DAYANANDA SAGAR COLLEGE OF ENGINEERING

(An Autonomous Institution affiliated to VTU, Belagavi)

BACHELOR OF ENGINEERING

DEPARTMENT
OF
INFORMATION SCIENCE AND ENGINEERING

SCHEME & SYLLABUS
III - VIII SEMESTERS
(Academic Year: 2019-23)

DSCE
Dept. of Information Science & Engg

DAYANANDA SAGAR COLLEGE OF ENGINEERING
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Department of Information Science and Engineering

INSTITUTE VISION

To impart quality technical education with a focus on Research and Innovation emphasizing on Development of Sustainable and Inclusive Technology for the benefit of society.

INSTITUTE MISSION

- To provide an environment that enhances creativity and Innovation in pursuit of Excellence.
- To nurture teamwork in order to transform individuals as responsible leaders and entrepreneurs.
- To train the students to the changing technical scenario and make them to understand the importance of Sustainable and Inclusive technologies.

DEPARTMENT VISION

To excel in teaching and research in the field of Information Science and Engineering with focus on industry needs and creating competent engineering graduates catering to the benefit of the society.

DEPARTMENT MISSION

1. To provide quality technical education in the field of Information Science and Engineering
2. To interact with industry and professional bodies for preparing the students to be industry ready
3. To imbibe professional behavior, leadership abilities in students to have successful careers and contribute to the society

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PROGRAMME EDUCATION OBJECTIVES (PEOs)

PEO1: Demonstrate strong foundation in fundamentals of mathematics and Engineering Sciences to solve problems using Information Technology

PEO2: Apply professional practices of Engineering and exhibit ability to solve complex real life problems

PEO3: Succeed as competent professionals, entrepreneurs and researchers.

PEO4: Lead and manage teams that address societal challenges.

PROGRAMME OUTCOMES (POs)

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: 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.

PO3: 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.

PO4: 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.

PO5: 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.

PO6: 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.

PO7: 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.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: 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.

PO11: 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.

PO12: Lifelong 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.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSO1: Students will be able to apply mathematical and analytical knowledge to solve complex problems through programming.

PSO2: Students will be able to design data oriented software and networking solutions.

PSO3: Students will be able to develop, test and manage software solutions.

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FACULTY LIST

Sl.No.	NAME	DESIGNATION
1.	Dr. UDAYA KUMAR REDDY K.R	Vice Principal& HOD
2.	Dr. RAMAMOHAN BABU K. N	Professor
3.	Dr. SUMA V.	Professor
4.	Dr. RAJESHWARI .J	Professor
5.	Dr. RASHMI .S	Associate Professor
6.	Dr. MUZAMEEL AHMED	Associate Professor
7.	Dr. RESHMA .J	Associate Professor
8.	Mrs. VAIDEHI M	Assistant Professor
9.	Mrs. BHAVANI K.	Assistant Professor
10.	Mrs. PRATHIMA MABEL J.	Assistant Professor
11.	Mrs. VANI K.A.	Assistant Professor
12.	Mrs. REKHA JAYARAM	Assistant Professor
13.	Mrs. RADHIKA T. V.	Assistant Professor
14.	Mrs. KRUPASHANKARI .S.S	Assistant Professor
15.	Mrs. SHALINI K.B	Assistant Professor
16.	Mrs. BINDU BHARGAVI S.M	Assistant Professor
17.	Mrs. MADHURA J.	Assistant Professor
18.	Mrs. SHILPASHREE .S	Assistant Professor
19.	Mrs. LATHA A.P	Assistant Professor

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SCHEME OF TEACHING AND EXAMINATION 2018-2019
Department of Information Science and Engineering

20.	Mrs. SREEVIDYA B.S	Assistant Professor
PG - FACULTY		
21.	Dr. CHANDRAKALA B.M.	Associate Professor
22.	Mr. SURESHKUMAR .M.	Assistant Professor

III SEMESTER (SCHEME)

Sl. No	Subject Code	Subject Title	Teaching Department	Teaching Hours /Week			Examination			Total Credits
				L	T	P	CIE	SEE	Total	
1	19MA3GCDIT	Discrete and Integral Transforms	MAT	3	0	0	50	50	100	3
2	19IS3DCDSA	Data Structures with Applications	IS	4	0	0	50	50	100	4
3	19IS3DCDLD	Digital Systems and Logic Design	IS	3	0	0	50	50	100	3
4	19IS3DCDCM	Data Communication	IS	3	0	0	50	50	100	3
5	19IS3DCCOG	Computer Organization	IS	3	0	0	50	50	100	3
6	19IS3DCDMS	Discrete mathematical Structures	IS	3	0	0	50	50	100	3
7	19IS3DLDSL	Data Structures Laboratory with C	IS	0	1	2	50	50	100	2
8	19IS3DLLDL	Logic Design Laboratory	IS	**0**	1	2	50	50	100	2
9	19HS3ICKAN/ 19HSS3ICCIP	Kannada /CIPE	HSS	**1**	0	0	50	--	50	1
Total				**20**	**02**	**04**	450	400	850	**24**

Course Prescribed to lateral entry Diploma holders admitted to III Semester of Engineering Programs										
10	17MA3IMMAT	Advance Mathematics-I	MAT	3	0	0	50	--	50	0

a) The mandatory non – credit courses Advance Mathematics- I and II prescribed at III and IV semesters respectively, to lateral entry Diploma holders admitted to III semester of BE/B.Tech programs shall compulsorily be registered during respective semesters to complete all the formalities of the course and appear for examination.

b) The mandatory non – credit courses Advance Mathematics I and II, prescribed to lateral entrant Diploma holders admitted to III semester of BE/B.Tech programs, are to be completed to secure eligibility to VII semester. However, they are not considered for vertical progression from II year to III year of the program.

IV SEMESTER (SCHEME)

Sl. No	Subject Code	Subject Title	Teaching Department	Teaching Hours /Week			Examination			Total Credits
				L	T	P	CIE	SEE	Total	
1	19MA4GCCVD	Complex Variables and Distribution	MAT	3	0	0	50	50	100	3
2	19IS4DCDDAA	Design & Analysis of Algorithms	IS	4	0	0	50	50	100	4
3	19IS4DCMPM	Microprocessors & Microcontrollers	IS	3	0	0	50	50	100	3
4	19IS4DCOPS	Operating System	IS	3	0	0	50	50	100	3
5	19IS4DCOOP	Object Oriented Programming with C++	IS	3	0	0	50	50	100	3
6	19IS4DCFLT	Automata Theory and Formal Languages	IS	3	0	0	50	50	100	3
7	19IS4DLADA	Design and Analysis of Algorithms Laboratory with Mini-project	IS	0	1	2	50	50	100	2
8	19IS4DLMPM	Microprocessors & Microcontrollers Laboratory	IS	0	1	2	50	50	100	2
9	18HS4ICKAN/ 18HSS4ICCIP	Kannada/CIPE	HSS	1	0	0	50	--	50	1
Total				**20**	**02**	**04**	**450**	**400**	**850**	**24**
Course Prescribed to lateral entry Diploma holders admitted to III Semester of Engineering Programs										
10	17MA4IMMAT	Advance Mathematics-II	MAT	3	0	0	50	--	50	0

a) The mandatory non – credit courses Advance Mathematics- I and II prescribed at III and IV semesters respectively, to lateral entry Diploma holders admitted to III semester of BE/B.Tech programs shall compulsorily be registered during respective semesters to complete all the formalities of the course and appear for examination.

b) The mandatory non – credit courses Advance Mathematics I and II, prescribed to lateral entrant Diploma holders admitted to III semester of BE/B.Tech programs, are to be completed to secure eligibility to VII semester. However, they are not considered for vertical progression from II year to III year of the programme.

V SEMESTER (SCHEME)

Sl. No	Subject Code	Subject Title	Teaching Department	Teaching Hours /Week			Examination			Total Credits
				L	T	P	CIE	SEE	Total	
1	19HS5ICMEP	Management& Entrepreneurship	IS	3	0	0	50	50	100	**3**
2	19IS5DCCNS	Computer Networks and Cyber Security	IS	4	0	0	50	50	100	**4**
3	19IS5DCIFR	Information Retrieval	IS	3	0	0	50	50	100	**3**
4	19IS5DCDBM	Database management Systems	IS	4	0	0	50	50	100	**4**
5	19IS5DEXXX	Department Elective A	IS	3	0	0	50	50	100	**3**
6	19IS5DEXXX	Department Elective B	IS	3	0	0	50	50	100	**3**
7	19IS5DLDBM	Database Applications Laboratory with Mini project	IS	0	1	2	50	50	100	**2**
8	19IS5DLCNS	Computer Networks and Cyber Security Laboratory	IS	0	1	2	50	50	100	**2**
9	19IS5DCEMT	Emerging Technologies	IS	2	0	0	50	--	50	**2**
Total				19	02	07	450	450	900	26

Emerging Technologies
a) The dynamics of industry is such that there are rapid advances in technology and systems that drive product, process and organizations. Therefore, there is a need for providing opportunities to students for keeping abreast with the latest practices. This course on Emerging technologies is conceptualized with that need in mind. b) This course would help in preparing the students to meet industry requirements and preparing them for their future professional career. The outcome of the course would be to ensure that the graduates are prepared to meet the future challenges and emerging needs of the society. c) This course will have CIE only. No SEE for this course. In case the student fails to obtain the minimum CIE marks prescribed the student has to register for the course in fast track semester and earn the CIE marks d) Scheme of Continuous Internal Evaluation (CIE) as per the regular format.

Department Elective-A		Department Elective-B	
19IS5DECCM	Cloud computing	**19IS5DEPYP**	Python Programming
19IS5DEFLS	File Structures	**19IS5DEDWM**	Data Warehousing and Data Mining
19IS5DECDN	Compiler Design	**19IS5DECGH**	Computer Graphics and Vision
19IS5DEITSM	Information Technology and Service Management	**19IS5DEMAD**	Mobile Application Development

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CHOICE BASED CREDIT SYSTEM (CBCS)
SCHEME OF TEACHING AND EXAMINATION 2018-2019

Department of Information Science and Engineering

VI SEMESTER (SCHEME)

Sl. No	Subject Code	Subject Title	Teaching Department	Teaching Hours /Week			Examination			Total Credits
				L	T	P	CIE	SEE	Total	
1	**19HS6ICEEM**	Engineering Economics	Humanities	3	0	0	50	50	100	3
2	**19IS6DCSFE**	Software Engineering	IS	4	0	0	50	50	100	4
3	**19IS6DCAML**	Artificial Intelligence and Machine Learning	IS	3	0	0	50	50	100	3
4	**19IS6DCJVA**	Java and J2EE	IS	3	0	0	50	50	100	3
5	**19IS6DEXXX**	Department Elective C	IS	3	0	0	50	50	100	3
6	**19IS6IEXXX**	Institutional Elective 1	IS	3	0	0	50	50	100	3
7	**19IS6DCMIP**	Mini Project	IS	0	0	3	50	50	100	3
8	**19IS6DLAML**	AI & Machine Learning Laboratory	IS	0	1	2	50	50	100	2
9	**19IS6DLJVA**	Java and J2EE laboratory	IS	0	1	2	50	50	100	2
10		Internship								
Total				19	02	07	450	450	900	26

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Department of Information Science and Engineering

Mini-Project	Internship
To be completed before VI semester. The examination for the same will be conducted during VI semester and accordingly credit is added. The mini-project is considered as a head of passing and is considered for the award of degree. Those, who do not take-up/complete the mini-project will be declared as failed and have to complete during subsequent examination after satisfying the internship requirements. Also, mini-project is considered for eligibility to VII semester.	All the students admitted to III year of B.E. / B.Tech have to undergo mandatory internship of 4 weeks during the vacations of VI and VII semesters and /or VII and VIII semesters. Examination will be conducted during VIII semester and prescribed credits are added to VIII semester. Internship is considered as a head of passing and is considered for the award of degree. Those, who do not take-up/complete the internship will be declared as failed and have to complete during subsequent examination after satisfying the internship requirements.

Institution Elective: Students can select any one of the Institution electives offered by any Department. Candidate will be offered with an Institution elective,

- If the candidate has not studied the same course during the earlier courses of the program.
- The syllabus content of Institution elective is not similar to that of Departmental core courses or professional electives.
- A similar course, under any category, is not prescribed in the higher semesters of the programme. Registration to electives shall be documented under the guidance of Programme Coordinator/ Adviser/Mentor.

Department Elective - C		Institutional Elective – 1	
19IS6DEDIP	Digital Image Processing	**19IS6IEJVA**	Introduction to Java
19IS6DEUSP	Unix System Programming		
19IS6DEIOT	5G and Internet of Things		
19IS6DEUID	User Interface Design		

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SCHEME OF TEACHING AND EXAMINATION 2018-2019

Department of Information Science and Engineering

VII SEMESTER (SCHEME)

Sl. No	Subject Code	Subject Title	Teaching Department	Teaching Hours/Week			Examination			Total Credits
				L	T	P	CIE	SEE	Total	
1	**19IS7DCSTQ**	Software Testing and Quality Metrics	IS	04	0	0	50	50	100	**4**
2	**19IS7DEXXX**	Department Elective D	IS	03	0	0	50	50	100	**3**
3	**19IS7DEXXX**	Department Elective E	IS	03	0	0	50	50	100	**3**
4	**19IS7IEXXX**	InstitutionalElective2	IS	03	0	0	50	50	100	**3**
5	**19IS7ICPR1**	Project Phase–I	IS	0	2	0	50	50	100	**2**
6	**19IS7DLSTL**	Software Testing and Quality Metrics	IS	0	1	2	50	50	100	**2**
7		Internship								
TOTAL				13	3	2	300	300	600	**17**

Project Work Phase-I	**Internship**
To be taken up during VII semester. The student has to identify the domain of interest, draft the objectives of the project, carry out detailed Literature Survey and define problem statement. The student has to submit the report before the deadline announced by the Department. Phase–I has both CIE and SEE.	All the students admitted to III year of BE/B.Tech have to undergo mandatory internship of 4 weeks during the vacations of VI and VII semesters and/or VII and VIII semesters. Examination will be conducted during VIII semester and prescribed credit are added to VIII semester. Internship is considered as a head of passing and is considered for the award of degree. Those, who do not take- up/complete the internship will be declared as failed and have to complete during subsequent examination after satisfying the internship requirements.

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Department of Information Science and Engineering

Institution Elective: Students cans elect any one of the Institution electives offered by any Department. Candidate will be offered with an Institution elective

- Ifthe candidate has not studied the same course during the earlier courses of the program.
- The syllabus content of Institution elective is not similar to that of Departmental core courses or professional electives.
- A similar course, under any category, is not prescribed in the higher semesters of the programme. Registration to electives shall be documented under the guidance of Programme Coordinator/ Adviser/Mentor.

Department Elective-D		**Department Elective-E**		**InstitutionalElective–2**	
19IS7DEWTS	Web Technologies	19IS7DEORS	Operation Research	19IS7IEDBS	Database Management System
19IS7DEVAR	Virtual and Augmented Reality	19IS7DECAR	Computer Architecture		
19IS7DEDSA	Data Science & Analytics	19IS7DEGCT	Green Computing		
19IS7DEBLC	Block Chain	19IS7DECNS	Cryptography and Network		

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SCHEME OF TEACHING AND EXAMINATION 2018-2019

Department of Information Science and Engineering

VIII SEMESTER (SCHEME)

Sl. No	Course Code	Course Title	Teaching Department	Teaching Hours/Week			Examination			Total Credits
				L	T	P	CIE	SEE	Total	
1	**19IS8ICPR2**	Project Work Phase-II		0	0	4	50	50	100	**12**
2	**19IS8ICTHS**	Technical Seminar		0	2	0	100	--	100	**2**
3	**19IS8ICHSS**	Swachh Bharath / Training / Innovation And Social Skills / MOOCs		0	0	0	--	--	---	**2**
4	**19IS8ICINT**	Internship	(To be carried out during the intervening Vacations of VI and VII Semester and / or VII and VIII Semester)				50	50	100	**2**
5	**19ATP1/ 19ATP2**	ACTIVITY POINTS – 50 / ACTIVITY POINTS – 25	-	0	0	0	0	0	0	0
Total				0	02	04	200	100	300	**18**

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SCHEME OF TEACHING AND EXAMINATION 2018-2019

Department of Information Science and Engineering

Sl. No.	Student Category	Activity Points to be Earned	Applicable course code
1	**Day college Regular student admitted to the 4 years degree programme (admitted during 2018-19 and 2019-20)**	**50**	**18ATP1**
2	**Student entering 4 years degree programme through lateral entry (admitted during 2019-20 and 2020-21)**	**25**	**18ATP2**
3	**The student transferred from other Universities to the fifth semester (admitted during 2020-21)**	**25**	**18ATP2**

Project Work Phase – II	**Innovation and Social Skills / Swachh Bharath / Training / MOOCs**
To be taken up during VII semester. The problem statement defined during the Project Work Phase–I has to be executed and results presented in Phase–II. The student has to submit the report before the deadline announced by the Department. Phase–II has both CIE and SEE.	Students can take up Innovation and Social Skills / Training / Swachh Bharath Abhyan / MOOCs from V Semester onwards and has to be completed before getting into VIII semester and the prescribed credits are added in VIII semester. Students have to compulsorily submit the certificate after completion of the course to the Department. This is considered as ahead of passing and is mandatory for the award of degree. Those, who do not take-up / complete the requirement, will be declared as failed and the degree will not be awarded.
Technical Seminar: Students can select any topic of their choice related to the latest development in the domain and present the seminar as per the guidelines issued by the Department. Technical Seminar has CIE only.	

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SCHEME OF TEACHING AND EXAMINATION 2018-2019

Department of Information Science and Engineering

MOOCs – Courses are to be selected from – NPTEL / SWAYAM / COURSERA / EDx / UDACITY. Can be taken from 5th sem to 7th sem and should be related courses of 5-7 semester. The courses elected should be approved by respective HoDs.

Swachh Bharath Abhyan – Students will have to intimate respective HoD's after registration. Can be taken from 5th sem to 7th sem.

Internship – After the internship, students have to submit report and have to make a presentation before a two member committee formed by the Department.

Innovation and Social Skills-

- To provide a platform for the students to exhibit their organizational capabilities, team building, ethical values and extra mural abilities.
- To encourage to carry out innovative ideas and projects.
- Take part in societal and community building activities.
- Make self learning, ethics and lifelong learning a motto.

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SCHEME OF TEACHING AND EXAMINATION 2018-2019

Department of Information Science and Engineering

III SEMESTER

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SCHEME OF TEACHING AND EXAMINATION 2018-2019
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DISCRETE AND INTEGRAL TRANSFORMS

Course code: 19MA3GCDIT **Credits: 03**
L: P: T: S: 3:1:0:0 **CIE Marks: 50**
Exam Hours: 03 **SEE Marks: 50**

Course Objectives:

1. Generalize a periodic function as a sum of series of trigonometric functions using Fourier series
2. Explain the concept of Fourier and Z transform and state the use of it in time varying signals (continuous).
3. Introduce Programming lab for Descriptive statistics

Course Outcomes: At the end of the course, student will be able to:

CO1	Use Method of Least Square for finding best fit Curves
CO2	Use software to analyze statistical data to standard typology
CO3	Apply Z - Transform to solve Difference Equations
CO4	Expand a periodic function as trigonometric series (Fourier series).
CO5	Apply Laplace Transform to solve ordinary differential equation
CO6	Demonstrate Fourier Transform as a tool for solving Integral equations.

Mapping of Course outcomes to Program outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	1								
CO2	3	3	2	1								
CO3	3	3	1	1								
CO4	3	3	2	1								
CO5	3	3	2	1								
CO6	3	3	2	1								

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Module	Contents of the Module	Hours	CO's
1	**Curve Fitting &Statistics :** Curve Fitting**:** Curve fitting by the method of least squares, Fitting a straight line and parabola Statistics Modeling**:** Analyzing a data - Mean, Standard deviation-combination of two groups, correlation, Linear regression. Application Problems	8	**CO1, CO2**
2	**Z-Transforms**: Introduction to Transforms. Definition, Standard Z-transforms, Damping rule, Shifting rule, Initial value and final value theorems (without proof), Inverse Z-Transforms, Application of Z-transforms to solve difference equations. Application Problems	8	**CO3**
3	**Fourier Series** Periodic functions, Dirichlet's conditions, Fourier series of periodic functions of period 2π and with arbitrary period $2l$, Half-range Fourier sine and cosine series, Practical Harmonic Analysis. Application Problems	8	**CO4**
4	**Integral Transforms –I** Laplace Transform: Definition and Laplace Transforms of Elementary functions, Laplace Transforms of $e^{at}f(t), t^n f(t), \frac{f(t)}{t}$, Periodic functions, Unit Impulse function (statements only)-problems. Inverse Laplace Transforms**:** Inverse Laplace Transforms of Logarithmic and Trigonometric functions, Inverse Laplace transform by the method of Partial Fractions. Convolution Theorem (statement only)-problems. Application Problems	8	**CO5**
5	**Integral Transforms –II** Fourier Transform: Infinite Fourier transform, Infinite Fourier sine and cosine transforms, Inverse Fourier transforms, Inverse Fourier sine and cosine transforms, Convolution theorem (without proof), Parseval's identity- problems. Application Problems	8	**CO6**

TEXT BOOKS:

1. B.S. Grewal, "Higher Engineering Mathematics" Khanna Publishers, 43rd Edition, 2014 June, ISBN: 9788174091956.
2. Erwin Kreyszig; Advanced Engineering Mathematics; John Wiley & Sons, 9th Edition, 2007, ISBN: 9788126531356.
3. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.

REFERENCE BOOKS:

1. B.V.Ramana, "Higher Engineering Mathematics", Tata Mc Graw-Hill, 2006; ISBN:9780070634190.
2. M. K. Jain, S. R. K. Iyengar and R. K. Jain "Numerical Methods: For Scientific and Engineering Computation", New Age International Publications, 6th Edition, 2012, ISBN: 9788122433234.
3. Murray Speigel, Schaum's Outline of "Advanced Mathematics for Engineers and Scientists"McGraw-Hill, 1971; ISBN: 9780070602168.

Self-study component:

UNIT 1: Weighted mean, Rank Correlation - Programming

UNIT 2: Region of convergence

UNIT 3: Fourier Integral Theorem -Proof

UNIT 4: Laplace Transform of Unit step function.

UNIT 5: Properties of Fourier Transform

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Department of Information Science and Engineering

DATA STRUCTURES WITH APPLICATIONS

Course code: 19IS3DCDSA **Credits: 04**
L: P: T: S: 4:0:0: 0 **CIE Marks: 50**
Exam Hours: 03 **SEE Marks: 50**
Total Hours: 50

Course objectives:

1. Explain fundamentals of data structures and their applications essential for programming / problem solving
2. Analyze Linear: Stack, Queues, Lists
3. Analyze Non-Linear Data Structures: Trees, Graphs
4. Assess appropriate data structure during program development / problem solving

Course Outcomes: At the end of the course, student will be able to:

CO1	Acquire knowledge of - Various types of data structures, operations and algorithms. - Sorting and searching operations.
CO2	Ability to analyze time and space efficiency of algorithms
CO3	Ability to apply various data structures and its properties to illustrate storage of data efficiently.
CO4	Analyze the performance of - Stack, Queue, Lists, Trees, Graphs, Searching and Sorting Techniques.
CO5	Implement all the applications of Data structures in a high-level language.
CO6	Design and apply appropriate data structures for solving computing problems.

Module	Contents of the Unit	Hours	COs
1.	**BASIC CONCEPTS:** Structure & Union, Introduction to Data Structure and its classification, the need for Data structure, Algorithm specification, performance analysis & measurements, Polynomials and Sparse Matrices.	**10**	**CO1 & CO2**
2.	**STACKS AND QUEUES:** Introduction to Stacks, Stacks Using Dynamic Arrays, Evaluation of Expressions, Introduction to Queues, Types of Queue: Ordinary queue, Circular Queues & Double ended queue, Application of stacks and Queues.	**10**	**CO3 & CO4**
3.	**LINKED LISTS:** Definition of Linked lists and Chains, Representing Chains in C, Types of Linked List: Singly Linked	**10**	**CO3 &**

	List, Circular Singly Linked List, Doubly Linked Lists & Circular doubly linked list, Application of Linked List.		**CO4**
4.	**TREES & GRAPH:** Introduction to Binary Search Trees (BST), Properties of Binary Tree, Operation on BST, Traversals in Binary Trees, Heaps, Selection Trees, Forests tree, Counting Binary Trees.	**10**	**CO4 & CO6**
5.	**EFFICIENT BINARY SEARCH TREES:** Optimal Binary Search Trees, AVL Trees, Properties of AVL tree, Construction of AVL tree, Red-Black Trees, Properties of red black tree, Construction of red black tree.	**10**	**CO5 & CO6**

Self-study component:

Note:
1. Questions for CIE and SEE not to be set from self-study component.
2. Assignment Questions should be from self-study component only.

UNIT 1: Dynamic Memory Allocation
UNIT 2: Multiple Stacks and Queues
UNIT 3: Operation on Linked list using Stacks, Queues, Polynomials
UNIT 4: Introduction to Graph, properties of graph, Representation of graph in memory
UNIT 5: Splay Trees

TEXT BOOK:

1. Horowitz, Sahni, Anderson-Freed: Fundamentals of Data Structures in C, 2nd Edition, Universities Press, 2007.

REFERENCE BOOKS:

1. Yedidyah, Augenstein, Tannenbaum: Data Structures Using C and C++, 2nd Edition, Pearson Education, 2003.
2. Richard F. Gilberg and Behrouz A. Forouzan: Data Structures A Pseudocode Approach with C, Cengage Learning, 2005.
3. A.M Padma Reddy," Approach of Data Structures", Person Publication, 5th Edition, 2015
4. Reema Theraja"Data Structure using C. 1st Edition, 2014

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DIGITAL SYSTEMS AND LOGIC DESIGN

Course code: 19IS3DCDLD | **Credits: 03**
L: P: T: S: 3:0:0: 0 | **CIE Marks: 50**
Exam Hours: 03 | **SEE Marks: 50**
Total Hours: 40

Course objectives:

1. Students will learn the basic concepts related to digital systems and its components like arithmetic, data processing register, and counter circuits.
2. Student will learn basic and universal gates and its significance
3. Students will learn to analyse Boolean expressions and learns to minimize and optimize it using various methods.
4. Students will understand the operation of digital circuit and learn to design and analyse to implement the same as Verilog program.

Module	Contents of the Unit	Hours	COs
1	**DIGITAL PRINCIPLES, DIGITAL LOGIC:** Introduction to Binary Systems, Definitions for Digital Signals, Digital Waveform, Digital Logic: Positive and Negative Logic, The Basic Gates: NOT, OR, AND, Universal Logic Gates: NOR, NAND **ARITHMETIC BUILDING BLOCKS:** Arithmetic Building Blocks, Adder - subtractor, Fast Adder, Arithmetic Logic Unit	08	CO1
2	**COMBINATIONAL LOGIC CIRCUITS:** Sum-of-Products Method, Truth Table to Karnaugh Map, Pairs Quads, and Octets, Karnaugh Simplifications, Don't-care Conditions, Product-of-sums Method and simplifications, Simplification by EVM, Simplification by Quine-McClusky Method.	08	CO1 CO2
3	**DATA-PROCESSING CIRCUITS:** Multiplexers, De-multiplexers, 1-of-16 Decoder, BCD-to-decimal Decoders Seven-segment Decoders, Encoders, Exclusive-or Gates, Parity Generators and Checkers, Magnitude Comparator **CLOCKS:** Clock Waveform, Edge triggering and Level Triggering	08	CO3 CO4
4	**FLIP-FLOPS:** Clocked D FLIP-FLOP, Edge-triggered D FLIP-FLOP,	08	CO3 CO4

	Edge-triggered JK FLIP-FLOP, FLIP-FLOP Timing, JK Master-slave FLIP-FLOP, Various Representation of FLIP-FLOP's, Analysis of Sequential Circuits **REGISTERS:** Types of Registers, Serial In - Serial Out, Serial In - Parallel out, Parallel In - Serial Out, Parallel In - Parallel Out, Universal Shift Register, Applications of Shift Registers		**CO5**
5	**COUNTERS:** Asynchronous Counters, Decoding Gates, Synchronous Counters, Counter Design as a Synthesis problem, A Digital Clock **VERILOG IMPLEMENTATION:** Introduction, Implementation Models, Verilog for Combinational Circuits and Data Processing Circuits, Verilog Constructs for Storage, Counter Design using Verilog	**08**	**CO4** **CO5** **CO6**

Self-study component:

BOOLEAN ALGEBRA: Basic Definitions, Axiomatic Definition of Boolean Algebra, Basic Theorems and Properties of Boolean Algebra

NUMBER SYSTEMS: Decimal, Binary, Octal and Hexadecimal, Conversion from one system to another, Representation of negative numbers, Representation of BCD numbers, Character representation, Character coding schemes, ASCII, EBCDIC etc.
Switch Contact Bounce Circuits

HAZARDS AND HAZARD COVERS

DESIGN OF SYNCHRONOUS AND ASYNCHRONOUS SEQUENTIAL CIRCUITS: Model Selection, State Transition Diagram, State Synthesis Table

D/A COVERSION AND A/D CONVERSION

Note:
1. Questions for CIE and SEE not to be set from self-study component.
2. Assignment Questions should be from self-study component only.

TEXT BOOKS:

1. Donald P Leach, Albert Paul Malvino & Goutam Saha: Digital Principles and Applications, 8th Edition, Tata McGraw Hill, 2010.
2. Stephen Brown, ZvonkoVranesic: Fundamentals of Digital Logic Design with Verilog, 2nd Edition, Tata McGraw Hill, 2005.
3. M Morris Mano: Digital Logic and Computer Design, 10th Edition, Pearson Education, 2008.

REFERENCE BOOKS:

1. C.H. Roth,"Fundamentals of Logic Design", 5th Ed., Cengage Learning, 2004.
2. R D Sudhaker Samuel: Illustrative Approach to Logic Design, Sanguine-Pearson, 2010.
3. Floyd T. L., Digital Fundamentals, 10/e, Pearson Education, 2009.

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DATA COMMUNICATION

Course code: 19IS3DCDCM **Credits: 03**
L: P: T: 3:0:0 **CIE Marks: 50**
Exam Hours: 03 **SEE Marks: 50**
Total Hours: 40

Course objectives:

1. Identify the components of a data communication system, factors which impact performance of data communication systems and solve numerical examples related to these.
2. Understand &Analyse Analog to Digital conversions and vice versa, Multiplexing and various types of transmission media used in computer networks and methods to optimize utilization of their capacities.
3. Understand the different types of circuit switched Networks and discuss various error detection and correction techniques employed in data link layer
4. Analyze the various ARQ protocols, frame construction protocols like HDLC, PPP and also the multiple access protocols employed by Data link layer.
5. Understand the structure of 802.3 and 803.11 protocols along with associated headers and algorithms used and also learn about the connecting devices.

Course Outcomes: At the end of the course, student will be able to:

CO1	Interpret the components of data communication system.
CO2	Distinguish different communication models / protocol stacks (OSI & TCP/IP) and solve problems on data transmission by measuring the performance parameters.
CO3	Handle the problems associated with digital data and signals.
CO4	Apply different error detection & correction strategies to solve errors induced during data communication.
CO5	Use the different strategies of multiple access and achieve better network efficiency.
CO6	Illustrate the architecture and working of different types of network as well as identify the connecting devices to be used for different types of networks.

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Module	Contents of the Unit	Hours	COs
1.	**INTRODUCTION** Data Communications, Networks, The Internet, Protocols &Standards, Layered Tasks, The OSI model, Layers in OSI model, TCP/IP Protocol suite.	**8**	**CO1 & CO2**
2.	**Physical Layer-1** Analog & Digital Signals, Transmission Impairment, DataRate limits, Performance, Digital-digital conversion -Only Line coding: Polar, Bipolar and Manchester coding, Analog to digital Conversion: Pulse Code Modulation	**8**	**CO3& CO4**
3.	**Data Link Layer-1** Error Detection & Correction: Introduction, Block coding, Linear block codes, Cyclic codes, Checksum. **Data Link Layer-2** Framing, Flow and Error Control Protocols, Noiseless Channels, Noisy channels	**8**	**CO3 & CO4**
4.	**Multiple Access & Ethernet** Random Access: Carrier Sense Multiple Access (CSMA), Carrier sense multiple access with collision detection (CSMA/CD), Carrier Sense Multiple Access with Collision Avoidance(CSMA/CA), Controlled Access, Channelization: FDMA, TDMA, CDMA Ethernet: IEEE standards, Standard Ethernet, Changes in the standard	**8**	**CO4& CO6**
5.	**Wireless LANs and Cellular Networks** Introduction, IEEE 802.11: Architecture, MAC Sublayer, Addressing Mechanism Bluetooth: Architecture, Bluetooth layers, Radio Layer, Baseband Layer, Connecting devices	**8**	**CO5 & CO6**

Self-study component:

Note: 1.Questions for CIE and SEE not to be set from self-study component.

2. Assignment Questions should be from self-study component only.

UNIT 1: Addressing

UNIT 2: Addressing, Analog to digital Conversion: Delta Modulation, Transmission Modes, Digital-to-analog conversion, Multiplexing, Spread Spectrum, HDLC, PPP - Framing, Transition phases only.

UNIT 3: Noiseless Channels, Noisy Channels, HDLC.

UNIT 4: Fast Ethernet, Gigabit Ethernet

UNIT 5: Wireless WANS: Satellite Networks, Cellular Telephony

TEXT BOOKS:

1. Behrouz A. Forouzan, Data Communications and Networking, Fourth Edition, Tata McGraw-Hill, 2006
2.

REFERENCE BOOKS:

1. Alberto Leon-Garcia and IndraWidjaja, Communication Networks – Fundamental Concepts and Key architectures, Second Edition, Tata McGraw-Hill,2004.

2. Wayne Tomasi, Introduction to Data Communications and Networking, Pearson Education, 2005.

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COMPUTER ORGANIZATION

Course code: 19IS3DCCOG **Credits: 03**
L: P: T: S: 3: 0: 0: 0 **CIE Marks: 50**
Exam Hours: 03 **SEE Marks: 50**
Total Hours: 40

Course Objectives:

1. To learn and understand about the fundamental concepts of how Computer Systems works & its basic principles.
2. To learn and understand I/O device address, Interrupts and different buses.
3. To learn and understand the current state of art in memory system design.
4. To impart knowledge on arithmetic concepts of signed numbers, Adders Design, Multiplication and floating-point numbers.

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

CO1	**Interpret** the concepts of working of Computer Systems and its basic principles.
CO2	**Illustrate** the concepts of interrupts and exceptions.
CO3	**Illustrate** the various types of standard input output interfaces buses.
CO4	**Explain** the function of each element of a memory hierarchy.
CO5	**Analyze** Performance issues in Processor and Memory Design of a Digital Computer.
CO6	**Solving** problems on addition and subtraction of signed numbers and multiplication of positive numbers.

Module	Course Content	Hours	COs
1	**Basic Structure of Computers:** Functional Units, Basic Operational Concepts, Performance – Basic Performance Equation, Clock Rate, Performance Measurement. **Machine Instructions and Programs:** Numbers, Arithmetic Operations and Characters, Memory Location and Addresses.	**08**	**CO1**

2	**Input/output Organization:** Accessing I/O Devices, Interrupts – Interrupt Hardware, Enabling and Disabling Interrupts, Handling Multiple Devices, Controlling Device Requests, Exceptions	**08**	**CO1, CO2**
3	**Input/output Organization cntd :** Direct Memory Access, Buses, Standard I/O Interfaces – PCI Bus, SCSI Bus, USB-Port Limitations, Plug-And-Play, USB Architecture, Addressing, and USB protocols.	**08**	**CO2, CO3**
4	**Memory System:** Basic Concepts, Semiconductor RAM Memories, Speed, Size and Cost, Cache Memories – Mapping Functions, Performance Considerations-Interleaving, Hit Rate and Miss Penalty; Virtual Memories.	**08**	**CO4, CO5**
5	**Arithmetic:** Addition and Subtraction of Signed Numbers, Design of Fast Adders, Multiplication of Positive Numbers, Signed Operand Multiplication, Fast Multiplication-Bit-Pair Recoding of Multipliers, Integer Division, Floating-point Numbers and Operations-IEEE Standard for Floating-point Numbers.	**08**	**CO6**

Self study component:

Note:

1. Questions for CIE and SEE not to be set from self-study component.
2. Assignment Questions should be from self-study component only.

UNIT – 1: Computer Types, Historical Perspective, Memory Operations, Instructions and Instruction Sequencing, processor clock.

UNIT – 2: Addressing Modes, Assembly Language, Basic Input and Output operation

UNIT – 3: Interface circuits.

UNIT – 4: Read Only Memories, Replacement Algorithms, Secondary Storage

UNIT – 5: Arithmetic: Fast multiplication -Carry-Save Addition of Summands

Basic Processing Unit: Single bus organization, Execution of a Complete Instruction, Multiple Bus Organization, Hard-wired Control, and Micro programmed Control.

TEXT BOOKS:

1. Carl Hamacher, ZvonkoVranesic, Safwat Zaky: Computer Organization, 5th Edition, Tata McGraw Hill, 2002. (Listed topics only from Chapters 1, 2, 4, 5, 6)

REFERENCE BOOKS:

1. William Stallings: Computer Organization & Architecture, 7th Edition, PHI, 2006.
2. Computer Systems Design and Architecture by Vincent P. Heuring& Harry F.Jordan, Ed2, Pearson Education, 2004.

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DISCRETE MATHEMATICAL STRUCTURES

Course code: 19IS3DCDMS | **Credits: 03**
L: P: T: S: 3:0:0: 0 | **CIE Marks: 50**
Exam Hours: 03 | **SEE Marks: 50**
Total Hours: 40

Course objectives:

1. To understand the fundamental mathematical concepts namely sets, relations, functions, logic and integers.
2. To understand the laws of logic and simplify logical statements with many connectives.
3. To analyze the basic concepts of principle of inclusion and exclusion.
4. To gain the knowledge of basic proposition concerning group theory.

Course Outcomes: At the end of the course, student will be able to:

CO1	Get familiarity with set logic and mathematical logic.
CO2	Calculate the number of possible outcomes of elementary combinatorial process such as permutations and combinations.
CO3	Evaluate the validity of a given argument by applying laws of logic.
CO4	Apply and analyze the basic knowledge gained by functions and relations.
CO5	Acquire the clarity of identifying the types of functions and apply pigeon-hole principle in various problems solving situation.
CO6	Determine solutions to mathematical problems using principle of inclusion and exclusion.

Module	Contents of the Unit	Hours	COs
1	**SET THEORY:** Sets and Subsets, Set Operations and the Laws of Set Theory, Addition Principle, A First Word on probability	**08**	**CO1 & CO2**
2	**FUNDAMENTALS OF LOGIC:** Basic Connectives and Truth Tables, Logical Equivalence: The laws of Logic, Logical Implication: Rules of Inference, The Use of Quantifiers – Open Statements, Quantifiers, and Logical Implication involving Quantifiers.	**08**	**CO1 & CO3**

3	**RELATIONS AND FUNCTIONS**: Cartesian Products and Relations, Functions, Types of functions, Stirling Numbers of the Second Kind, The Pigeonhole Principle, Function Composition of functions and Invertible Functions.	**08**	**CO4 & CO5**
4	**RELATIONS:** Zero-one matrices and directed graphs, Properties of Relations, Equivalence Relations, Partial Orders – Hasse Diagrams, Groups: Groups, Subgroups, Cyclic groups.	**08**	**CO4**
5	**PRINCIPLES OF COUNTING:** The Rules of Sum and Product, Permutations, Combinations, Principle of Inclusion and Exclusion, Derangements, Rook Polynomials.	**08**	**CO6**

Self-study component:

Note:

1. Questions for CIE and SEE not to be set from self-study component.
2. Assignment Questions should be from self-study component only.
1. Coset Decomposition of a group: Lagrange's Theorem, Homomorphism, Isomorphism
2. Binomial and Multinomial Theorem, Combinations with repetitions, Catalan Numbers.

TEXT BOOKS:

1. Ralph P. Grimaldi: Discrete and Combinatorial Mathematics, 5th Edition, Pearson Education, 2004.
2. Dr. D.S.C, Discrete Mathematical Structures, 3rd Edition, PRISM

REFERENCE BOOKS:

1. Kenneth H. Rosen: Discrete Mathematics and its Applications, 7th Edition, McGraw Hill, 2010.
2. Jayant Ganguly: A Treatise on Discrete Mathematical Structures, Sanguine-Pearson, 2010.
3. D.S. Malik and M.K. Sen: Discrete Mathematical Structures: Theory and Applications, Cengage Learning, 2004.

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DATA STRUCTURES LABORATORY WITH C

Course code: 19IS3DLDSL **Credits: 02**
L: P: T: S: 0: 2: 1: 0 **CIE Marks: 50**
Exam Hours: 03 **SEE Marks: 50**

Course Objectives: Students undergoing this course are expected to:

1. Selecting appropriate data structure for a given problem and write programs.
2. Designing the algorithms using procedural concepts.
3. Understand and implement fundamentals of data structures using C.
4. Develop ability to apply data structures in solving real-world problems.

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

CO1	Analyse algorithms and determine algorithm correctness.
CO2	To design and implement the concept of Queues and Stacks.
CO3	To design and implement the concept of Linked lists.
CO4	To demonstrate the paradigm of Sorting algorithms.
CO5	Design and implement Binary Trees.
CO6	Familiarize the utilities of arrays and structures.

Exp No.	Contents of the experiment	Hours	COs
1.	Write a C program to create a sequential file with at least 5 records, each record having the structure shown below. a. To display all records in the file. b. To search for a specific record based on the USN. In case the record is not found, suitable message should be displayed. Both the options in this case must be demonstrated.	**3**	**CO1**
2.	Design, develop and execute a C program to check if a string is a palindrome or not.	**3**	**CO1**
3.	Design, develop and execute a program in C to convert a given valid parenthesized infix arithmetic expression to postfix expression and	**3**	**CO1** **CO2**

	then print both the expressions. The expression consists of single character operands and the binary operators +, - , * , /		
4.	Design, develop and execute a program in C to evaluate a valid postfix expression using stack. Assume that the postfix expression is read as single line consisting of non-negative single digit operands and binary arithmetic operators. The arithmetic operators are +(add),-(sub),*(mul) and / (divide)	**3**	**CO1 CO2**
5.	Design, develop, and execute a program in C to simulate the working of a queue of integers using an array. Provide the following operations: a. Insert b. Delete c. Display	**3**	**CO1 CO4**
6.	Design, develop and execute a program in C to implement linked list to insert and delete an element from the list.	**3**	**CO1 CO4**
7.	Design, develop, and execute a program in C to read a sparse matrix of integer values and to search the sparse matrix for an element specified by the user. Print the result of the search appropriately. Use the triple <row, column, value> to represent an element in the sparse matrix.	**3**	**CO1 CO2 CO4**
8.	Design, develop, and execute a program in C to create a max heap of integers by accepting one element at a time and by inserting it immediately in to the heap. Use the array representation for the heap. Display the array at the end of insertion phase.	**3**	**CO1 CO3 CO4**
9.	Design, develop, and execute a program in C to implement a doubly linked list where each node consists of integers. The program should support the following operations: i. Create a doubly linked list by adding each node at the front. ii. Insert a new node to the left of the node whose key value is read as an input. iii. Delete the node of a given data if it is found, otherwise display appropriate message iv. Display the contents of the list. (Note: Only either (a, b and d) or (a, c and d) may be asked in the examination)	**3**	**CO1**
10.	Design, develop and execute a program in C to create a Binary Tree and to perform inorder, preorder and postorder traversals.	**3**	**CO1 CO3**

TEXT BOOKS:

1. Horowitz, Sahni, Anderson-Freed: Fundamentals of Data Structures in C, 2nd Edition, Universities Press, 2007.
2. Yedidyah, Augenstein, Tannenbaum: Data Structures Using C and C++, 2nd Edition, Pearson Education, 2003.

Assessment Pattern:

CIE –Continuous Internal Evaluation Lab (50 Marks)

Continual Internal Evaluation Marks (25)	IA Test Marks (25)	Final Marks (50)

SEE –Semester End Examination Lab (50 Marks)

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LOGIC DESIGN LABORATORY

Course code: 19IS3DLLDL **Credits: 02**
L: P: T: S: 0:2:1: 0 **CIE Marks: 50**
Exam Hours: 03 **SEE Marks: 50**

Course objectives: Students undergoing this course are expected to:

1. Gain knowledge of various basic gates as well as its application in data processing circuits.
2. Will learn the designing and working of various data processing circuits.
3. Will learn the working of flip-flops and verify the working of various registers.
4. Will learn the design, implementation and working of synchronous as well as asynchronous circuits.
5. Will learn the Verilog implementation of digital circuits.

Course Outcomes: At the end of the course, student will be able to:

CO1	Understand the working of different components used in logic design lab
CO2	Familiarize with the IC's and its layout
CO3	Analyze requirements and design combinational and sequential circuits from it.
CO4	Verify the working of flip-flops and registers
CO5	Design and verify the working of synchronous and asynchronous circuits.
CO6	Write the Verilog implementation of various digital circuits.

Expt. No.	Contents of the experiment	Hours	COs
	PART A		
1.	**Familiarization of digital IC's and digital IC trainer kit by verifying the truth tables**	**3**	**CO1**
2.	**II. Study of Combinational Circuits:** Universal Gates a. Simplify the given expression and realize it with universal gates	**3**	**CO1, CO2**

	b. For the given expression, design and develop a Verilog code after simplifying it. Simulate and verify the working of the same.		
3.	Adder Subtractor Circuit a. Design and verify the truth table of full adder and half subtractor circuit b. Design and develop the Verilog code for full adder. Simulate and verify the working of the same	**3**	**CO1, CO2**
4.	Code Converter and Magnitude Comparator Circuit a. To design and set up the BCD to Excess-3 converter circuit b. Design and develop the Verilog code for a single bit magnitude comparator circuit. Simulate and verify the working of the same.	**3**	**CO1, CO4**
5.	Data Processing Circuit a. Given a four-variable expression, simplify using Entered Variable Map (EVM) and realize the simplified logic using 8:1 MUX. b. Design and develop the Verilog code for 8:1 MUX. Simulate and verify the working of the same.	**3**	**CO1, CO4**
6.	**III. Flip Flops Using Gates and Familiarization of IC's:** SR and D flip flop a. To Setup SR and D flip flops using gates and verify the truth table also familiarize the flip flop ICs b. Design and develop the Verilog code for SR flip flop with positive edge triggering	**3**	**CO1, CO2, CO4**
7.	JK and T flip flop a. To Setup JK and T flip flops using gates and verify the truth table also familiarize the flip flop ICs b. Design and develop the Verilog code for T flip flop with positive edge triggering	**3**	**CO1,CO3,CO4**

8.	J-K Master/Slave FF a. Realize a J-K Master/Slave flip flop using only NAND gates and verify its truth table. b. Design and develop the Verilog code for JKflip flop with positive edge triggering	**3**	**CO4, CO5, CO6**
9.	**IV. Shift Registers and Counters:** Shift Register a. To set up and verify the performance of4bit SISO shift register and 2 bit PISO shift register using D flip flop b. Design and develop the Verilog code to represent any give type of Register and verify the working of the same	**3**	**CO5, CO6**
10.	Ring and Johnson counter a. Design and implement ring counter using 4-bit shift register IC and Johnson counter using D flip flop demonstrate its working. b. Design and develop the Verilog code for ring counter. Simulate and verify the working of the same.		**CO1, CO3**
11.	Sequence Generator a. Design and implement a sequence generator counter using D flip flop IC's and demonstrate its working. b. Design and develop the Verilog code for switched tail counter. Simulate and verify the working of the same		**CO1, CO3**
12.	Asynchronous Counter a. Design and implement asynchronous counter of the given modulus using decade counter IC and demonstrate its working. b. Design and develop the Verilog code for 3bit counter. Simulate and verify the working of the same.		**CO1, CO3**

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Department of Information Science and Engineering

Practical Examination Procedure:

- All laboratory experiments are to be included for practical examination.
- Strictly follow the instructions as printed on the cover page of answer script for breakup of marks

Assessment Pattern:

CIE –Continuous Internal Evaluation Lab (50 Marks)

Continual Internal Evaluation Marks (25)	IA Test Marks (25)	Final Marks (50)

SEE –Semester End Examination Lab (50 Marks)

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Department of Information Science and Engineering

ADVANCED MATHEMATICS-I

Sub. Code: 20MA3IMMAT	CIE: --
Hrs./ Week: 4	SEE:100
Total Hrs.: 40	Credits: --

Course Objectives:

1. Solve differential equations of first order and first degree, higher order linear differential equations by various methods.
2. Understand the concept of Calculus and apply it appropriately in solving Engineering problems.
3. Understand the usage of complex numbers and apply these techniques to complex problems.
4. Understand numerical methods for solving equations and evaluate definite Integrals.

Course outcomes:

On completion of the course a student will be able to

1. Apply the knowledge of Calculus to solve the problems by the method of Leibnit'z, Taylor's, Maclaurin's and Euler's Theorems.
2. Solve the Integrals with standard limits using the Reduction Formulae.
3. Recognize and solve first order Ordinary Differential Equations.
4. Solve Differential Equations and use it to model simple Engineering Phenomena.
5. Know the real and imaginary roots of a Complex Number.
6. Solve equations and evaluating approximate areas and volume using numerical methods

MODULE 1

MULTIVARIATE CALCULUS:

Introduction to Polar coordinate system, Curvature, radius of curvature, Mean value theorems: Rolle's and Cauchy MVT, L'Hospital Rule for indeterminate forms (0/0, ∞/∞ forms), Partial differentiation, Partial Derivatives, Composite functions, Taylor's and Maclaurin's series for several variables. **8 hours**

MODULE 2

INTEGRAL CALCULUS:

Reduction formulae for integrals: $\int sin^n xdx, \int cos^n xdx$, $\int sin^m xcos^n xdx$problems with standard limits, Double and triple integrals simple problems, Beta and Gamma functions and problems. **8 hours**

MODULE 3

DIFFERENTIAL EQUATIONS:

Order and Degree of an ordinary differential equation, Equations of first order and of first degree, Solutions of Differential equation, Separation of variables, Linear Differential equations, Bernoulli's equations, Exact differential equations, Higher order linear differential equations, Inverse Differential operator. **8 hours**

MODULE 4

COMPLEX NUMBERS:

Algebra of complex numbers, Conjugate of a complex number, Geometrical representation and polar form of complex numbers, Geometrical representation of algebraic operation on complex number, Exponential form, De-Moivre's Theorem (statement only), Roots of a complex number. **8hours**

MODULE 5

ELEMENTARY NUMERICAL METHODS

Solution of Algebraic and Transcendental Equations –Newton- Raphson and Regula-Falsimethods(only formulae)- Problems.

Numerical integration: Simpson's (1/3)th and (3/8)th rules, Weddle's rule (without proof) – Problems. **8 hours**

TEXT BOOKS:

1. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 43rd Edition, 2014 June, ISBN: 9788174091955.

2. B.V.Ramana, "Higher Engineering Mathematics", Tata Mc Graw-Hill, 2006, ISBN: 9780070634190.

REFERENCE BOOKS:

1. H. K. Dass and Er. RajnishVerma, "Higher Engineering Mathematics", Third Edition, 2014, ISBN: 9788121938907.

2. N.P. Bali and Manish Goyal, "A text book of Engineering Mathematics", Laxmi Publications, 8th Edition, 2011, ISBN: 9788131808320.

3. R.K. Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa Publishing House, 2002, ISBN: 8173194203.

4. Schaum's Outline of Advanced Mathematics for Engineers and Scientists, Tata McGraw Hill Education publishers, 1971, (Revised) ISBN-13:9780070606142.

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Department of Information Science and Engineering

IV SEMESTER

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Department of Information Science and Engineering

COMPLEX VARIABLES AND DISTRIBUTIONS

Course code: 19MA4GCCVD **Credits: 03**
L: P: T: S: 3:0:1:0 **CIE Marks: 50**
Exam Hours: 03 **SEE Marks: 50**

Course Objectives:

1. To introduce the topics of vector space and graph theory
2. To understand theory of complex variables
3. To provide the foundations of probabilistic and statistical analysis mostly used in varied applications in engineering and science

Course Outcomes: At the end of the course, student will be able to:

CO1	Acquire an overview of the concepts and simple techniques in Graph Theory and vector spaces
CO2	Understand the significance of analytical functions and contour integration.
CO3	Understand the basic concepts of random variables and probability distributions
CO4	Explain sampling distributions and test the hypothesis for a given sample
CO5	Understand the basic concepts of Joint Probability distribution
CO6	Specify a given discrete time Markov chain in terms of a transition matrix and a transition diagram

Mapping of Course outcomes to Program outcomes:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**3**	**1**	**1**								
CO2	**3**	**3**	**2**	**1**								
CO3	**3**	**3**	**1**	**1**								
CO4	**3**	**3**	**2**	**1**								
CO5	**3**	**3**	**2**	**1**								
CO6	**3**	**3**	**2**	**1**								

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Department of Information Science and Engineering

Module	Contents of the Module	Hours	CO's
1	**Linear Algebra & Graph Theory** **Linear Algebra:** Vector space, Linear dependence, Dimension &basis, Linear transformations, Matrix representation of linear transformation. Definition, Types of graph, Circuits, Hamilton graph, Matrix representation, Application Problems	08	CO1
2	**Complex Variable** Basic definitions**,** Elementary function, Analytic function, Cauchy-Riemann equations in Cartesian and polar coordinates , Analyticity of given function, Harmonic function , Construction of analytic functions (with application problem), Milne-Thompson method, Application Problems	08	CO2
3	**Probability Distributions** Types of variables, Probability mass & density function, Expectation or Mean & variance of random and continuous variable, Probability Distribution**:** Geometric distribution, Poisson distribution, Exponential and Normal distributions, Application Problems	08	CO3
4	**Sampling Distribution** Sampling, sampling distribution, central limit theorem, Sampling with & without replacement, Confidence limits for means, Student's t distribution, Chi-Square distribution as a test of goodness of fit, Application Problems	08	CO4
5	**Joint Probability Distribution & Markov Chains** Concept of joint probability, joint probability distribution, Expectation, variance, covariance and correlation, Stochastic or random processes, Transition and Regular stochastic matrix, Markov chain, Transition probabilities matrix, Higher transition probabilities. Application Problems	08	CO5, CO6

TEXT BOOKS:

1. B.S. Grewal, "Higher Engineering Mathematics" Khanna Publishers, 43rd Edition, 2014 June, ISBN: 9788174091956.
2. Erwin Kreyszig; Advanced Engineering Mathematics; John Wiley & Sons, 9th Edition, 2007, ISBN: 9788126531356.
3. Gilbert Strang, Linear Algebra and its Applications, 4th edition ,Cengage Publishers, 2014, ISBN: 9788131501726,

REFERENCE BOOKS:

1. B.V.Ramana, "Higher Engineering Mathematics", Tata McGraw-Hill, 2006; ISBN: 9780070634190.
2. M. K. Jain, S. R. K. Iyengar and R. K. Jain "Numerical Methods: For Scientific and Engineering Computation", New Age International Publications, 6th Edition, 2012, ISBN: 9788122433234.
3. Murray Speigel, Schaum's Outline of "Advanced Mathematics for Engineers and Scientists"McGraw-Hill, 1971; ISBN: 9780070602168.
4. Schaum's Outline: Introduction to Probability and Statistics**,** McGraw Hill Education (India) Private Limited (1 September 2005); ISBN-13: 978-0070605015.
5. David C Lay, "Linear Algebra and Application", Pearson Education, ISBN-9788177583335

Self-study component:

Unit 1: Inner product space
Unit 2: Cauchy's Integral formula and Cauchy's theorem
Unit 3: Binomial distribution
Unit 4: Hypothesis testing for proportions and difference of means
Unit 5: Markov chain

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Department of Information Science and Engineering

DESIGN AND ANALYSIS OF ALGORITHMS

Course code: 19IS4DCDAA **Credits: 04**
L: P: T: S: 4:0:0:0 **CIE Marks: 50**
Exam Hours: 03 **SEE Marks: 50**
Total Hours: 50

Course Objectives:

1. Identify the problem and design an algorithmic strategy to solve it.
2. Ability to understand and use asymptotic notation to formulate the time and space complexities of algorithms.
3. Develop different algorithms for the same problem and classify them based on their complexities.
4. Acquire basic knowledge of computational complexity, approximation algorithms.

Course Outcomes

CO1	**Identifying** asymptotic runtime complexity and formulating recurrence relations of algorithms.
CO2	**Interpret** the various algorithm paradigms and optimization
CO3	**Implement** various searching and sorting algorithmic techniques.
CO4	**Implement** Dynamic programming, greedy technique, and Backtracking algorithmic technique.
CO5	**Analyze** the limitations of various algorithms and finding approximate solution to them.
CO6	**Apply and analyze** different algorithm techniques and derive its time complexity.

Module	Contents of the Unit	Hours	COs
1	**INTRODUCTION:** What is an algorithm, Fundamentals of Algorithmic Problem Solving. Fundamentals of the Analysis of Algorithm Efficiency: The Analysis Framework, Asymptotic and Basic Efficiency Classes, Mathematical Analysis of Non recursive, Algorithms Mathematical Analysis of Recursive Algorithms. **BRUTE FORCE:** Introduction, Bubble sort, Selection Sort, Sequential/linear Search, Brute Force String Matching.	**10**	**CO1 CO2**
2	**DIVIDE-AND-CONQUER:** Introduction, Master theorem, Quick sort, Merge sort, Multiplication of Large Integers and Strassen's Matrix Multiplication. **DECREASE-AND-CONQUER:** Introduction, Insertion Sort, Depth-	**10**	**CO3**

	First Search and Breadth-First Search, Topological Sorting, Algorithms for Generating Combinatorial Objects.		
3	**SPACE AND TIME TRADE-OFFS:** Introduction, Sorting by Counting, Input Enhancement in String Matching. **DYNAMIC PROGRAMMING:** Introduction, Warshall's and Floyd's Algorithms, The Knapsack Problem and Memory Functions.	**10**	**CO4**
4	**GREEDY TECHNIQUE:** Introduction, Prim's Algorithm, Kruskal's Algorithm, Dijkstra's Algorithm, Huffman Trees and Codes. **PRAM ALGORITHMS:** Introduction, Computational Model, Parallel Algorithms for Prefix Computation.	**10**	**CO6**
5	**LIMITATIONS OF ALGORITHM POWER:** Lower-Bound Arguments, Decision Trees, P, NP, and NP Complete Problems. **COPING WITH THE LIMITATIONS OF ALGORITHM POWER:** Backtracking & Branch-and-Bound: nqueens problem, sum of subset, assignment, and problem.	**10**	**CO5**

Self study component:

Note: 1.Questions for CIE and SEE not to be set from self-study component.
2. Assignment Questions should be from self-study component only.

UNIT 1: Fibonacci Numbers
UNIT 2: Job Sequencing with deadlines, Defective chessboard Problem
UNIT 3: The sales person problem using dynamic programming**.**
UNIT 4: List Ranking and Graph Problems
UNIT 5: Approximation Algorithms for NP-Hard Problems, Hamiltonian Circuit Problem.

TEXT BOOKS:

1. Anany Levitin: Introduction to the Design & Analysis of Algorithms, 3rd Edition, Pearson Education, 2012.
2. Ellis Horowitz, SartajSahni, Sanguthevar Rajasekaran: Fundamentals of Computer Algorithms, 2nd Edition, Universities Press.

REFERENCE BOOKS:

1. Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein: Introduction to Algorithms, 3rd Edition, PHI, 2010.
2. Kenneth A. Berman, Jerome L. Paul: Algorithms, Cengage Learning, 2002.

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Department of Information Science and Engineering

Microprocessors and Microcontrollers

Course code: 19IS4DCMPM **Credits: 03**
L: P: T: S: 3: 0: 0: 0 **CIE Marks: 50**
Exam Hours: 03 **SEE Marks: 50**
Total Hours: 50

Course Objectives:

1. Understand the architecture of 8086 microprocessor
2. Able to write software and hardware programs using assembly language programming
3. Understand the difference between microprocessors and microcontrollers
4. Understand the architecture of ARM processor

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

CO1	Analyse the architecture of Microprocessor
CO2	Understand the concept of data accessing using different addressing modes
CO3	Apply the defined instruction set to design assembly level language programs
CO4	Understand the difference between Microprocessors and microcontrollers
CO5	Understand the architecture of ARM processor.
CO6	Identify and apply various addressing modes.

Module	Course Content	Hours	COs
1	**Introduction, Microprocessor Architecture – 1** The Microprocessor-Based Personal Computer Systems. The Microprocessor and its Architecture: Internal Microprocessor Architecture, Real Mode Memory Addressing.	**10**	**CO1**
2	**Microprocessor Architecture – 2, Addressing Modes** Introduction to Protected Mode Memory Addressing, Memory Paging, Flat Mode Memory Addressing Modes: Data Addressing Modes, Program Memory Addressing Modes, Stack Memory Addressing Modes	**10**	**CO1, CO2**

3	**Programming – 1** Data Movement Instructions. PUSH/POP, Load-Effective Address, String Data Transfers, Miscellaneous Data Transfer Instructions, Segment Override Prefix, Assembler Details. Arithmetic and Logic Instructions: Addition, Subtraction and Comparison, Multiplication and Division. **Programming – 2:** Arithmetic and Logic Instructions (continued): BCD and ASCII Arithmetic, Basic Logic Instructions, Shift and Rotate, String Comparisons. Program Control Instructions: The Jump Group	**10**	**CO2, CO3**
4	**Microprocessors versus Microcontrollers, ARM Embedded Systems :**The RISC design philosophy, The ARM Design Philosophy, Embedded System Hardware, Embedded System Software, **ARM Processor Fundamentals :** Registers , Current Program Status Register	**10**	CO4
5	**Introduction to the ARM Instruction Set :** Data Processing Instructions , Branch Instructions, Software Interrupt Instructions, Program Status Register Instructions	**10**	**CO4, C05**

Self study component:

Note:
1. Questions for CIE and SEE not to be set from self-study component.
2. Assignment Questions should be from self-study component only.

UNIT 1: Introduction: History of Microprocessors
UNIT 3: Hardware Specifications, Memory Interface – 1
Pin-Outs and the Pin Functions, Clock Generator, Bus Buffering and Latching, Bus Timings, Ready and Wait State, Minimum versus Maximum Mode. Memory Interfacing: Memory Devices
UNIT 5: I/O Interface – 2, Interrupts, and DMA: I/O Interface: The Programmable Peripheral Interface 82C55, Programmable Interval Timer 8254. Interrupts: Basic Interrupt Processing, Hardware Interrupts: INTR and INTA/; Direct Memory Access: Basic DMA Operation and Definition.

TEXT BOOKS:

1. Barry B Brey: The Intel Microprocessors, 8th Edition, Pearson Education, 2009.
2. ARM system developers guide, Andrew N Sloss, Dominic Symes and Chris Wright, Elsevier, Morgan Kaufman publishers, 2008.

REFERENCE BOOKS:

1. Douglas V. Hall: Microprocessors and Interfacing, Revised 2nd Edition, TMH, 2006
2. K. Udaya Kumar & B.S. Umashankar : Advanced Microprocessors & IBM-PC Assembly Language Programming, TMH 2003.
3. Ayala: The 8086 Microprocessor: programming and interfacing - 1st edition, Cengage Learning
4. The Definitive Guide to the ARM Cortex-M3, by Joseph Yiu, 2nd Edition, Newnes, 2009
5. The Insider's Guide to the ARM7 based microcontrollers, Hitex Ltd., 1st edition, 2005
6. ARM System-on-Chip Architecture, Steve Furber, Second Edition, Pearson, 2015
7. Architecture, Programming and Interfacing of Low power Processors- ARM7, Cortex-M and MSP430, Lyla B Das Cengage Learning, 1st Edition

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Department of Information Science and Engineering

OPERATING SYSTEM

Course code: 19IS4DCOPS **Credits: 03**
L: P: T: S: 3: 0: 0: 0 **CIE Marks: 50**
Exam Hours: 03 **SEE Marks: 50**
Total Hours: 40

Course Objectives:

1. Understand the structure and services of the operating system that provides to users and system.
2. Know the various CPU scheduling algorithms and multithreading concepts
3. Identify methods for handling deadlocks and recognize the classic synchronization problems
4. To gain knowledge on the various memory management techniques and file systems with their storage structure

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

CO1	Describe types, features and design considerations of operating systems
CO2	Analyze and Apply the various process scheduling algorithms.
CO3	**Solve** appropriate deadlock handling method, synchronization methods
CO4	Analyze memory management techniques and choose the suitable algorithm.
CO5	**Apply** suitable techniques for management of different resources.
CO6	Describe the design considerations of file system and compare various disk scheduling algorithms.

Module	Contents of the Unit	Hours	COs
1	**OVERVIEW-Introduction:** What operating systems do; Operating system architecture, Operating System Structure, Operating System operations. System Structures: Operating System Services, System calls, Types of System calls, Virtual Machines	**08**	**CO1**

2	**PROCESS MANAGEMENT-**: **Process concept**: Process scheduling, interprocess communication, **Multithreaded programming:** Overview; Multithreading models; Process Scheduling: Basic concepts, scheduling criteria, Scheduling algorithms: FCFS (5.3.1), SJF(5.3.2), Priority Scheduling(5..3.3) and Round Robin Scheduling(5.3.4).	**08**	**CO2 & CO5**
3	**PROCESS COORDINATION- Synchronization:** The Critical section problem, Peterson's solution, Semaphores; Classical problems of synchronization: Bounded-Buffer Problem, Reader's-Writer's Problem. **Deadlocks:** System model; Deadlock characterization; Methods for handling deadlocks; Deadlock prevention; Deadlock avoidance; Deadlock detection and recovery from deadlock.	**08**	**CO3 & CO5**
4	**MEMORY MANAGEMENT-Memory Management Strategies:** Background, Contiguous memory allocation, Paging, Segmentation **Virtual Memory management:** Background, Demand Paging, Basic Page Replacement Algorithms: FIFO(9.4.2), Optimal(9.4.3), LRU(9.4.4),	**08**	**CO4 CO5**
5	**STORAGE MANAGEMENT-File System:** File concept, Access methods, Protection. **Secondary Storage Structures**: Overview of Mass storage structures; Disk scheduling algorithms. **PROTECTION AND SECURITY-System Protection:** Goals of protection, Principles of protection, Domain of protection, Access matrix.	**08**	**CO6**

Self study component:

Note:
1. Questions for CIE and SEE not to be set from self-study component.
2. Assignment Questions should be from self-study component only.

UNIT 1: Distributed system, Operating System structure;
UNIT 2: Threading Issues, Thread Libraries.
UNIT 3: Peterson's solution, Dining Philosopher's Problem, Monitors.
UNIT 4: Swapping, Thrashing**.**
UNIT 5: File System Structure, File System Implementation.

TEXT BOOKS:

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne: Operating System Principles, 8th edition, Wiley India, 2011

.

REFERENCE BOOKS:

1. D.M Dhamdhere: Operating systems - A concept based Approach, 2nd Edition, Tata McGraw- Hill, 2002.
2. P.C.P. Bhatt: Introduction to Operating Systems: Concepts and Practice, 2nd Edition, PHI, 2008.
3. Harvey M Deital: Operating systems, 3rd Edition, Pearson Education, 1990.

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Department of Information Science and Engineering

OBJECT ORIENTED PROGRAMMING WITH C++

Course code: 19IS4DCOOP **Credits: 03**
L: P: T: S: 3:0:0:0 **CIE Marks: 50**
Exam Hours: 03 **SEE Marks: 50**
Total Hours: 40

Course objectives:

1. Understand the basic concepts of object oriented programming languages and the techniques of software development inC++.
2. Learn the role of inheritance, polymorphism, dynamic binding and generic structures in building reusable code.
3. Understand object oriented or non-object oriented techniques to solve bigger computing problems.
4. Build C++ classes using appropriate encapsulation and design principles.

Course Outcomes: At the end of the course, student will be able to:

CO1	Identify and utilize the basics of OOPs concepts
CO2	Apply the knowledge of pointers, constructors and destructors
CO3	Design classes and implement the given real world application using OOPs concepts.
CO4	Apply the knowledge of exception handling and operator overloading during implementation of the programs
CO5	Use concept of virtual functions and its implementation.
CO6	Apply inheritance concepts in real world applications

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Department of Information Science and Engineering

Module	Contents of the Unit	Hours	COs
1.	**An Overview of C++:** The origins of C++,What is Object Oriented Programming?, Some C++ Fundamentals, A Sample C++ Program **Classes and objects**: Classes, Structures and classes are related, Unions and Classes are Related, Friend Functions, Friend Classes, Inline Functions, Parameterized Constructors, Static Class Members, When Constructors and Destructors are Executed, The Scope Resolution Operator.	**8**	**CO1 & CO2**
2.	**Arrays ,Pointers, References, and the Dynamic memory allocation operators:** Arrays of Objects, Pointers to Objects, Type Checking C++ Pointers, The This Pointer, References **Function overloading copy constructors, and default arguments:** Function Overloading, Overloading constructors, Copy constructors, Finding the Address of an Overloaded Function, The Overload Anachronism, and Default Function Arguments.	**8**	**CO3& CO4**
3.	**Operator overloading:** Creating a Member Operator Function, Operator Overloading Using a Friend Function, Overloading new and delete, Overloading some Special Operators.	**8**	**CO3 & CO4**
4.	**Inheritance:** Base-Class Access Control, Inheritance and protected Members, Inheriting Multiple Base Classes, Constructors, Destructors and Inheritance, Granting Access, Virtual Base Classes.	**8**	**CO4& CO6**
5.	**Virtual functions and polymorphism:** Virtual Functions, The Virtual attribute Is Inherited, Virtual Functions Are Hierarchical, Pure virtual Functions, Using Virtual Functions, Early vs. late binding **Templates:** Generic Functions, Applying Generic Functions, Generic Classes	**8**	**CO5 & CO6**

Note:

1. **Questions for CIE and SEE not to be set from self-study component**
2. **Questions for CIE and SEE not to 2) Assignment Questions should be from self-study components only.**

Self-study component:

UNIT 1: Nested classes, Local classes, Passing Objects to Functions, Returning Objects, Object Assignment.
UNIT 2: Function Overloading Ambiguity.
UNIT 3: Overloading the Comma Operator.
UNIT 4: Exception Handling.
UNIT 5: The power of Templates.

TEXT BOOK:

1. **The Complete Reference C++** by Herbert Schildt, Third Edition, Tata McGraw-Hill Edition

REFERENCE BOOKS:

1. **Object oriented Programming with C++** by Sourav Sahay, Fourth Edition, Oxford Education publications
2. **Object oriented Programming with C++** by E Balaguruswamy**,** Second edition, McGraw-Hill Companies.
3. **C++ and Object-Oriented Programming Paradigm** by Debasish Jana, 3rd Edition, **PHI Learning Pvt. Ltd**

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Department of Information Science and Engineering

AUTOMATA THEORY AND FORMAL LANGUAGES

Course code: 19IS4DCFLT **Credits: 03**
L: P: T: S: 3: 0: 0: 0 **CIE Marks: 50**
Exam Hours: 03 **SEE Marks: 50**
Total Hours: 40

Course Objectives:

1. Understand basic properties of formal languages and formal grammars.
2. To present the theory of finite automata, as the first step towards learning advanced topics such as compiler design.
3. Understand basic properties of deterministic and nondeterministic finite automata and discussing the applications of finite automata towards text processing.
4. Understand the relation between types of languages and types of finite automata and to develop an understanding of computation through Turing Machines.

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

CO1	Proficiency with mathematical tools & formal method.
CO2	Acquire a fundamental understanding of core concepts relating to the theory of computation.
CO3	Ability to understand the regular languages, its properties, equivalence and minimization of automata.
CO4	Ability to solve problems on Deterministic finite automata and Non Deterministic machines.
CO5	Ability to analyze and solve problems related to pushdown automata and Turing machines.
CO6	Develop a view on the importance of computational theory.

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SCHEME OF TEACHING AND EXAMINATION 2018-2019
Department of Information Science and Engineering

Module	Course Content	Hours	Cos
1	**AUTOMATA : THE METHODS AND THE MADNESS** Introduction to Finite Automata; The central concepts of Automata theory; Deterministic finite automata; Nondeterministic finite automata, An application: Text search, Finite automata with Epsilon-transitions. **REGULAR EXPRESSIONS AND LANGUAGES:** Regular expressions; Finite Automata and Regular Expressions;	**8**	**CO1** **CO4**
2	**PROPERTIES OF REGULAR LANGUAGES:** Proving languages not to be regular languages; Closure properties of regular languages; Decision properties of regular languages; Equivalence and minimization of automata.	**8**	**CO3**
3	**CONTEXT-FREE GRAMMARS AND LANGUAGES:** Context –free grammars; Parse trees; **PROPERTIES OF CONTEXT-FREE LANGUAGES:** Normal forms for CFGs, The Pumping Lemma for CFLs, Closure properties of CFL.	**8**	**CO2**
4	**PUSHDOWN AUTOMATA:** Definition of the Pushdown automata; the languages of a PDA; Equivalence of PDA's and CFG's; Deterministic Pushdown Automata	**8**	**CO5**
5	**INTRODUCTION TO TURING MACHINES:** Problems that Computers cannot solve; The turning machine; Programming techniques for Turning Machines. **UN-DECIDABILITY:** A Language that is not recursively enumerable; Post's Correspondence problem.	**8**	**CO5** **CO6**

Self study component:

Note:

1. Questions for CIE and SEE not to be set from self-study component.
2. Assignment Questions should be from self-study component only.

UNIT 1: Applications of Regular Expressions.
UNIT 3: Applications of Context –free grammars
UNIT5: Extensions to the basic Turning Machines, Turing Machine and Computers, an undecidable problem that is RE

TEXT BOOKS:

1. John E. Hopcroft, Rajeev Motwani, Jeffrey D.Ullman: Introduction to AutomataTheory, Languages and Computation, 3rd Edition, Pearson Education, 2007. (Chapters: 1.1, 1.5, 2.2 to 2.5, 3.1 to 3.3, 4, 5.1 to 5.3, 6, 7.1 to 7.3, 8.1 to 8.4, 8.6, 9.1, 9.2,9.4.1)

REFERENCE BOOKS:

1. Elaine Rich: Automata, Computability and Complexity,1st edition, Pearson Education, 2008.
2. Raymond Greenlaw, H. James Hoover: Fundamentals of the Theory of Computation, Principles and Practice, Elsevier, 1998.
3. John C Martin: Introduction to Languages and Automata Theory, 3rd Edition, Tata McGraw-Hill, 2007.
4. Thomas A. Sudkamp: An Introduction to the Theory of Computer Science, Languages and Machines, 3rd Edition, Pearson Education, 2006.
5. K.L.P. Mishra: Theory of Computer Science, Automata, Languages, and Computation, 3rd Edition, PHI Learning, 2009.

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Department of Information Science and Engineering

DESIGN AND ANALYSIS OF ALGORITHMS LABORATORY WITH MINI PROJECT

Course code: 19IS4DLADA **Credits: 02**
L: T: P: S 0:2:1:0 **CIE Marks: 50**
Exam Hours: 03 **SEE Marks: 50**

Course objective

1. Identify the problem and design an algorithmic strategy to solve it.
2. Analyze the problem statement and implement different programmatic approach to solve the same.
3. Compare the efficiencies by developing different algorithms for the given problem statement with various inputs.
4. Develop an algorithm for the problem statement and prove its correctness

Course Outcomes:

CO1	**Acquire** Programming Knowledge about different algorithm paradigms
CO2	**Interpret** the searching, sorting algorithmic techniques.
CO3	**Apply** an algorithm for the problem statement and prove its correctness.
CO4	**Solve** a problem by making use of techniques like Greedy method, Divide and Conquer approach, Dynamic Programming and Backtracking.
CO5	**Develop** efficient algorithms in common engineering design practice.
CO6	**Analyze** time complexity of the algorithms by providing different inputs and monitoring its behavior.

Expt. No.	Contents of the Experiment	Hours	COs
1	Design, develop, and execute a program called QUICK_SORT to sort a given set of elements using the Quick sort method and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus n. The elements should be read from a file and also be generated using the random number generator.	**03**	**CO1, CO2, CO3 & CO5**

2	Design, develop, and execute a program called MERGE_SORT to sort a given set of elements using the merge sort method and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus n. The elements should be read from a file and also be generated using the random number generator.	**03**	**CO1, CO2, CO3 & CO5**
3	3a. Design, develop, and execute a program called BFS. Print all the nodes reachable from a given starting node in a digraph using BFS method. b. Design, develop, and execute a program called DFS. Print all the nodes reachable from a given starting node in a digraph using DFS method.	**03**	**CO1, CO3, CO4 & CO5**
4	a. Design, develop, and execute a program called FLOYDS to Implement All-Pairs Shortest Paths Problem using Floyd's algorithm. b. Design, develop, and execute a program called WARSHALL to compute the transitive closure of a given directed graph using Warshall's algorithm. Print all the matrices of transitive closure.	**03**	**CO1, CO3, CO4 & CO5**
5	Design, develop, and execute a program called KNAPSACK to Implement 0/1 Knapsack problem using Dynamic Programming.	**03**	**CO1, CO3, CO4 & CO6**
6	Design, develop, and execute a program called KRUSKAL. Find Minimum Cost Spanning Tree of a given undirected graph using Kruskal's algorithm.	**03**	**CO1, CO3, CO5 & CO6**
7	Design, develop, and execute a program called PRIMS to find Minimum Cost Spanning Tree of a given undirected graph using Prim’s algorithm.	**03**	**CO1, CO3, CO4 & CO6**
8	Design, develop, and execute a program called DIJKSTRA’S. From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm.	**03**	**CO1, CO3, CO4 & CO6**
9	Design, develop, and execute a program called SUMOFSUBSET to find a subset of a given set S = {sl, s2,.....,sn} of n positive integers whose sum is equal to a given positive integer d. For example, if S	**03**	**CO1, CO3, CO4 & CO6**

	= {1, 2, 5, 6, 8} and d = 9 there are two solutions {1,2,6} and {1,8}. A suitable message is to be displayed if the given problem instance doesn't have a solution.		
10	Design, develop, and execute a program called N QUEENS to Implement N Queen's problem using Back Tracking.	**03**	**CO1, CO3, CO4 & CO6**

TEXT BOOKS:

1. AnanyLevitin: Introduction to the Design & Analysis of Algorithms, 3rd Edition, Pearson Education, 2012.
2. Ellis Horowitz, SartajSahni, SanguthevarRajasekaran: Fundamentals of Computer Algorithms, 2nd Edition, Universities Press.

REFERENCE BOOKS:

1. Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein: Introduction to Algorithms, 3rd Edition, PHI, 2010.
2. Kenneth A. Berman, Jerome L. Paul: Algorithms, Cengage Learning, 2002.

Assessment Pattern:

CIE –Continuous Internal Evaluation Lab (50 Marks)

Continual Internal Evaluation Marks (25)	IA Test Marks (25)	Final Marks (50)

SEE –Semester End Examination Lab (50 Marks)

Program write-up, Execution & Viva (40)	Project execution (10)	Final Marks (50)

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SCHEME OF TEACHING AND EXAMINATION 2018-2019
Department of Information Science and Engineering

MICROPROCESSORS AND MICROCONTROLLERS LABORATORY

Course code: 19IS4DLMPM **Credits: 02**
L: P: T: S: 0: 2: 1: 0 **CIE Marks: 50**
Exam Hours: 03 **SEE Marks: 50**

Course objective

1. To become familiar with the architecture and instruction set of Intel 8086 and ARM processor.
2. To provide practical hands on experience with Assembly Language Programming.
3. To understand the working of a microcontroller
4. To familiarize the students with interfacing of various peripheral devices with ARM processor.

Course Outcomes: At the end of the course, student will be able to

CO1	Analyze the architecture and memory organization of microprocessor.
CO2	Examine instruction formats to write well commented assembly level programs.
CO3	Elaborate on the working of procedures in 8086 programming
CO4	Analyze software interrupts and further write programs to perform I/O operations.
CO5	Understand the working and architecture of ARM processor
CO6	Analyze the working and investigate the interfacing of external I/0 devices using ARM processor

Expt. No.	CONTENTS OF THE EXPERIMENT	Hours	COs
	PART A		
1	Design and develop an assembly language program to search a key element "X" in a list of 'n'16-bit numbers. Adopt Binary search algorithm in your program for searching	**3**	**CO1, 2**
2	Design and develop an assembly program to sort a given set of 'n' 16-bit numbers in ascending order. Adopt Bubble Sort algorithm to sort given elements.	**3**	**CO2, 3**
3	Develop an assembly language program to reverse a given string and verify whether it is a palindrome or not. Display the appropriate message.	**3**	**CO3**
4	Develop an assembly language program to compute nCr using recursive	**3**	**CO3, 4**

	procedure. Assume that 'n' and 'r' are non-negative integers.		
5	Design and develop an assembly language program to read the current time from the system and display it in the standard format on the screen.	**3**	**CO4, 5**
6	a. Write an ARM assembly language program to find factorial of a number. b. To write and simulate ARM assembly language programs for data transfer, arithmetic and logical operations (Demonstrate with the help of a suitable program).	**3**	**CO4, 5, 6**
7	a. Write a ARM assembly language program to find the square of a number (1 to 10) using look-up table. b. Write and simulate an ARM assembly language program to multiply two 16-bit binary numbers.	**3**	**CO4, 5, 6**
PART B			
8	To interface LCD with ARM processor-- ARM7TDMI/LPC2148. Write and execute programs in C language for displaying text messages and numbers on LCD.	**3**	**CO4, 5, 6**
9	To interface Stepper motor with ARM processor-- ARM7TDMI/LPC2148. Write a program to rotate stepper motor.	**3**	**CO4, 5, 6**
10	To write and simulate C Programs for ARM microprocessor using KEIL (Demonstrate with the help of a suitable program): LED blinking using LPC2148	**3**	**CO4, 5, 6**

TEXT BOOKS:

1. Barry B Brey: The Intel Microprocessors, 8th Edition, Pearson Education, 2009.
2. Microcomputer systems-The 8086/8088 Family – Y.C.Liu and G.A Gibson, 2E PHI-2003.

REFERENCE BOOKS:

1. Douglas V. Hall: Microprocessors and Interfacing, Revised 2nd Edition, TMH, 2006.
2. K. Udaya Kumar & B.S. Umashankar : Advanced Microprocessors & IBM-PC Assembly Language Programming, TMH 2003.
3. James L. Antonakos: The Intel Microprocessor Family: Hardware and Software Principles and Applications, Cengage Learning, 2007.

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SCHEME OF TEACHING AND EXAMINATION 2018-2019

Department of Information Science and Engineering

Assessment Pattern:

CIE –Continuous Internal Evaluation Lab (50 Marks)

Continual Internal Evaluation Marks (25)	IA Test Marks (25)	Final Marks (50)

SEE –Semester End Examination Lab (50 Marks)

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CHOICE BASED CREDIT SYSTEM (CBCS)

SCHEME OF TEACHING AND EXAMINATION 2018-2019

Department of Information Science and Engineering

V SEMESTER

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SCHEME OF TEACHING AND EXAMINATION 2018-2019
Department of Information Science and Engineering

MANAGEMENT AND ENTREPRENEURSHIP

Course Code: 19HS5ICMEP **Credits: 03**
L: P: T: S: 3: 0:0:0 **CIE Marks: 50**
Exam Hours: 03 **SEE Marks: 50**
Total Hours: 40

COURSE OBJECTIVES:

- Understand the underlying principles of management.
- To analyze and identify the functions of entrepreneurial activities and its prerequisites under practical conditions.
- To develop and enhance one's decision making skills amidst competitive business market**.**

Course Outcomes: After completion of the course, the graduates will be able to	
CO1	Apply the principles of management in business activities.
CO2	Use the managerial and entrepreneurial qualities & skills under real world condition.
CO3	Analyze the functions of Management & Entrepreneurship and apply those in practical situations.
CO4	Identify various schemes provided by government of India to support business enterprise.
CO5	Develop leadership skills to build a small scale industry.
CO6	Develop entrepreneurial personality, able to prepare project report and initiate SSI.

Module	**Course Content**	**Hours**	**COs**
1	MANAGEMENT: Introduction – Meaning – nature and characteristics of Management, Scope and Functional areas of management – Management as a science, art and profession – Management & Administration – Roles of Management, Levels of Management. PLANNING: Nature, importance and purpose of planning process – Objectives – Types of plans.	**06**	**CO1 CO2**

2	ORGANIZING AND STAFFING: Nature and purpose of organization – Principles of organization – types of organization – Departmentation – Committees-Centralization Vs Decentralization of authority and responsibility – Span of control – MBO and MBE (Meaning Only) Nature and importance of staffing. (Case studies discussion)	**10**	**CO1 CO2**
3	DIRECTING & CONTROLLING: Meaning and nature of directing – Leadership styles, Motivation (Definition),characteristics, motivational theories (Maslow‟s theory, theory „X‟ and „Y‟), Meaning and steps in controlling – Essentials of a sound control system – Methods of establishing control (in brief).	**06**	**CO3 CO4**
4	ENTREPRENEUR: Meaning of Entrepreneur; Evolution of the Concept, Functions of an Entrepreneur, Types of Entrepreneur, and Entrepreneur – an emerging Class. Stages in entrepreneurial process; Role of entrepreneurs in Economic Development; Entrepreneurship – its Barriers, EDP and its objectives (Case studies discussion, role play / group discussion)	**08**	**CO3 CO4**
5	SMALL SCALE INDUSTRY: Definition; Characteristics; Objectives; Scope; role of SSI in Economic Development. Advantages of SSI, Steps to start an SSI, Impact of Liberalization, Privatization, Globalization on S.S.I, Effect of WTO/GATT. Overview of detailed project report/profile. Startup India: Benefits, Policies. Action plan- simplification and Handholding, Funding Support and incentives, Industry-Academia Partnership and Incubation. Salient features of Karnataka Startup Policy 2015-2020, Strategies encouraging entrepreneurship through NAIN. Venture capitalist, SSI funding schemes by banks and financial institutions, Government of India Initiatives on Thrust Areas, (Related case studies, supporting videos)	**10**	**CO5 CO6**

SELF-STUDY COMPONENT:

Preparation of Project report/Profile Note:

At the end of the course students should have cultivated the ability to prepare project profile based on their selected business idea.

One Credit is allocated to project profile prepared by students.

Project profile/report shall be submitted before the end of the course.

Contents /Structure of project report/profile:

1. Introduction
2. Market potential
3. Basis and preassumptions
4. Implementation schedule
5. Technical aspects
6. Financial aspects and analysis
7. Details of machinery and equipment/ service suppliers

TEXT BOOKS:

1.Principles of Management – P.C.Tripathi, P.N.Reddy – Tata McGrawHill.
2.Dynamics of Entrepreneurial Development & Management – Vasant Desai – Himalaya Publishing House.
3.Entrepreneurship Development – Poornima.M.Charantimath – Small Business Enterprises – Pearson Education – 2006 (2 & 4).
4.Management & Entrepreneurship-N V R Naidu, IK International, 2008

REFERENCE BOOKS:

1. Management Fundamentals – Concepts, Application, Skill Development – Robers Lusier – Thomson.
2. Entrepreneurship Development – S.S.Khanka – S.Chand &Co.
3. Management – Stephen Robbins – Pearson Education/PHI – 17th Edition, 2003.
4. http://www.startupindia.gov.in/
5. http://startup.karnataka.gov.in/docs/Startup_Policy_Karnataka.pdf

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CHOICE BASED CREDIT SYSTEM (CBCS)
SCHEME OF TEACHING AND EXAMINATION 2018-2019

Department of Information Science and Engineering

Assessment Pattern:

CIE –Continuous Internal Evaluation Theory (50 Marks)

Bloom"s Category	Tests	Preparation of Project Report/ Profile
Marks (Out of 50)	30	20
Remember	--	02
Understand	10	02
Apply	10	04
Analyze	05	04
Evaluate	05	03
Create		05

SEE –Semester End Examination Theory (50 Marks)

Bloom"s Category	Marks Theory(50)
Remember	10
Understand	10
Apply	10
Analyze	10
Evaluate	10
Create	

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ISO 9001:2008 Certified
CHOICE BASED CREDIT SYSTEM (CBCS)
SCHEME OF TEACHING AND EXAMINATION 2018-2019
Department of Information Science and Engineering

COMPUTER NETWORKS AND CYBER SECURITY

Course code: 19IS5DCCNS **Credits: 04**
L: P: T: S: 4: 0:0: 0 **CIE Marks: 50**
Exam Hours: 03 **SEE Marks: 50**
Total Hours: 50
Course Objectives:

1. To gain an insight into the functionality of network layer from a design and performance perspective.
2. To gain ample understanding of key concepts of transport layer protocols.
3. To understand the need and techniques for network security and cryptography.
4. To introduce the basic application layer protocols.

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

CO1	Develop capability to design networks based on their knowledge of layered communication architecture and its functionalities (TCP/IP) in teams.
CO2	Design and build solutions for problems in routing.
CO3	Know how the different Internet Protocol message formats are designed and implemented
CO4	Identify different types of networks, their management and security issues.
CO5	Comprehend areas affected by cyber crime
CO6	Investigate the use of tools used in cyber security

Mapping of Course outcomes to Program outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	-	-	-	-	-	-	-	-	2	-	-	2
CO2	2	3	-	-	-	-	-	-	-	-	-	1	-	2	2
CO3	3	3	2	2	-	-	-	-	-	-	-	2	-	2	2
CO4	3	3	2	2	-	-	-	-	-	-	-	2	-	2	2
CO5	3	3	-	-	-	-	-	-	-	-	-	2	-	2	1
CO6	3	3	-	-	-	-	-	-	-	-	-	2	-	-	1

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CHOICE BASED CREDIT SYSTEM (CBCS)
SCHEME OF TEACHING AND EXAMINATION 2018-2019
Department of Information Science and Engineering

Module	Contents of the experiment	Hours	COs
1.	Packet Switching Networks-1: Network services and internal network operation, Packet network topology, Routing in Packet networks, Shortest path routing: Bellman-Ford algorithm, Dijkstra's algorithm.	**10**	**CO1, CO2 & CO3, CO4**
2.	Packet Switching Networks -2: Traffic management at the Packet level, Traffic management at Flow level, Traffic management at flow aggregate level.TCP/IP-1: TCP/IP architecture, The Internet Protocol, IPv6, UDP, TCP segment and TCP congestion control, Internet Routing Protocols.	**10**	**CO1, CO2 & CO3, CO4**
3.	Applications, Network Management, Network Security: Application layer overview, Domain Name System (DNS), Remote Login Protocols, E-mail ,File Transfer and FTP, World Wide Web and HTTP, Network management, Overview of network security, Overview of security methods, Secret-key encryption protocols, Public-key encryption protocols, Authentication, Authentication and digital signature	**10**	**CO1, CO2, & CO3, CO4**
4.	Introduction to Cybercrime: Cybercrime: Definition and Origins of the Word, Cybercrime and Information Security, Who are Cybercriminals?, Classifications of Cybercrimes, Cybercrime: The Legal Perspectives, Cybercrimes: An Indian Perspective, Cybercrime and the Indian ITA 2000, A Global Perspective on Cybercrimes, Cybercrime Era: Survival Mantra for the Netizens. Cyber offenses: How Criminals Plan Them: How Criminals Plan the Attacks, Social Engineering, Cyberstalking, Cybercafe and Cybercrime	**10**	**CO5& CO6**
5.	Tools and Methods Used in Cybercrime: Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Phishing and Identity Theft: Introduction, Phishing, Attacks on wireless networks.	**10**	**CO5& CO6**

Self-study component:

UNIT 1: Source routing
UNIT 2: Multicast Routing
UNIT 3: Firewalls.
UNIT 4: Cybercafe and Cybercrimes.
UNIT 5: Identity Theft (ID Theft)

TEXT BOOKS:

1. Alberto Leon Garcia & Indra Widjaja, Communication Networks – Fundamental Concepts & key architectures, 2nd Edition, Tata McGraw-Hill, India (7 - excluding 7.6, 8)
2. Nadir F Mir, Computer & Communication Networks, Pearson Education, India (9, 10 excluding 10.7, 12.1 to 12.3, 16, 17.1 to 17.6, 18.1 to18.3,18.5, 19, 20)
3. Sunit Belapure and Nina Godbole, "Cyber Security: Understanding Cyber Crimes, Computer Forensics And Legal Perspectives", Wiley India Pvt Ltd, ISBN: 978-81-265-21791, 2013.

REFERENCE BOOKS:

1. Behrouz A. Forouzan: Data Communications and Networking, 4th Edition, Tata McGraw-Hill, 2006.
2. William Stallings: Data and Computer Communication, 8th Edition, Pearson Education, 2007.

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CHOICE BASED CREDIT SYSTEM (CBCS)
SCHEME OF TEACHING AND EXAMINATION 2018-2019

Department of Information Science and Engineering

Assessment Pattern:

CIE –Continuous Internal Evaluation Theory (50 Marks)

Bloom's Category	**Tests**	**Assignments**	**AAT1**	**AAT2**
Marks (Out of 50)	**30**	**10**	**05**	**05**
Remember	10			01
Understand	10	05	01	01
Apply	10	05	02	01
Analyze			02	
Evaluate				
Create				02

***AAT 1– Alternate Assessment Tool 1: Quiz**

AAT 2 - Alternate Assessment Tool 2: Surprise Test

SEE –Semester End Examination Theory (50 Marks)

Bloom's Category	**Marks Theory(50)**
Remember	10
Understand	20
Apply	10
Analyze	10
Evaluate	
Create	

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NAAC Accredited with A Grade
ISO 9001:2008 Certified
CHOICE BASED CREDIT SYSTEM (CBCS)
SCHEME OF TEACHING AND EXAMINATION 2018-2019
Department of Information Science and Engineering

INFORMATION RETRIEVAL

COURSE CODE: 19IS5DCIFR **Credits: 03**
L:P:T:S: 3:0:0:0 **CIE Marks:50**
Exam Hours: 03 **SEE Marks: 50**
Total Hours: 40

Course Objectives:

1. Explore the various Information Retrieval Strategies.
2. Understand the various retrieval utilities to improve the results of retrieval strategies
3. Evaluate information retrieval algorithms for document indexing, relevance ranking, Web search, query processing, recommender systems.
4. Analyze performance of textual document indexing, relevance ranking and Web Search.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	-	-	-	-	-	-	-	-	2
CO2	3	3	2	-	-	-	-	-	-	-	-	2
CO3	3	3	2	2	-	-	-	-	-	-	-	2
CO4	3	3	2	2	-	-	-	-	-	-	-	2
CO5	3	3	2	-	-	-	-	-	-	-	-	2
CO6	3	3	2	-	-	-	-	-	-	-	-	2

Module	Contents of the Unit	Hours	Cos
1	**Introduction to IRS** **Retrieval Strategies:** Static Document Collection, Document Routing Vector Space Model, Probabilistic Retrieval strategies Language Models	**08**	**CO1 & C02**
2	**Retrieval Utilities** Relevance feedback; Clustering, Passage-Based Retrieval, N-Grams, Regression Analysis, Thesauri, Semantic Networks, Parsing.	**08**	**CO3**
3	**Indexing and Searching** Introduction, Inverted Files, Boolean queries, Sequential searching, Pattern matching, Structural queries, Compression.	**08**	**CO4**
4	**Cross-Language Information Retrieval and Efficiency** Introduction, Crossing the language barrier, Cross-Language retrieval strategies, Cross language utilities.	**08**	**CO5**
5	**Integrating Structured Data and Text** Review of the relational model, A historical progression, Information retrieval as a relational application, Semi structured search using a relational schema, Multi-dimensional data model. Web Crawling: Features a crawler must provide, Crawling, Crawler architecture	**08**	**CO6**

TEXT BOOKS:

1. David A. Grossman Ophir Frieder, "Information Retrieval- Algorithm and Heuristics" , Second Edition, ISBN 1-4020-3003-7 (HB) Springer International Edition
2. Ricardo Baeza-Yates, Berthier Ribeiro-Neto, "Modern information retrieval ", 1st edition, Addison Wesley Longman Publishing co. INC,2009,ISBN-10:0321416910

REFERENCE BOOKS:

1. Christopher D.Manning, Prabhakar Raghavan, Hinrich Schutze: "An Introduction to Information retrieval", Cambridge University press, England, Online Edition, 2008, ISBN 13:9780521865715

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SCHEME OF TEACHING AND EXAMINATION 2018-2019
Department of Information Science and Engineering

DATABASE MANAGEMENT SYSTEMS

Course code: 19IS5DCDBM **Credits: 04**
L: P: T: S: 4:0:0:0 **CIE Marks: 50**
Exam Hours: 03 **SEE Marks: 50**
Total Hours: 50

Course objectives:

1. Know the fundamentals of database management systems, transactions and related concepts
2. Study E-R model and relational model for designing database.
3. Understand normalization techniques for designing good database.
4. Learn writing SQL queries for the given requirements.

Course Outcomes: At the end of the course, student will be able to:

CO1	Interpret the essentials of database management systems, transactions and related concepts.
CO2	Apply E-R and relational modeling techniques for designing database.
CO3	Analyze and apply transaction processing on data
CO4	Construct queries using SQL for the given requirements.
CO5	Design good database using normalization techniques.
CO6	Evaluate, design and build a database application for the specified requirements

Mapping of Course outcomes to Program outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	-	-	2	-	-	-
CO2	3	2	1	-	-	-	-	-	-	-	-	2	-	1	1
CO3	3	2	-	-	-	-	-	-	-	-	-	2	-	1	1
CO4	3	3	-	-	-	-	-	-	-	-	-	2	-	1	2
CO5	2	2	-	-	-	-	-	-	-	-	-	2	-	2	2
CO6	2	3	2	-	-	-	-	-	-	-	-	2	-	3	3

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CHOICE BASED CREDIT SYSTEM (CBCS)
SCHEME OF TEACHING AND EXAMINATION 2018-2019
Department of Information Science and Engineering

Module	Content of the Unit	Hours	COs
1.	**Introduction:** Introduction ; An example; Characteristics of Database approach; Advantages of using DBMS approach; When not to use DBMS; Data models, schemas and instances; Three schema architecture and data independence; Database System environment. **Entity-Relationship model**: A sample Database Application; Entity types, Entity Sets, Attributes and Keys; Relationship types, Relationship Sets, Roles and structural Constraints; Weak Entity types; ER Diagrams, Naming Conventions and Design issues.	**10**	**CO1, CO2, CO6**
2.	**Relational Model:** Relational Model Concepts; Relational Model constraints and Relational Database Schemas; update operations, Transactions and dealing with constraint violations. **Relational Algebra**: Unary Relational Operations: SELECT and PROJECT; Relational Algebra Operations from Set Theory; Binary Relational Operations: JOIN and DIVISION; Additional Relational Operations. Relational Database Design Using ER-to-Relational mapping.	**10**	**CO1, CO2**
3.	**SQL:** Overview; The Form of a Basic SQL Query; Union, Intersect and Except; Nested Queries; Aggregate Operators; Null Values	**10**	**CO4**
4.	**SQL**: Complex Integrity Constraints in SQL; Triggers and active Databases; Accessing Databases from Applications; Stored Procedures. **Database Design:** Informal Design Guidelines for Relation Schemas; Functional Dependencies; Normal Forms Based on Primary Keys. General Definitions of Second and Third Normal Forms; Boyce-Codd Normal form.	**10**	**CO4, CO5, CO6**
5.	**Database Design: Transaction Management**: The ACID properties; Transactions and Schedules; Concurrent Execution of Transactions; Lock Based Concurrency Control; Transaction Support in SQL **Crash Recovery**: Introduction to ARIES, the LOG, Other recovery related structures, The Write-Ahead Log protocol, checkpointing, Recovery from a system Crash, media recovery, other approaches and interaction with concurrency control	**10**	**CO3, CO5, CO6**

Self-study component:

Note: 1.Questions for CIE and SEE not to be set from self-study component.
2. Assignment Questions should be from self-study component only.

UNIT 1: Classification of Database management systems, MongoDB Architecture, its Key features

UNIT 2: Examples of Queries in Relational Algebra.

UNIT 3: NoSQL, MongoDB Aggregation Framework

UNIT 4: PL/SQL, JDBC classes and Interfaces

UNIT 5: Current trends in database management such as Big Data, Business Intelligence etc.,

TEXT BOOKS:

1. Fundamentals of Database Systems, Ramez Elmasri and Shamkant B. Navathe, 7th Edition,2017,Pearson.(1:1.1,1.2,1.3,1.6,1.8;2:2.1,2.2,2.4;3:3.2,3.3,3.4,3.5,3.7;5:5.1,5.2,5.3;8: 8.1,8.2, 8.3, 8.4; 9:9.1; 14:14.1, 14.2, 14.3, 14.4, 14.5)

2. Database management systems, Ramakrishnan, and Gehrke, 3rd Edition, 2014, McGraw Hill (5: 5.1-5.8; 6: 6.1,6.5; 16: 16.1,16.2,16.3,16.4,16.6,18.1-18.8)

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Department of Information Science and Engineering

CLOUD COMPUTING

Course code: 19IS5DECCM **Credits: 03**
L: P: T: S: 3: 0: 0: 0 **CIE Marks: 50**
Exam Hours: 03 **SEE Marks: 50**
Total Hours: 40

Course Objectives:

1. Understand the basic principles in Cloud Technology.
2. Follow various services of cloud computing.
3. Figure out the cloud analytics and cloud management
4. Perceive the concept of Virtualization in Cloud environment.
5. Cognize the role of SOA and mobility in cloud computing.

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

CO1	Comprehend the basic principles of Cloud Computing.
CO2	Figure out the various cloud services offered in cloud computing.
CO3	Grasp the skills of cloud management and cloud analytic.
CO4	Differentiate the various Virtualization technologies.
CO5	Explain the importance of SOA in cloud computing.
CO6	Interpret the applications of cloud computing by cloud mobility.

Mapping of Course outcomes to Program outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	-	-	-	1	-	-	-	-	-	-	-	-
CO2	3	2	2	-	-	-	1	-	-	-	-	-	-	-	-
CO3	3	2	2	-	-	-	1	-	-	-	-	-	-	-	-
CO4	3	2	2	-	-	-	1	-	-	-	-	-	-	-	1
CO5	3	2	2	-	-	-	1	-	-	-	-	-	-	1	1
CO6	3	2	2	-	-	-	1	-	-	-	-	-	-	1	1

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SCHEME OF TEACHING AND EXAMINATION 2018-2019
Department of Information Science and Engineering

Module	Course Contents	Hours	COs
1	**First Drive:** Introduction, Essentials, Benefits, Why Cloud, Business and IT perspective, Cloud and virtualization, Cloud services requirements, cloud and dynamic infrastructure, cloud computing characteristics. **Cloud deployment models:** Cloud characteristics, Measured Service, Cloud models, security in a public cloud, public verses private clouds, cloud infrastructure self-service.	08	CO1
2	**Cloud as a service:** Gamut of cloud solutions, principle technologies, cloud strategy, cloud design and implementation using SOA, Conceptual cloud model. **Cloud solutions:** Cloud ecosystem, cloud business process management, cloud service management, computing on demand, cloud sourcing.	08	CO2
3	**Cloud offerings:** Cloud analytics, Testing under cloud, information security, virtual desktop infrastructure, Storage cloud Cloud Management: Resiliency, Provisioning, Asset Management, Cloud Governance, High availability and disaster recovery, Charging models, usage reporting, billing, and metering.	08	CO3
4	**Cloud virtualization technology:** Virtualization defined, virtualization benefits, server virtualization, virtualization for x86 architecture, Hypervisor management software, Virtual infrastructure requirements. **Cloud Infrastructure:** Deep Dive: Storage virtualization, storage area networks.	08	CO4
5	**Cloud Infrastructure:** Deep Dive: network attached storage, cloud server virtualization **Cloud and SOA:** SOA journey to infrastructure, SOA and Cloud, SOA defined, SOA and IaaS, SOA-based cloud infrastructure steps,	08	CO4, CO5

	SOA business and IT service. **Cloud Mobility:** The business problem, Mobile enterprise application platform, Mobile application architecture overview.		

Self-study component:

1. Questions for CIE and SEE not to be set from self-study component.

2. Assignment Questions should be from self-study component only.

MODULE 1: cloud adoption, cloud service defined

MODULE 2: Cloud service defined, On-Premise cloud orchestration and provisioning engine.

MODULE 3: Information storage, retrieval, archive, and protection

MODULE 4:Networking essential to cloud.

TEXT BOOKS:

1. Dr.Kumar Saurabh, Cloud Computing by, 2nd Edition

REFERENCE BOOKS:

1. Kai Hwang, Geoffrey C Fox and Jack J Dongarra, Distributed and Cloud Computing

2. RajkumarBuyya, James Broberg, AndrzejGoscinski: Cloud Computing Principles and Paradigms, Willey 2014

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SCHEME OF TEACHING AND EXAMINATION 2018-2019
Department of Information Science and Engineering

FILE STRUCTURES

Course code: 19IS5DEFLS **Credits: 03**
L: P: T: S: 3:0:0:0 **CIE Marks: 50**
Exam Hours: 03 **SEE Marks: 50**
Total Hours: 40

Course Objectives:

1. Students will learn the basic concepts related to file processing operations
2. To provide a solid introduction to the topic of file structures design.
3. Knowledge on organizing the files for performance, data compression and indexing.
4. To develop important programming skills in and object-oriented language such as C++

Course Outcomes: At the end of the course, student will be able to:

CO1	Understand the fundamental concepts of file processing operations and storage structures
CO2	Apply object orientation concepts to manipulate records.
CO3	Develop the mini projects based on sorting and merging on multiple files using co sequential processing for various applications.
CO4	Demonstrate the sequential and indexing file accessing techniques with appropriate data structures wherever necessary.
CO5	Design and develop the small applications based on hashing techniques to organize file structures
CO6	Develop the mini projects based on B-Tre and B+Tree for implementing file server

Mapping of Course outcomes to Program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	3	2	1	-	-	-	-	-	-	1	1	2	2	1
CO 2	3	2	2	1	-	-	-	-	-	-	1	1	2	2	1
CO 3	3	3	2	-	-	-	-	-	-	-	1	1	2	2	-
CO 4	3	2	2	1	-	-	-	-	-	-	1	1	2	-	-
CO 5	3	3	2	1	-	-	-	-	-	-	1	1	2	1	-
CO 6	3	3	3	-	-	-	-	-	-	-	-	-	2	2	-

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SCHEME OF TEACHING AND EXAMINATION 2018-2019
Department of Information Science and Engineering

Module	Contents of the Unit	Hours	COs
1	**Introduction:** File Structures: The Heart of the file structure Design, A Short History of File Structure Design, A Conceptual Toolkit; Fundamental File Operations: Physical Files and Logical Files, Opening Files, Closing Files, Reading and Writing, Seeking, Special Characters in files, The Unix Directory Structure, Physical devices and Logical Files, File-related Header Files, UNIX file System Commands; Input /Output in UNIX.	**08**	**CO1** **CO2** **CO3**
2	**Fundamental File Structure Concepts, Managing Files of Records :** Field and Record Organization, Using Classes to Manipulate Buffers, Using Inheritance for Record Buffer Classes, Managing Fixed Length, Fixed Field Buffers, Record Access, File Access and File Organization.	**08**	**CO2** **CO3** **CO4**
3	**Organization of Files for Performance, Indexing:** Data Compression, Reclaiming Space in files, Internal Sorting and Binary Searching, Key sorting; What is an Index? A Simple Index for Entry-Sequenced File, , Indexes that are too large to hold in Memory, Indexing to provide access by Multiple keys, Retrieval Using Combinations of Secondary Keys, Improving the Secondary Index structure: Inverted Lists, Selective indexes. **Cosequential Processing and the Sorting of Large Files:** A Model for Implementing Cosequential Processes, , Extension of the Model to include Mutiway Merging.	**08**	**CO4**
4	**Hashing:** Introduction, A Simple Hashing Algorithm, Hashing Functions and Record Distribution, How much Extra Memory should be used?, Collision resolution by progressive overflow, Buckets, Making deletions, **Extendible Hashing:** How Extendible Hashing Works.	**08**	**CO5**

5	**Multi-Level Indexing and B-Trees:** The invention of B-Tree, Statement of the problem, Indexing with Binary Search Trees; Multi-Level Indexing, BTrees, Example of Creating a B-Tree. B-Tree Methods; Nomenclature, Formal Definition of B-Tree Properties, Worst-case Search Depth, Deletion, Merging and Redistribution, Redistribution during insertion, Indexed Sequential File Access and Prefix B + Trees: Introduction.	**08**	**CO5** **CO6**

Self study component:

Note: 1.Questions for CIE and SEE not to be set from self-study component.

2. Assignment Questions should be from self-study component only.

UNIT 1: Secondary Storage and System Software:Disks, Magnetic Tape,; CD-ROM: Introduction, PhysicalOrganization, Strengths and Weaknesses;

UNIT 2: More about Record Structures, Encapsulating ,Record Operations in a Single Class,

UNIT 3: Binding, A Second Look at Sorting in Memory, Merging as a Way of Sorting Large Files on Disk, Application of the Model to a General Ledger Program

UNIT 4: Other collision resolution techniques, Extendible Hashing, performance, Alternative Approaches

UNIT 5: Indexed Sequential Access, Maintaining a Sequence Set, Adding a Simple Index to the Sequence Set, The Content of the Index: Separators Instead of Keys,

TEXT BOOK:

1. Michael J. Folk, Bill Zoellick, Greg Riccardi: File Structures-An Object Oriented Approach with C++, 3rd Edition, Pearson Education, 1998. (Chapters 1 to 12 excluding 1.4, 1.5, 5.5, 5.6, 8.6, 8.7, 8.8)

REFERENCE BOOKS:

1. K.R. Venugopal, K.G. Srinivas, P.M. Krishnaraj: File Structures Using C++, Tata McGraw- Hill, 2008.
2. Scot Robert Ladd: C++ Components and Algorithms, BPB Publications, 1993.
3. Raghu Ramakrishan and Johannes Gehrke: Database Management Systems, 3rd Edition, McGraw Hill, 2003.
4. Data Management and File Structures, Mary E.S. Loomis, Second Edition, PHI.
5. File Organization and Processing, Alan L. Tharp, Wiley India Edition.

Assessment Pattern:

CIE –Continuous Internal Evaluation Theory (50 Marks)

Bloom's Category	**Tests**	**Assignments**	**AAT1**	**AAT2**
Marks (Out of 50)	**30**	**10**	**05**	**05**
Remember	10			01
Understand	10	05	01	01
Apply	10	05	02	01
Analyze			02	
Evaluate				
Create				02

***AAT 1– Alternate Assessment Tool 1:**
AAT 2 - Alternate Assessment Tool 2:
SEE –Semester End Examination Theory (50 Marks)

Bloom's Category	**Marks Theory(50)**
Remember	05
Understand	10
Apply	10
Analyze	10
Evaluate	10
Create	05

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SCHEME OF TEACHING AND EXAMINATION 2018-2019
Department of Information Science and Engineering

COMPILER DESIGN

Course code: 19IS5DECDN **Credits: 03**
L: P: T: S: 3:0:0:0 **CIE Marks: 50**
Exam Hours: 03 **SEE Marks: 50**
Total Hours: 40

Course Objectives:

1. To understand, design and implement a lexical analyzer.
2. To understand, design and implement a parser.
3. To understand, design code generation schemes.
4. To understand optimization of codes and runtime environment.

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

CO1	Analyze the major concepts in language translation and compiler design.
CO2	Investigate the various phases of a compiler.
CO3	Construct simple lexical analyzers and syntax analyzers.
CO4	Distinguish the various types of parsers and generation of intermediate code.
CO5	Determine the issues in runtime environment creation.
CO6	Generate machine code for simple instructions.

Mapping of Course outcomes to Program outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	2	-	1	-	-	-	-	-	-	-	2	1	-
CO4	3	2	2	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	2	-	-	-	-	-	-	-	-	-	-	-	-
CO6	3	2	2	-	-	-	-	-	-	-	-	-	2	-	-

Module	Course Content	Hours	COs
1	**Introduction**: Language processors; The structure of a Compiler; Applications of Compiler technology; Phases of a compiler **Lexical analysis**: the Role of Lexical Analyzer; Input Buffering; Specifications of Tokens; Recognition of Tokens **Syntax Analysis-I :**Introduction, Context Free Grammars, Derivations, Ambiguous grammar, Eliminating Ambiguity, Error recovery strategies	**10**	**CO1** **CO2** **CO3**
2	**Syntax Analysis-II :** Writing a grammar; Top-down Parsing; Bottom-up Parsing; Introduction to LR Parsing: Simple LR; More powerful LR parsers- canonical LR(1) Items, Constructing LR(1) sets of items, canonical LR(1) parsing tables, Constructing LALR parsing tables.	**10**	**CO3** **CO4**
3	**Syntax-Directed Translation:** Syntax-directed definitions; **Intermediate Code Generation:** Variants of syntax trees; Three-address code; Translation of expressions; Switch-statements.	**10**	**CO1**
4	**Run-Time Environments:** Storage Organization; Stack allocation of space - Activation Trees, Activation Records; Heap management; Introduction to garbage collection.	**10**	**CO5**
5	**Code Generation:** Issues in the design of Code Generator; The Target Language; Addresses in the target code; Basic blocks and Flow graphs; Optimization of basic blocks; A Simple Code Generator.	**10**	**CO6**

Self-study component:

Note: 1.Questions for CIE and SEE not to be set from self-study component.

2. Assignment Questions should be from self-study component only.

1. Introduction to System Software: System Software, Application Software, Components making up the System Software: Compilers, Assemblers, Editors and debuggers, Linkers and Loaders, Macro processors.

2. Assemblers: Basic Assembler Function - A Simple SIC Assembler, Assembler Algorithm and Data Structures, Machine Dependent Assembler Features - Instruction Formats & Addressing Modes, Program Relocation. Machine Independent Assembler Features – Literals, Symbol - Definition Statements, Expression, Program Blocks, Control Sections, Programming Linking.

TEXT BOOKS:

1. Alfred V Aho, Monica S.Lam, Ravi Sethi, Jeffrey D Ullman: Compilers - Principles, Techniques and Tools, 2nd Edition, Pearson Education, 2007.

REFERENCE BOOKS:

1. Charles N. Fischer, Richard J. leBlanc, Jr.: Crafting a Compiler with C, Pearson Education, 1991.
2. Kenneth C Louden: Compiler Construction Principles & Practice, Cengage Learning, 1997.
3. Allen I. Holub: Compiler Design in C , Prentice-Hall, 1990.
4. Leland. L. Beck, System Software, 3rd Edition, Addison-Wesley, ISBN: 978-8-13176-281-3, 2010

Assessment Pattern:

CIE –Continuous Internal Evaluation Theory (50 Marks)

Bloom's Category	Tests	Assignments	AAT1	AAT2
Marks (Out of 50)	30	10	05	05
Remember	10			01
Understand	10	05	01	01
Apply	10	05	02	01
Analyze			02	
Evaluate				
Create				02

***AAT 1– Alternate Assessment Tool 1: Quiz**

AAT 2 - Alternate Assessment Tool 2: Surprise Test

SEE –Semester End Examination Theory (50 Marks)

Bloom's Category	Marks Theory(50)
Remember	10
Understand	20
Apply	10
Analyze	10
Evaluate	
Create	

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Department of Information Science and Engineering

INFORMATION TECHNOLOGY & SERVICE MANAGEMENT

Course code: 19IS5DEITSM **Credits: 03**
L: P: T:S: 3:0:0:0 **CIE Marks:50**
Exam Hours: 03 **SEE Marks:50**
Total Hours: 40

Course Objectives:

1. To develop an understanding of the "state of the art" of IT service management thinking including IT service systems
2. To understand the service system world view in order to develop a service mindset and service development from both a product and process perspective.
3. To gain an appreciation of the complexities associated with implementing change during IT services.
4. To extend the knowledge scope from Technique to Management, and from Software Engineering to Service Science

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

CO1	Assessing the need for Service Management in Information Business Sector
CO2	Determining the importance of adhering to Information Technology Service Management Framework
CO3	Illustrating the implementation of service management process through various strategies and design methods
CO4	Mapping the service design to build and deploy IT Services
CO5	Facilitating the delivery of services effectively and efficiently to fulfill the user requests
CO6	Adapting the service methods to facilitate quality management

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Department of Information Science and Engineering

Module	Course Content	Hours	COs
1	**Service Management Introduction:** The Importance of IT Service Management Processes, IT Service Management Frameworks, Introduction to the Service Life Cycle, Introduction to ITIL, IT Governance, Organizational maturity, Benefits and risks of ITSM frameworks, Service Life Cycle: concept and overview.	08	CO1
2	**Service Strategy-I:** Basic concepts, Processes and other activities**. Service Strategy-II:** Organization, Methods, Techniques and Tools. **Service Design:** Basic concepts, Processes and other activities, Organization, Implementation	08	CO2 CO3
3	**Service Transition:** Basic concepts, Processes and other activities, Organization, Methods, Techniques and Tools, Implementation.	08	CO4 CO5
4	**Service Operation:** Basic concepts, Processes and other activities, Organization, Methods, Techniques and Tools, Implementation.	08	CO6
5	**Continual Service Improvement:** Basic concepts, Processes and other activities, Organization, Methods, Techniques and Tools, Implementation.	08	CO6

Self-Study Component:

Unit 1: Complementary Frameworks, IT Service Management Standard–ISO/IEC 20000, Assessing Process Maturity

Unit 2: Service Strategy: Implementation

Unit 3: **Service Design** Methods, Techniques and Tools

Unit 4: Service Operation: Functions and Processes

Unit 5: Continual Service Improvement: Functions and Processes

TEXT BOOKS:

1. Foundations of IT Service Management: based on ITIL by Jan van Bon, Arjen de Jong, Axel Kolthof, Mike Pieper, Ruby Tjassing, Annelies van der Veen, TienekeVerheijen,3rd Edition, Van Haren Publishing, Zaltbommel, September 2007 (Chapters: 2,3,4,5,6,7)
2. Foundations of ITIL: Volume 3: Based on ITIL V3 (Best Practice IT Management), Jan Van Bon, Annelies van der Veen, Van Haren Publishing,November2007

REFERENCEBOOK:

1. The Official Introduction to the ITIL, Service Lifecycle, Stationery Office Books, May2007

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Department of Information Science and Engineering

PYTHON PROGRAMMING

Course code: 19IS5DEPYP **Credits: 03**
L: P: T: S: 3:0:0: 0 **CIE Marks: 50**
Exam Hours: 03 **SEE Marks: 50**
Total Hours: 40

Course objectives:

1. Develop a basic Understanding of the Python Programming language.
2. Introduction the python language its most important Data types, libraries, and its recommended programming styles and idioms.
3. Methods to solve logical programming problems in python style. It also describes the some of the python programming environments that are available.
4. Describing python programming environments that are available.

Course Outcomes: At the end of the course, student will be able to:

CO1	Acquire knowledge of - Various types of data types, identifiers and keywords, Floating Point numbers, String operator and Methods.
CO2	Apply various concepts of Looping , control structures and Exception Handling.
CO3	Ability to analyze collections of data types to illustrate the process of structuring the data using lists, tuples and dictionaries.
CO4	Analyze the Regular Expression and implement the object oriented programming concepts in python.
CO5	Ability to demonstrate the use of built-in functions to navigate the file system and Implement the applications of Data base programming and Networking.
CO6	Design and apply appropriate Python Programming for solving computing problems.

Mapping of Course outcomes to Program outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-	1	1	-
CO5	3	2	1	-	-	-	-	-	-	-	-	3	3	3	2
CO6	3	3	1	-	-	-	-	-	-	-	-	3	3	3	2

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SCHEME OF TEACHING AND EXAMINATION 2018-2019
Department of Information Science and Engineering

Module	Contents of the Unit	Hours	COs
1	**Python Basics and Data Types:** Introduction, Features of Python, Versions, Keywords and Identifiers, Integral Types: integers, Booleans, Floating-point Types: Floating-point Number, Complex Numbers, Decimal Numbers, **Strings**: Comparing Stings, Slicing and Striding Strings, String operators and Methods, Examples.	**08**	**CO1 & CO3**
2	**Control statements and Exception Handling**: Flow control, Boolean Values, Comparison Operators, Boolean Operators, Mixing Boolean and Comparison Operators, Elements of Flow Control, Program Execution, Flow Control Statements, Importing Modules, Ending a Program Early with sys.exit(), Functions, def Statements with Parameters, Return Values and return Statements, The None Value, Keyword Arguments and print(), Local and Global Scope, The global Statement, Exception Handling, A Short Program: Guess the Number	**08**	**CO2**
3	**Lists:** The List Data Type, Working with Lists, Augmented Assignment Operators Methods, Example Program: Magic 8 Ball with a List, List-like Types: Tuples, References. **Dictionaries and Structuring Data:** The Dictionary Data Type, Pretty Printing, Using DataStructures to Model Real-World Things. **Pattern Matching with Regular Expressions,** Finding Patterns of Text Without Regular Expressions, Finding Patterns of Text with Regular Expressions,Greedy and Nongreedy Matching, The findall() Method, Character Classes, Making Your Own Character Classes, The Caret and Dollar Sign Characters, The Wildcard Character, Review of Regex Symbols, Case-Insensitive Matching, Substituting Strings with the sub() Method, Combining re .IGNORECASE, re .DOTALL, and re .VERBOSE,	**08**	**CO3 & CO4**
4	**Classes and objects:** Programmer-defined types, Attributes, Rectangles, Instances as return values, Objects are mutable, Copying. **Classes and functions:** Time, Pure functions, Modifiers, Prototyping versus planning, **Classes and methods,** Object-oriented features, Printing objects, Another example, A more complicated example, The init method, The __str__ method, Operator overloading, Type-based dispatch, Polymorphism, Interface and implementation. **Inheritance:** Card objects, Class attributes, Comparing cards, Decks, Printing the deck, Add, remove, shuffle and sort, Inheritance, Class diagrams, Data encapsulation.	**08**	**CO4& CO6**

5	**Reading and Writing Files:** Files and File Paths, The os.path Module, The File Reading/Writing Process, Saving Variables with the shelve Module, Saving Variables with the pprint.pformat() Function, **Debugging:** Raising Exceptions, Getting the Traceback as a String, Assertions, Logging, IDLE's Debugger.	**08**	**CO5 & CO6**

Self-study component:

Note: 1. Questions for CIE and SEE not to be set from self-study component.

2. Assignment Questions should be from self-study component programming examples from each unit.

UNIT 1: Creating and running python programs**.**

UNIT 2: String formatting and programming examples

UNIT 3: More Pattern Matching with Regular Expressions

UNIT 4: DATABASE PROGRAMMING: Database Programming: DBM Databases, SQL Databases. **NETWORKING:** Creating a TCP Client, Creating a TCP Server.

UNIT 5: Organizing Files: The shutil Module, Walking a Directory Tree, Compressing Files with the zipfile Module, Project: Renaming Files with American-Style Dates to European-Style Dates, Project: Backing Up a Folder into a ZIP File.,

Projects:

1. Project: Phone Number and Email Address Extractor.
2. Project: Generating Random Quiz Files, Project: Multiclipboard.

TEXT BOOKS:

1. Mark Summerfield, Programming in Python 3, A complete introduction to the Python Language, Second Edition.(Chapters 2, 12)
2. Al Sweigart,"Automate the Boring Stuff with Python",1st Edition, No Starch Press, 2015. (Available under CC-BY-NC-SA license at https://automatetheboringstuff.com/) (Chapters 2, 3, 4, 5, 7, 8, 9, 10)
3. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2nd Edition, Green Tea Press, 2015. (Available under CC-BY-NC license at http://greenteapress.com/thinkpython2/thinkpython2.pdf) (Chapters 15, 16, 17, 18)

REFERENCE BOOKS:

1. Paul Gries, Jennifer Campbell, Jason Montojo, Practical Programming: An Introduction to Computer Science Using Python 3, Pragmatic Bookshelf, 2/E 2014
2. James Payne, Beginning Python: Using Python 2.6 and PYHTON 3, Wiley India 2010

Assessment Pattern:

CIE –Continuous Internal Evaluation Theory (50 Marks)

Bloom's Category	**Tests**	**Assignments**	**AAT1**	**AAT2**
Marks (Out of 50)	**30**	**10**	**05**	**05**
Remember	10			01
Understand	10	05	01	01
Apply	10	05	02	01
Analyze			02	
Evaluate				
Create				02

***AAT 1– Alternate Assessment Tool 1: Quiz**

AAT 2 - Alternate Assessment Tool 2: Surprise Test

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Department of Information Science and Engineering

DATA WAREHOUSING AND DATA MINING

Course code: 19IS5DEDWM **Credits: 03**
L: P: T: S: 0:2:1:0 **CIE Marks: 50**
Exam Hours: 03 **SEE Marks: 50**

Course objectives:

1. To appreciate the basic concepts of Data mining, Data Warehouse and OLAP technology.
2. To learn the data pre-processing methods.
3. To develop different algorithms for association, classification and clustering for the given dataset.
4. To illustrate the usage of various data mining models.

Course Outcomes: At the end of the course, student will be able to:

CO1	Interpret the concepts of Data mining and Data Warehouse technology
CO2	Analyze the different data pre-processing methods
CO3	Examine the basic concepts and algorithms in association mining
CO4	Inspect the algorithms for solving classification problem
CO5	Identify the appropriate clustering techniques for the given data sets
CO6	Illustrate the usage of data mining for solving problems

Mapping of Course outcomes to Program outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	1	-	-	-	-	-	-	-	-	-	1	-	1
CO3	3	2	2	-	-	-	-	-	-	-	-	-	-	2	1
CO4	3	2	2	-	-	-	-	-	-	-	-	-	-	1	1
CO5	3	2	1	-	-	-	-	-	-	-	-	-	-	1	1
CO6	3	1	1	-	-	-	-	-	-	-	-	-	-	1	1

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CHOICE BASED CREDIT SYSTEM (CBCS)
SCHEME OF TEACHING AND EXAMINATION 2018-2019
Department of Information Science and Engineering

Module	Course Content	Hours	COs
1	Introduction: Need for Data Mining, Define Data Mining, Kinds of Data to be mined, Kinds of Patterns to be mined, Technologies Used, Data Objects and Attribute Types. Data Pre-processing: Data Pre-processing: An Overview, Data Cleaning, Data Integration, Data Reduction.	**08**	**CO1 & CO2**
2	Data Pre-processing: Data Transformation and Discretization. Data Warehousing and Online Analytical Processing: Data Warehouse: Basic Concepts, Data Warehouse Modeling: Data Cube and OLAP. Mining Frequent Patterns, Associations, and Correlations: Basic Concepts and Methods: Basic Concepts, Frequent Itemset Mining Methods: Apriori Algorithm- Finding Frequent Item sets by Confined Candidate Generation, Generating Association Rules from Frequent Item sets.	**08**	**CO2 & CO3**
3	Classification: Basic Concepts: Basic Concepts, Decision Tree Induction, Bayes Classification Methods, Rule-Based Classification, Model Evaluation and Selection: Metrics for Evaluating Classifier Performance, Comparing Classifiers Based on Cost–Benefit and ROC Curves.	**08**	**CO4 & CO6**
3	Cluster Analysis: Basic Concepts and Methods: Cluster Analysis, Partitioning Methods, Hierarchical Methods: Agglomerative versus Divisive Hierarchical Clustering, Distance Measures in Algorithmic Methods, Density Based Methods: DBSCAN, Grid based methods. Outlier Detection: Outliers and Outlier Analysis, Outlier Detection Methods.	**08**	**CO5 & CO6**
5	Data Mining Trends and Research Frontiers: Mining Complex Data Types, Data Mining Applications, Data Mining and Society, Data Mining Trends.	**08**	**CO6**

Self-Study Component:

- Data Visualization
- Data Warehouse Implementation
- Classification by Back propagation, Support Vector Machines, Lazy Learners
- Evaluation of Clustering
- Other Methodologies of Data Mining

TEXT BOOKS:

1. Jiawei Han, Micheline Kamber, Jian Pei, "Data Mining – Concepts and Techniques", 3rd Edition, Morgan Kaufmann, 2012.

REFERENCE BOOKS:

1. Pang Ning Tan, Michael Steinbach, Vipin Kumar, "Introduction to Data Mining", Pearson Education, 2016.

2. G. K. Gupta, "Introduction to Data Mining with Case Studies", 3rd Edition, PHI Learning, 2014.

Assessment Pattern:

CIE –Continuous Internal Evaluation Theory (50 Marks)
SEE –Semester End Examination Theory (50 Marks)
CIE=30 marks
Assignment=10 marks
AAT=10 Marks

COMPUTER GRAPHICS AND VISION

Course code: 19IS5DECGH **Credits: 03**
L: P: T: S: 3:0:0:1 **CIE Marks: 50**
Exam Hours: 03 **SEE Marks:50**
Total Hours: 40

Course objectives:

1. To provide an introduction to the theory and practice of computer graphics.
2. Apply graphics programming techniques to design, and create computer graphics scenes.
3. Analyze the two-dimensional transformations, line drawing, Clipping, and filling algorithms.
4. Create effective OpenGL programs to solve graphics programming issues, including objects modeling, 3D transformation, color modeling, lighting, and textures.

Course Outcomes: At the end of the course, student will be able to:

CO1	Understand all aspects of computer graphics including hardware, software and applications.
CO2	Gain in-depth knowledge of display systems, image synthesis, and interactive control of computer graphics applications.
CO3	Illustrate the 2D graphics algorithms like the line drawing, polygon filling, clipping, and transformation algorithms.
CO4	Integrate the concepts and techniques used in interpretation of 2D and 3D visual information.
CO5	Comprehend the concepts of viewing, transformations, hierarchical modeling, color, lighting and texture mapping.
CO6	understanding of the fundamental concepts related to multi-dimensional signal processing, feature extraction, pattern analysis visual geometric modeling, stochastic optimization etc.

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CHOICE BASED CREDIT SYSTEM (CBCS)
SCHEME OF TEACHING AND EXAMINATION 2018-2019
Department of Information Science and Engineering

Mapping of Course outcomes to Program outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PSO2	PSO3
CO1	3	3	3				3				3		2		2
CO2	2	3										3			
CO3	3	3					3				3		2		
CO4	3	3	3						3			3			
CO5		3	3								3				
CO6		3	3			3	3					3	2		2

Module	Content of the Unit	Hours	COs
1.	**Graphics systems and models:** Applications of computer graphics; A graphics system; Images: Physical and synthetic; The synthetic camera model; The programmer's interface; Graphics architectures; Programmable pipelines; Performance characteristics. **Interactive lnput Methods and Graphical User Interfaces:** Graphical input Data, Logical Classification of Input Devices, lnput Functions for Graphical data, Open GL Interactive input functions, OpenGL menu functions, Designing Graphical User Interface **Graphics Programming:** The Sierpinski gasket; Programming two-dimensional applications,.	**09**	**CO1 & CO2**
2.	**From Vertices to Fragments:** Basic implementation strategies; The major tasks; Clipping; Line-segment clipping; Polygon clipping; Rasterization; Bresenham's algorithm;	**08**	**CO3, CO4 & CO6**
3.	**Geometric Objects & Transformations:** Scalars, points, and vectors; Three-dimensional primitives; Coordinate systems & frames; Frames in OpenGL, Modeling a colored cube; Affine transformations; Rotation, translation, & scaling, Transformations in homogeneous coordinates; Concatenation of transformations.	**08**	**CO3, CO4 & CO6**
4.	**Viewing:** Classical and computer viewing; Viewing with a computer; Positioning of the camera; Simple projections; Projections in OpenGL; Hidden-surface removal; Parallel-projection matrices;	**08**	**CO4 & CO5**
5.	**Digital Image Formation and Introduction:** Overview and state of the Art, fundamentals of image formation, Transformation: Orthogonal, Euclidean, Affine, Projective, etc; Fourier Transform, Convolution and Filtering, Image Enhancement, Restoration, Histogram Processing.	**07**	**CO5 & CO6**

Self-study component:

Note: 1.Questions for CIE and SEE not to be set from self-study component.
2. Assignment Questions should be from self-study component only.

UNIT 1: Imaging systems, Display lists; Programming event-driven input.
UNIT 2: Clipping of other primitives; Clipping in three dimensions.
UNIT 3: Quaternion's.
UNIT 4: Projections and shadows.
UNIT 5: Shading of the sphere model; Global illumination.

TEXT BOOKS:

1. Edward Angel: Interactive Computer Graphics A Top-Down Approach with OpenGL, 5th Edition, Pearson Education, 2008.
2. Donald Hearn and Pauline Baker: Computer Graphics- OpenGL Version, 3rd Edition, Pearson Education, 2004.

REFERENCE BOOKS:

1. F.S. Hill Jr.: Computer Graphics Using OpenGL, 3rd Edition, PHI, 2009.
2. James D Foley, Andries Van Dam, Steven K Feiner, John F Hughes, Computer Graphics, Pearson Education 1997.
3. Richard Szeliski, Computer Vision: Algorithms and Applications, Springer-Verlag London Limited 2011
4. Computer Vision: A Modern Approach, D. A. Forsyth, J. Ponce, Pearson Education, 2003.

E-books:

1. Graphics Programming Black Book by Michael Abrash.

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CHOICE BASED CREDIT SYSTEM (CBCS)
SCHEME OF TEACHING AND EXAMINATION 2018-2019

Department of Information Science and Engineering

Assessment Pattern:

CIE –Continuous Internal Evaluation Theory (50 Marks)

Bloom's Category	**Tests**	**Assignments**	**AAT1**	**AAT2**
Marks (Out of 50)	**30**	**10**	**05**	**05**
Remember	10			01
Understand	08	05	01	01
Apply	07	05	02	01
Analyze	05		02	
Evaluate				
Create				02

AAT 1– Alternate Assessment Tool 1: Quiz

AAT 2 - Alternate Assessment Tool 2: Surprise Test

SEE –Semester End Examination Theory (50 Marks)

Bloom's Category	**Marks Theory(50)**
Remember	05
Understand	10
Apply	10
Analyze	10
Evaluate	10
Create	05

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SCHEME OF TEACHING AND EXAMINATION 2018-2019
Department of Information Science and Engineering

MOBILE APPLICATION DEVELOPMENT

Course code: 19IS5DEMAD **Credits: 03**
L: P: T: S: 3:0:0: 0 **CIE Marks: 50**
Exam Hours: 03 **SEE Marks: 50**
Total Hours: 40

Course objectives:

1. Learn to setup Android application development environment
2. Illustrate user interfaces for interacting with apps and triggering actions
3. Interpret tasks used in handling multiple activities
4. Identify options to save persistent application data
5. Appraise the role of security and performance in Android applications

Course Outcomes: At the end of the course, student will be able to:

CO1	Create, test and debug Android application by setting up Android development Environment
CO2	Implement adaptive, responsive user interfaces that work across a wide range of devices.
CO3	Infer long running tasks and background work in Android applications
CO4	Demonstrate methods in storing, sharing and retrieving data in Android applications
CO5	Analyze performance of android applications and understand the role of permissions and security
CO6	Describe the steps involved in publishing Android application to share with the world

Mapping of Course outcomes to Program outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	2	-	-	3	-	-	-	-	-	-	-	-	-	-
CO2	-	2	-	-	3	-	-	-	-	-	-	-	-	-	-
CO3	-	2	-	-	3	-	-	-	-	-	-	-	-	-	-
CO4	-	2	1	-	3	-	-	-	-	-	-	-	-	-	-
CO5	--	2	1	-	3	-	-	-	-	-	-	-	-	-	-
CO6		2	1	-	3	-	-	-	-	-	-	-	-	-	-

Module	Contents of the Module	Hours	COs
1	Get started, Build your first app, Activities, Testing, debugging and using support libraries	**08**	**CO1, CO2**
2	User Interaction, Delightful user experience, Testing your UI	**08**	**CO2**
3	Background Tasks, Triggering, scheduling and optimizing background tasks	**08**	**CO3**
4	All about data, Preferences and Settings, Storing data using SQLite, Sharing data with content providers, Loading data using Loaders	**08**	**CO4**
5	*Permissions, Performance and Security, Firebase and AdMob, Publish*	**08**	**CO5, CO6**

Self-study component:

Note:

1. **Questions for CIE and SEE not to be set from self-study component.**
2. **Assignment Questions should be from self-study component only.**
3. **Every student should develop a mini project on mobile application development**

TEXT BOOKS:

1. Google Developer Training, "Android Developer Fundamentals Course – Concept Reference", Google Developer Training Team, 2017. https://www.gitbook.com/book/google-developer-training/android-developer-fundamentals- course-concepts/details (Download pdf file from the above link)

REFERENCE BOOKS:

1. Erik Hellman, "Android Programming – Pushing the Limits", 1st Edition, Wiley India Pvt Ltd, 2014
2. Dawn Griffiths and David Griffiths, "Head First Android Development", 1st Edition, O'Reilly SPD Publishers, 2015
3. J F DiMarzio, "Beginning Android Programming with Android Studio", 4th Edition, Wiley India Pvt Ltd, 2016

4. Anubhav Pradhan, Anil V Deshpande, " Composing Mobile Apps" using Android, Wiley 2014

Assessment Pattern:

1. **CIE –Continuous Internal Evaluation Theory (50 Marks)**

Bloom's Category	**Tests**	**Assignments**	**AAT1**	**AAT2**
Marks (Out of 50)	**30**	**10**	**05**	**05**
Remember	10			01
Understand	10	05	01	01
Apply	10	05	02	01
Analyze			02	
Evaluate				
Create				02

***AAT 1– Alternate Assessment Tool 1: Quiz**

AAT 2 - Alternate Assessment Tool 2: Surprise Test

2. **SEE –Semester End Examination Theory (50 Marks)**

Bloom's Category	**Marks Theory(50)**
Remember	05
Understand	10
Apply	10
Analyze	10
Evaluate	10
Create	05

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SCHEME OF TEACHING AND EXAMINATION 2018-2019
Department of Information Science and Engineering

DATABASE APPLICATIONS LABORATORY WITH MINIPROJECT

Course code: 19IS5DLDBM **Credits: 02**
L: P: T: S: 0:2:1:0 **CIE Marks: 50**
Exam Hours: 03 **SEE Marks: 50**

Course objectives:

1. Execute SQL commands.
2. Implement simple exercises on relational database schema.
3. Design a relational database schema for specific database application using SQL
4. Apply normalization procedure on relational database schema.

Course Outcomes: At the end of the course, student will be able to:

CO1	Interpret and use the fundamentals of database, transactions and related concepts.
CO2	Apply E-R and relational modeling techniques for a given problem
CO3	Develop and impose integrity constraints on a database
CO4	Build a database using SQL for the given requirements.
CO5	Analyze and query a database using SQL
CO6	Generate suitable reports from the database application

Mapping of Course outcomes to Program outcomes:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	3	-	2	-	-	2	-	-	-	2
CO2	3	3	3	1	2	-	-	2	-	-	-	1
CO3	3	3	3	1	2	-	-	2	-	-	-	1
CO4	3	3	3	1	2	-	-	2	-	-	-	1
CO5	3	3	3	1	2	-	-	2	-	-	-	1
CO6	3	3	3	1	2	-	-	2	-	-	-	1

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CHOICE BASED CREDIT SYSTEM (CBCS)
SCHEME OF TEACHING AND EXAMINATION 2018-2019
Department of Information Science and Engineering

Instructions:
In the examination, one exercise from Part A is to be asked for a total of 20 marks. The mini project developed under Part B has to be evaluated for a total of 30 marks.

For Part A:
1. The exercises are to be solved in an RDBMS environment like Oracle / MySQL / DB2/ MS SQL Server, or any other DBMS under LINUX/Windows environment.
2. Add appropriate database constraints.
3. Create Schema and insert at least 5 records for each table. Suitable records have to be entered so that queries are executed correctly.
3. The results of the queries must be displayed directly.
4. Relevant queries other than the ones listed along with the exercises may also be asked in the examination.
5. Questions must be asked based on lots.

For Part B:
1. Front end may be created using any of VB/HTML/JAVA/Python.
2. Back end may be Oracle/DB2/SQL/MYSQL.
3. Report should be prepared in a standard format prescribed for project work.
4. All applications must be demonstrated on desktop/laptop as a stand-alone or web based application. (Mobile apps on Android/IOS are not permitted.)

Part A: Lab Experiments			
Expt. No	**Course Content**	**Hours**	**COs**
1	**Consider the following schema for a Library Database:** BOOK (Book_id, Title, Publisher_Name, Pub_Year) BOOK_AUTHORS (Book_id, Author_Name) PUBLISHER (Pub_id,Name, Address, Phone) BOOK_COPIES (Book_id, Branch_id, No-of_Copies) BOOK_LENDING (Book_id, Branch_id, Card_No, Date_Out, Due_Date) LIBRARY_BRANCH (Branch_id, Branch_Name, Address) **Write SQL queries to** i. Create the above tables by properly specifying the primary keys and the foreign keys. ii. Enter at least five tuples for each relation.	**3**	**CO1, CO2, CO3, CO4, CO5**

	iii. Retrieve details of all books in the library – book-id, title, publisher name, authors, number of copies, etc. iv. Get the details of borrowers who have borrowed more than 3 book from Jan 2021 to Jun 2021 v. Demonstrate the DELETE operation by deleting a book details in BOOK table. vi. Partition the BOOK table based on year of publication. Demonstrate its working with a simple query. vii. Create a view of all books and its number of copies that are currently available in the Library.		
2	**Consider the following schema for Order Database:** SALESMAN (Salesman_id, Name, City, Commission) CUSTOMER (Customer_id, Cust_Name, City, Grade, Salesman_id) ORDERS (Ord_No, Purchase_Amt, Ord_Date, Customer_id, Salesman_id) **Write SQL queries to** i. Create the above tables by properly specifying the primary keys and the foreign keys. ii. Enter at least five tuples for each relation. iii. Count the customers with grades above Bangalore's average. iv. Find the name and numbers of all salesmen who had more than one customer. v. List all salesmen and indicate those who have and don't have customers in their cities (Use UNION operation.) vi. Create a view that finds the salesman who has the customer with the highest order of a day. vii. Demonstrate the DELETE operation by removing salesman with id 1000. All his orders must also be deleted.	**3**	**CO1, CO2, CO3, CO4, CO5**
3	**Consider the schema for Movie Database:** ACTOR (Act_id, Act_Name, Act_Gender) DIRECTOR (Dir_id, Dir_Name, Dir_Phone) MOVIES (Mov_id, Mov_Title, Mov_Year, Mov_Lang, Dir_id) MOVIE_CAST (Act_id, Mov_id, Role) RATING (Mov_id, Rev_Stars) **Write SQL queries to** i. Create the above tables by properly specifying the primary keys and the foreign keys. ii. Enter at least five tuples for each relation. iii. List the titles of all movies directed by 'Mr. Dwarakesh'.	**3**	**CO1, CO2, CO3, CO4, CO5**

	iv. Find the movie names where actors acted in two or more movies. v. List all actors who acted in a movie before 2005 and also in a movie after 2015 (use JOIN operation). vi. Find the title of movie and number of stars rated for each movie that has at least one rating and also find the highest number of stars that movie received. Sort the result by movie title. vii. Update rating of all movies directed by 'Lankesh' to 3.		
4	**Consider the schema for College Database:** STUDENT(USN, SName, Address, Phone, Gender) SEMSEC(SSID, Sem, Sec) CLASS(USN, SSID) COURSE(Subcode, Title, Sem, Credits) IAMARKS(USN, Subcode, SSID, Test1, Test2, Test3, FinalIA) **Write SQL queries to** i. List all the student details studying in fourth semester 'C' section. ii. Compute the total number of male and female students in each semester and in each section. iii. Create a view of Test1 marks of student with USN '1DS18IS101' in all Courses. iv. Calculate the FinalIA (average of best two test marks) and update the corresponding table for all students. v. Categorize students based on the following criterion: If FinalIA = 17 to 20 then CAT = 'Outstanding' If FinalIA = 12 to 16 then CAT = 'Average' If FinalIA< 12 then CAT = 'Weak' Give these details only for 8th semester A, B, and C section students.	**3**	**CO1, CO2, CO3, CO4, CO5**
5	**Consider the following database for a banking enterprise** BRANCH(branch-name:string, branch-city:string, assets:real) ACCOUNT(accno:int, branch-name:string, balance:real) DEPOSITOR(customer-name:string, accno:int) CUSTOMER(customer-name:string, customer-street:string, customer-city:string) LOAN(loan-number:int, branch-name:string, amount:real) BORROWER(customer-name:string, loan-number:int) **Write each of the following queries in SQL.**	**3**	**CO1, CO2, CO3, CO4, CO5**

	i. Create the above tables by properly specifying the primary keys and the foreign keys ii. Enter at least five tuples for each relation iii. Find all the customers who have at least two accounts at the *Main* branch. iv. Find all the customers who have an account at *all* the branches located in a specific city. v. Demonstrate how you delete all account tuples at every branch located in a specific city. vi. Find the names of all depositors of a specific branch. vii. Find the details of all loan holders of a specific branch.		
Part B: Mini project			
Each student has to carry out a mini project on the problem identified individually or in a group. For the problem identified : 1) List the set of requirements 2) Design an ER Diagram by identifying the following: i. Entities(Minimum 5) and attributes ii. Relationships and key for each entity iii. Relationship Constraints: Cardinality Ratio and Participation. 3) Draw the Schema Diagram with Referential Integrity Constraints displayed. 4) Normalize the relations up to BCNF or 3rd Normal Form. 5) Create the database. 6) Insert suitable records (at least 5 records for each table) in the database. 7) Execute any two distinctive queries on the database. 8) Create and execute at least one trigger on the database. 9) Create and execute at least one stored procedure on the database. 10) Generate at least one typical report on the database. The code developed during the project will be reviewed by internal faculties during the semester. At the completion of a project the student will submit a project report, which will be evaluated by duly appointed examiner(s).			**CO1, CO2, CO3, CO4, CO5, CO6**

TEXT BOOKS:

1. Fundamentals of Database Systems, Ramez Elmasri and Shamkant B. Navathe, 7th Edition, 2017,Pearson.
2. Database management systems, Ramakrishnan, and Gehrke, 3rd Edition, 2014,McGraw Hill

REFERENCE BOOKS:

1. Silberschatz Korth and Sudharshan, Database System Concepts, 6th Edition, Mc-GrawHill, 2013.
2. Coronel, Morris, and Rob, Database Principles Fundamentals of Design, Implementation and Management, Cengage Learning 2012

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SCHEME OF TEACHING AND EXAMINATION 2018-2019
Department of Information Science and Engineering

COMPUTER NETWORKS AND CYBER SECURITY LABORATORY

Course code: 19IS5DLCNS **Credits: 02**
L: P: T: S: 0: 2: 1: 0 **CIE Marks: 50**
Exam Hours: 03 **SEE Marks: 50**

Course Objectives:

1. To understand the design and implementation of routing concepts
2. To gain insight into flow control and congestion control mechanisms
3. To understand the concept of wired networks using TCP through simulation
4. To understand the concept of wireless networks using UDP through simulation

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

CO1	Implement and analyze networking protocols in NS2
CO2	Implement and use routing protocols.
CO3	Implement cryptographic algorithms like RSA for data communication
CO4	Implement congestion control algorithms like leaky bucket.
CO5	Demonstrate various cyber security concepts like ARP poisioning, man in the middle attack.
CO6	Demonstrate the working of different concepts of networking.

Mapping of Course outcomes to Program outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	-	-	-	-	-	-	-	-	2	-	-	2
CO2	2	3	-	-	-	-	-	-	-	-	-	1	-	2	2
CO3	3	3	2	2	-	-	-	-	-	-	-	2	-	2	2
CO4	3	3	2	2	-	-	-	-	-	-	-	2	-	2	2
CO5	3	3	-	-	-	-	-	-	-	-	-	2	-	2	1
CO6	3	3	-	-	-	-	-	-	-	-	-	2	-	-	1

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SCHEME OF TEACHING AND EXAMINATION 2018-2019
Department of Information Science and Engineering

Description (If any):
For the experiments below modify the topology and parameters set for the experiment, take multiple rounds of reading, and analyze the results available in log files. Plot necessary graphs and conclude. Use NS2/NS3.

Exp. No.	Contents of the experiment	Hours	COs
1.	Implement three nodes point – to – point network with duplex links between them. Set the queue size, vary the bandwidth and find the number of packets dropped.	**3**	**CO1**
2.	Implement transmission of ping messages/trace route over a network topology consisting of 6 nodes and find the number of packets dropped due to congestion.	**3**	**CO1**
3.	Implement an Ethernet LAN using n nodes, set multiple traffic nodes, and plot congestion window for different source / destination.	**3**	**CO1**
4.	Implement simple ESS and with transmitting nodes in wire-less LAN by simulation and determine the performance with respect to transmission of packets.	**3**	**CO1**
5.	Write a program for congestion control using leaky bucket algorithm.	**3**	**CO1, CO5**
6.	Write a program for distance vector algorithm to find suitable path for transmission	**3**	**CO1, CO5**
7.	Write a program for simple RSA algorithm to encrypt and decrypt the data.	**3**	**CO1, CO3 CO4**
8.	Using TCP/IP sockets, write a client – server program to make the client send the file name and to make the server send back the contents of the requested file if present.	**3**	**CO1**
9.	Demonstrate Deauthentication Attack using Kali Linux	**3**	**CO1**
10.	Demonstrate Detection of ARP poisoning using Kali linux	**3**	**CO1, CO3**
11.	Demonstrate Prevention of man in the middle attack using Kali Linux	**3**	**CO1, CO4 CO5**
12.	Write a program to illustrate buffer overflow attack.	**3**	**CO1, CO4 CO6**

TEXT BOOKS:

1. Communication Networks – Fundamental Concepts & key architectures, Alberto Leon Garcia &Indra Widjaja, 2nd Edition, Tata McGraw-Hill, India
2. Computer & Communication Networks, Nadir F Mir, Pearson Education, India
3. Sunit Belapure and Nina Godbole, "Cyber Security: Understanding Cyber Crimes, Computer Forensics And Legal Perspectives", Wiley India Pvt Ltd, ISBN: 978-81-265-21791, 2013.
4. Kali Linux Revealed – Mastering the Penetration Testing Distribution, Administrator's ***Handbook***, Raphaël Hertzog is the Debian guru in the Kali team.
5. Hacking With Kali Linux: A Comprehensive, Step-By-Step Beginner's Guide to Learn Ethical Hacking With Practical Examples to Computer Hacking, Wireless Network, Cybersecurity and Penetration Testing Kindle Edition, by Peter Bradley .

REFERENCE BOOKS:

1. Behrouz A. Forouzan: Data Communications and Networking, 4th Edition, Tata McGraw-Hill, 2006.
2. William Stallings: Data and Computer Communication, 8th Edition, Pearson Education, 2007.
3. Larry L Peterson and Bruce S Davie: Computer Networks – A Systems Approach, 4th Edition, Elsevier, 2007.
4. Wayne Tomasi: Introduction to Data Communications and Networking, Pearson Education, 2005.

Assessment Pattern:

CIE –Continuous Internal Evaluation Lab (50 Marks)

Continual Internal Evaluation Marks (25)	IA Test Marks (25)	Final Marks (50)

SEE –Semester End Examination Theory (50 Marks)

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SCHEME OF TEACHING AND EXAMINATION 2018-2019
Department of Information Science and Engineering

DevOps

Course code: 19IS5DCEMT **Credits: 02**
L: P: T: S: 2:0:0: 0 **CIE Marks: 50**

Course objectives:

To understand the basic ideas and principles of DevOps

1. Understand the challenges in Software Engg and Continuous Integration and Continuous Delivery
2. To understand how DevOps is applied and used in Software Development cycle.
3. To understand how DevOps can be applied in testing phase of SDLC.
4. To understand the DevOps tools used in each phase of software development activity.
5. To appreciate the use of DevOps post software development and deployment

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

CO1	Understand the Software Engg process, and challenges
CO2	Understand the DevOps
CO3	Understand application of DevOps in Software Development activity
CO4	Understand application of DevOps in Software Testing and Validation activity
CO5	Understand Tools used in SDLC phases
CO6	Build familiarity of application of DevOps in Software Deployment phase

Mapping of Course outcomes to Program outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	-	3	-	-	-	-	-	-	-	-	-	-
CO2	3	2	2	-	3	-	-	-	-	-	-	-	-	-	-
CO3	3	2	2	-	3	-	-	-	-	-	-	-	-	-	-
CO4	3	2	2	-	3	-	-	-	-	-	-	-	-	-	1
CO5	3	2	2	-	3	-	-	-	-	-	-	-	-	-	1
CO6	3	2	2	-	3	-	-	-	-	-	-	-	-	-	1

Module	Contents of the Unit	Hours	COs
1.	**Introduction to DevOps and Continuous Delivery**: Introducing DevOps, how fast is fast? The Agile wheel of wheels, Beware the cargo cult Agile fallacy. **A View from Orbit:** The DevOps process and Continuous Delivery, Release management, Scrum, Kanban, and the delivery pipeline, wrapping up – a complete example, Identifying bottlenecks	**08**	**CO1 & CO2**
2.	**Everything is Code**: The need for source code control, The history of source code management, Roles and code, Which source code management system?, A word about source code management system migrations, Choosing a branching strategy, Branching problem areas, Artifact version naming. Choosing a client, Setting up a basic Git server, Shared authentication, Hosted Git servers.	**08**	**CO1, CO2 & CO5**
3.	**Building the Code**: Why do we build code?, The many faces of build systems, The Jenkins build server, Managing build dependencies, The final artifact, Continuous Integration, Continuous Delivery, Jenkins plugins, The host server, Build slaves, Software on the host, Triggers. Job chaining and build pipelines, A look at the Jenkins filesystem layout, Build servers and infrastructure as code, Build phases, Alternative build servers, Collating quality measures, About build status visualization, Taking build errors seriously	**08**	**CO3 & CO5**

4.	**Testing the Code** : Manual testing, Pros and cons with test automation, Unit testing, JUnit in general and JUnit in particular, A JUnit example, Mocking, Test Coverage, Automated integration testing, Performance testing, Automated acceptance testing, Automated GUI testing, JavaScript testing, Testing backend integration points, A complete test automation scenario	**08**	**CO4 & CO5**
5.	**Deploying the Code:** Why are there so many deployment systems?, Virtualization stacks, Executing code on the client, The Puppet master and Puppet agents, Cloud solutions, AWS, Azure.	**08**	**CO5 & CO6**

Note: 1. Questions for CIE and SEE not to be set from self-study component.

TEXT BOOK:

1. Joakum Verona, "Practical DevOps", Packt Publishing Limited, 2016

REFERENCE BOOKS:

1. Jennifer Davis, Ryn Daniels, "Effective DevOps", O'reilly Publications, 2016.

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SCHEME OF TEACHING AND EXAMINATION 2018-2019

Department of Information Science and Engineering

VI SEMESTER

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SCHEME OF TEACHING AND EXAMINATION 2018-2019
Department of Information Science and Engineering

SOFTWARE ENGINEERING

Course code: 19IS6DCSFE **Credits: 04**
L: P: T: S: 4:0:0:1 **CIE Marks: 50**
Exam Hours: 03 **SEE Marks: 50**
Total Hours: 50

Course objectives:

1. To understand the significance of software engineering principles and methodologies for the development of software projects.
2. To analyze and apply the different process models for various types of software applications.
3. To develop qualitative software projects within project constraints in order to attain sustainability in software projects

Course Outcomes: At the end of the course, student will be able to:

CO1	Apply software engineering principles and methodologies for all projects which will be developed.
CO2	Design and apply appropriate process models depending on the application requirement.
CO3	Develop projects qualitatively within the project constraints.
CO4	Comprehend, analyze and develop projects with people and process management.
CO5	Demonstrate comprehensive knowledge of software testing principles
CO6	Comprehend the basics of Ethics and principles in Information Technology

Mapping of Course outcomes to Program outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PSO2	PSO3
CO1	3	2	-	-	-	1	-	1	-	-	-	2	-	-	1
CO2	3	2	-	-	-	2	-	2	-	-	-	1	-	1	1
CO3	3	2	-	-	-	2	-	1	-	-	-	1	-	3	1
CO4	2	1	-	-	-	-	-	-	-	-	-	1	-	-	1
CO5	3	2	-	-	-	-	-	-	-	-	-	1	-	3	1
CO6	3	2	-	-	-	-	-	3	-	-	1	3	-	1	1

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SCHEME OF TEACHING AND EXAMINATION 2018-2019
Department of Information Science and Engineering

Module	Course Content	Hours	COs
1	**Introduction:** software engineering and its significance**,** Professional and ethical responsibility**,** System engineering, Organizations, people and computer systems, Legacy systems**. Software Requirements**: Software requirements: Functional and Non-functional requirements, User requirements, System requirements, Interface specification, The software requirements document, Software Requirements Specifications, Request for Proposal **Requirements engineering process**: Feasibility studies, Requirements elicitation and analysis, Requirements validation, Requirements management, Requirements Traceability Matrix.	**10**	**CO1**
2	**Software Process Models:** The waterfall model, Evolutionary development model, spiral model, component-based software engineering, Process iteration, process activities, Rational Unified Process Agile methods, Extreme programming, Rapid application development and software prototyping, scrum.	**10**	**CO1, CO2**
3	**Design and Development**: Architectural design decisions, system organization, modular decomposition styles, control styles. User Interface design: Design issues, UI design process, user analysis, user interface prototyping and evaluation, UML and Design patterns.	**10**	**CO3, CO4, CO5**
4	**Verification and Validation**: Fundamentals of Software Testing, Types of Testing, Levels of Testing, Software Testing Lifecycle. **Verification and Validation:** Planning; Software inspections; Automated static analysis; Verification and formal methods. **Software testing:** System testing; Component testing; Test case design	**8**	**CO4, CO5**
5	**Management:** Managing People: Selecting staff; Motivating people; