tests
4.	NPTEL/Edusat	4.	Course Seminar
5.	Class Room Exercises	5.	Course Activity

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Average of two assignments	Quiz/Seminar/Course Project	Total Marks
Maximum Marks: 50	15+15 = 30	10	10	50
➢ **Writing two IA tests is compulsory** ➢ **Minimum marks required to qualify for SEE : 20 out of 50**				

Self-Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2.	**Minimum marks required in SEE to pass: 40 out of 100**
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.

Web Programming

Course Code	18CS762	Credits	3
Course type	OE	CIE Marks	50 marks
Hours/week: L-T-P	3-0-0	SEE Marks	50 marks
Total Hours	40	SEE Duration	3 Hours for 100 marks

Course learning objectives

1. To understand HTML and design web pages
2. To utilize JavaScript for interactive pages on the client side.
3. To understand server side programming and that can be deployed on any device.

Pre-requisites: Computer Concepts and C Programming, Database Management Systems, Web Programming

Unit – I 08 Hours

Fundamentals of Web, XHTML – 1: Internet, WWW, Web Browsers and Web Servers, URLs, MIME, HTTP, Security, The Web Programmers Toolbox. XHTML: Basic syntax, Standard structure, Basic text markup, Images, Hypertext Links.
Self learning topics: Built-In Directives

Unit – II 08 Hours

CSS: XHTML (continued): Lists, Tables, Forms, Frames
CSS: Introduction, Levels of style sheets, Style specification formats, Selector forms, Property value forms, Font properties, List properties, Color, Alignment of text, The box model, Background images, The and tags, Conflict resolution.
Self learning topics: Built-In Directives

Unit – III 08 Hours

Javascript: Overview of Javascript, Object orientation and Javascript, Syntactic characteristics, Primitives, operations, and expressions, Screen output and keyboard input, Control statements, Object creation and modification, Arrays, Functions, Constructors, Pattern matching using regular expressions, Errors in scripts, Examples.

Unit – IV 08 Hours

Javascript and HTML Documents, Dynamic Documents with Javascript: The Javascript execution environment, The Document Object Model, Element access in Javascript, Events and event handling, Handling events from the Body elements, Button elements, Text box and Password elements, The DOM 2 event model, The navigator object, DOM tree traversal and modification. Introduction to dynamic documents, Positioning elements, Moving elements, Element visibility, Changing colors and fonts, Dynamic content, Stacking elements, Locating the mouse cursor, Reacting to a mouse click, Slow movement of elements, Dragging and dropping elements.

Unit – V 08 Hours

PHP: Origins and uses of PHP, Overview of PHP, General syntactic characteristics, Primitives, operations and expressions, Output, Control statements, Arrays, Functions, Pattern matching, Form handling, Files, Cookies, Session tracking, Database access with PHP and MySQL.

Books

Text Books

1. Robert W. Sebesta: Programming the World Wide Web, 4th Edition, Pearson education, 2008
2. Simon Holmes, Getting MEAN: Mongo, Express, Angular, Node, Dreamtech press, 2015, 1st Edition and onwards
3. HTML and CSS: Design and Build Websites, Jon Duckett

Reference Books

1. M. Deitel, P.J. Deitel, A. B. Goldberg: Internet & World Wide Web How to Program, 3rd Edition, Pearson education
2. Chris Bates: Web Programming Building Internet Applications, 3rd Edition, Wiley India, 2006
3. Xue Bai et al: The web Warrior Guide to Web Programming, Thomson, 2003

Course Outcome (COs)

At the end of the course, the student will be able to**:**	**Bloom's Level**
1. **Explain** basic concepts of Web programming	L2
2. **Describe** usage of HTML and CSS	L2
3. **Implement** simple applications with HTML, CSS and Javascript	L3
4. **Implement** simple server side programs using php	L3

Program Outcome of this course (POs)	**PO No.**
1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	1
2. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	3
3. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	12

Course delivery methods		**Assessment methods**	
1.	Lecture	1.	Internal Assessment Test
2.	Demonstration	2.	Assignment
3.	Hands on	3.	Quiz
4.	Presentation	4.	Programming Exercises

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Average of two assignments	Quiz/Seminar/Course Project	Total Marks
Maximum Marks: 50	15+15 = 30	10	10	50
➢ **Writing two IA tests is compulsory** ➢ **Minimum marks required to qualify for SEE : 20 out of 50**				

Self-Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2.	**Minimum marks required in SEE to pass: 40 out of 100**
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.

