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

5th and 6th Semester Scheme of Teaching and Examination

Detailed Syllabi of 5th to 6th 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.

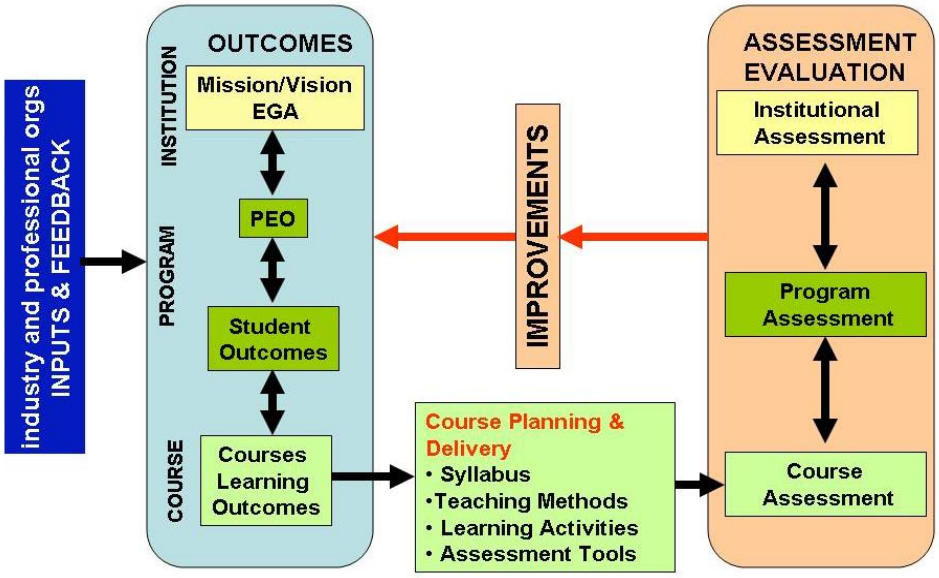
DEPARTMENT VISION

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.

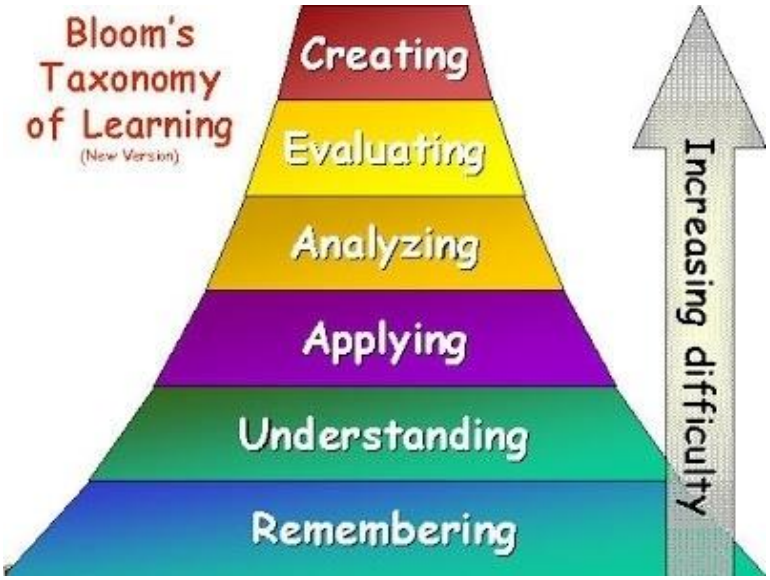
PROGRAM SPECIFIC OUTCOMES (PSOs):

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- 3rdto 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 – 3	3	1.5	25	25	50
8	18CSL38	Object Oriented Programming with Java Laboratory	LAB	0 – 0 – 3	3	1.5	25	25	50
9	18CS39	Kannada	HS	2 – 0 – 0	2	MNC	25	-	25
		Total			**31**	**24**	**350**	**325**	**675**

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 – 3	3	1.5	25	25	50
8	18CSL38	Object Oriented Programming with Java Laboratory	LAB	0 – 0 – 3	3	1.5	25	25	50
9	18CS39	Kannada	HS	2 – 0 – 0	2	MNC	25	-	25
		Total			**31**	**24**	**350**	**325**	**675**

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

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)

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,2017 .

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,Nide 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.	Analyze, compare and contrast randomized algorithms	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 & 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 10 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**

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.		

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	12

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

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
		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.

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
2.	**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. 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.	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 ,The RSA Algorithm

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

Unit – IV **8 Hours**

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, S/MIME

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.