Machine Learning

Course Code	18CS763	Credits	3
Course type	OE	CIE Marks	50 marks
Hours/week: L-T-P	3-0-0	SEE Marks	50 marks
Total Hours	40	SEE Duration	3 Hours for 100 marks

Course learning objectives

1. To understand the basic concepts of learning and decision tree
2. To understand neural networks and genetic algorithms
3. To understand Bayesian techniques
4. To understand learning through emergent behavior

Pre-requisites: Algorithms, Probability theory

Unit - I 8 Hours

Introduction to Machine Learning: Introduction, Training Rote Learning, Learning Concepts, General-to-Specific Ordering, Version Spaces, Candidate Elimination, Inductive Bias, Decision-Tree Induction, The Problem of Overfitting, The Nearest Neighbor Algorithm, Learning Neural Networks, Supervised Learning, Unsupervised Learning, Reinforcement Learning

Unit – II 8 Hours

Neural Networks: Introduction, Neurons, Perceptrons, Multilayer Neural Networks, Recurrent Networks, Unsupervised Learning Networks, Evolving Neural Networks

Unit – III 8 Hours

Probabilistic Reasoning and Bayesian Belief Networks: Introduction, Probabilistic Reasoning, Joint Probability Distributions, Bayes' Theorem, Simple Bayesian Concept Learning, Bayesian Belief Networks, The Noisy-V Function, Bayes' Optimal Classifier, The Naïve Bayes Classifier, Collaborative Filtering.

Unit – IV 8 Hours

Artificial Life-Learning through Emergent Behavior: Introduction, What Is Life?, Emergent Behavior, Finite State Automata, Cellular Automata, Evolution, Evolution Strategies, Genetic Programming, Evolutionary Programming, L-Systems, Classifier Systems, Artificial Immune Systems.

Unit – V 8 Hours

Genetic Algorithms: Introduction, Representations, The Algorithm, Fitness, Crossover, Mutation, Termination Criteria, Optimization of a Mathematic Function, Why Genetic Algorithms Work, Messy Genetic Algorithms, Prisoner's Dilemma, Diversity, Evolving Pictures, Predators and Coevolution, Other Problems.

Books

Text Book

1. Ben Coppin, "Artificial Intelligence Illuminated", Jones and Bartlet Publishers, 1st Edition, 2004.

Reference Books

1. Tom M. Mitchell, "Machine Learning", McGraw-Hill Education (INDIAN EDITION), 2013
2. Ethem Alpaydin, "Introduction to Machine Learning", 2nd Edition, PHI Learning Pvt. Ltd., 2013
3. T Hastie, R. Tibshirani, J.H.Fiedman, "The Elements of statistical learning", Springer, 1st Edition 2001

Course Outcome (COs)

At the end of the course, the student will be able to:	Bloom's Level
1. Choose the learning techniques with this basic knowledge.	L3
2. Apply effectively neural networks and genetic algorithms for appropriate applications.	L3
3. Apply bayesian techniques and derive effectively learning rules.	L3

Program Outcome of this course (POs)	PO No.
1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	1
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	2
3. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.	5

Course delivery methods		Assessment methods	
1.	Lecture & Board	1.	Assignments
2.	Power-point Presentation	2.	Quizzes
3.	Online Videos / Learning	3.	Internal Assessment Tests
4.	NPTEL / Edusat	4.	Course Seminar
5.	Class Room Exercises	5.	Course Project (Mini project)

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Average of two assignments	Quiz/Seminar/Course Project	Total Marks
Maximum Marks: 50	15+15 = 30	10	10	50

- **Writing two IA tests is compulsory**
- **Minimum marks required to qualify for SEE : 20 out of 50**

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2.	**Minimum marks required in SEE to pass: 40 out of 100**
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.

Big Data and Hadoop

Course Code	**18CS764**	**Credits**	3
Course type	OE	**CIE Marks**	50 marks
Hours/week: L-T-P	3 – 0 – 0	**SEE Marks**	50 marks
Total Hours	40	**SEE Duration**	3 Hours for 100 marks

Course learning objectives

1. To understand Big data dimensions and its applications with case studies.
2. To explore Hadoop framework and architecture.
3. To understand the importance of MapReduce framework.
4. To explore PIG Architecture and functionalities.

Pre-requisites: Database Management System, Data Mining

Unit – I 8 Hours

Understanding Big Data: What is big data?: Characteristics of Big Data, Data in the Warehouse and Data in Hadoop; Why is Big Data Important? : When to consider a Big Data solution? Big Data Use Cases: Patterns for Big Data Deployment

Unit – II 8 Hours

The History of Hadoop: Components of Hadoop, Hadoop Distributed File System, The Basics of Map Reduce Hadoop Common Components, HDFS Shell Commands: Hadoop Architecture, Notable Hadoop Related Projects.

Unit – III 8 Hours

Application Development in Hadoop: PIG and PigLatin, Hive, Jaql, Hadoop Streaming Getting your data into Hadoop: Basic Copy Data, Flume, Other Hadoop Components: Zookeeper, HBase, Oozie, Avro

Unit – IV 8 Hours

Understanding MapReduce: The MapReduce Framework: Exploring the Features of MapReduce, Working of MapReduce, Exploring Map and Reduce Functions, Uses of MapReduce.

Unit – V 8 Hours

PIG: Introduction to PIG, The PIG Architecture, Benefits and Limitations of PIG, Properties of PIG, Differences between PIG vs Map Reduce, PIG Latin: Basic Operations (DUMP, LOAD, STREAM, GROUP, JOIN), Grunt, PIG's data model: scalar types(int, long, float, double, chararray, bytearray) and complex types(Map, Tuple, Bag, Nulls, Casts).

Books

Text Books:

1. Paul C. Zikopoulos, Chris Eaton, Dirk deRoos, Thomas Deutsch, George Lapis, Understanding Big Data – Analytics for Enterprise Class Hadoop and Streaming Data, McGraw Hill, 2012 https://www.ibm.com/developerworks/vn/library/contest/dw.freebooks/Tim_Hieu_Big_Data/Understanding_BigData.PDF.
2. TomWhite,"Hadoop:TheDefinitiveGuide",ThirdEdition,O'Reilly,2012.

3. EricSammer,"HadoopOperations",O'Reilly,2012.

Reference Books:

1. VigneshPrajapati,BigdataanalyticswithRandHadoop,SPD2013
2. Alan Gates,"ProgrammingPig", O'Reilly, 2011

Course Outcome (COs)

At the end of the course, the student will be able to	Bloom's Level
1. **Outline** the importance of Big Data, its characteristics and use of Big Data in different fields/sectors.	L1
2. **Explain** the ecosystem of Hadoop	L2
3. **Apply** map reduce framework in analyzing the data and relate to YARN	L3
4. **Explain** usage of PIG Language in analyzing the data and managing Big Data	L2

Program Outcome of this course (POs)	PO No.
1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	1
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	2
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	3

Course delivery methods		**Assessment methods**	
1.	Lecture & Board	1.	Assignments
2.	Power-point Presentation	2.	Quizzes
3.	Online Videos / Learning	3.	Internal Assessment Tests
4.	NPTEL / Edusat	4.	Course Seminar
5.	Class Room Exercises	5.	Course Project (Mini project)
		6.	Case Studies

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Average of two assignments	Quiz/Seminar/Course Project	Total Marks
Maximum Marks: 50	15+15 = 30	10	10	50

- **Writing two IA tests is compulsory**
- **Minimum marks required to qualify for SEE : 20 out of 50**

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2.	**Minimum marks required in SEE to pass: 40 out of 100**
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.

Network Programming Laboratory

Course Code	**18CSL77**	**Credits**	1.5
Course type	LAB	**CIE Marks**	25 marks
Hours/week: L-T-P	0-0-3	**SEE Marks**	25 marks
Total Hours:	36	**SEE Duration**	3 Hours/2 Hours for 50 marks

Course learning objectives

1. To practice the students for network programming in UNIX based operating systems
2. To design and simulate the network in latest simulation tools
3. To illustrate message controlling mechanisms
4. To Perform the real time network traffic analysis using network monitoring tools

Pre-requisites: Computer Network, Network Programming and Unix System Programming

List of experiments

1. Implementing IPC using Pipes and message queues.
2. Implementing client server communication using socket programming that uses connection oriented protocol at transport layer.
3. Implement the distance vector routing algorithm
4. Using WIRESHARK observe the data transferred in client server communication using UDP and identify the UDP datagram.
5. Using WIRESHARK analyze three way handshaking connection establishment, data transfer and connection termination in client server communication using TCP.
6. Simulate a Full duplex connection in an wired network using NS3.
7. Simulate a simple Wireless UDP application using NS3.
8. Simulate a simple 5G Network application using NS3.
9. Understanding the working of Ipv6 in Low power lossy network
10. Understanding the working of IoT routing using RPL protocol

Books

1. W. Richard Stevens, Bill Fenner, Andrew M. Rudoff: “UNIX Network Programming”. Volume 1, Third Edition, Pearson 2004.
2. Barry Nance: “Network Programming in C”, PHI 2002 3.Bob Quinn, Dave Shute: “Windows Socket Network Programming”, Pearson 2003.
3. Richard Stevens: “UNIX Network Programming”. Volume 2, Second Edition.
4. James F Kurose and Keith W Ross, Computer Networking, A Top-Down Approach, Sixth edition, Pearson,2017 .

Course Outcome (COs)

At the end of the course, the student will be able to	Bloom's Level
1. Develop Inter Process Communication and client server communication using Pipes, Sockets and message queues.	L3
2. Implement message controlling mechanisms encryption.	L3
3. Design and Analyze network traffic using network simulation and monitoring tools	L4

Program Outcome of this course (POs)	**PO No.**
1. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	1
2. Design solutions for complex engineering problems and design systems, components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations	3
3. Create, select and apply appropriate techniques, resources, and modern engineering tools, including prediction and modeling, to complex engineering activities, with an understanding of the limitations	5

Assessment methods	
1.	Lab IA
2.	Lab journal evaluation
3.	Day today Lab Conduction from students

Scheme of Continuous Internal Evaluation (CIE):

Components	Conduct of the lab	Journal submission	Lab project	Total Marks
Maximum Marks:25	10	10	5	25
➢ Submission and certification of lab journal is compulsory to qualify for SEE. ➢ **Minimum marks required to qualify for SEE : 10 marks out of 25**				

Scheme of Semester End Examination (SEE):			
1.	It will be conducted for 50 marks of 3 hours / 2 hrs duration. It will be reduced to 25 marks for the calculation of SGPA and CGPA.		
2.	Only one experiment to be conducted.		
3.	Minimum marks required in SEE to pass: **20/50 (10/25)**		
4.	Initial write up	10 marks	50 marks
	Conduct of experiments, results and conclusion	20 marks	
	One mark question	10 marks	
	Viva- voce	10 marks	
5.	Viva-voce shall be conducted for individual student and not in a group.		

Mobile Application Development Laboratory

Course Code	**18CSL78**	**Credits**	1.5
Course type	LAB	**CIE Marks**	25 marks
Hours/week: L-T-P	0-0-3	**SEE Marks**	25 marks
Total Hours	30	**SEE Duration**	3 Hours for 50 marks

Course learning objectives

1. To introduce the Android and its architecture
2. To develop the activity life cycle, views, layouts and events
3. To introduce SQLite and Ionic Frameworks

Pre-requisites: Java Programming

List of experiments

1. Develop an application that uses GUI components, Font and Colors.
2. Develop an application that uses Layout Managers and event listeners.
3. Develop a native calculator application.
4. Develop an application that makes use of database.
5. Develop an application that makes use of notification.

Books

1. Android Studio 3.5 Development Essentials, Java Edition, 2019 Neil Smyth / Payload Media, Inc
2. Build Mobile Apps with Ionic 2 and Firebase, Fu Cheng, apress
3. Ionic Cookbook, Hoc Phan, Packt Publishing

Course Outcome (COs)

At the end of the course, the student will be able to		**Bloom's Level**
1.	**Explain** basic concepts and anatomy of an Android application	L2
2.	**Apply** design principles for interactive client side web pages	L2
3.	**Design** and **develop** cross-platform apps for native iOS, Android and the web.	L3

	Program Outcome of this course (POs)	**PO No.**
1.	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	1
2.	**Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	3
3.	**Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	12

Assessment methods	
1.	IA Test
2.	Mini Project
3.	Periodic Journal Evaluation

Scheme of Continuous Internal Evaluation (CIE):

Components	Conduct of the lab	Journal submission	Lab project	Total Marks
Maximum Marks:25	10	10	5	25
➢ Submission and certification of lab journal is compulsory to qualify for SEE. ➢ **Minimum marks required to qualify for SEE : 10 marks out of 25**				

Scheme of Semester End Examination (SEE):			
1.	It will be conducted for 50 marks of 3 hours duration. It will be reduced to 25 marks for the calculation of SGPA and CGPA.		
2.	Only one experiment to be conducted.		
3.	Minimum marks required in SEE to pass: 20/50 (10/25)		
4.	Initial write up	10 marks	50 marks
	Conduct of experiments, results and conclusion	20 marks	
	One mark question	10 marks	
	Viva- voce	10 marks	
5.	Viva-voce shall be conducted for individual student and not in a group.		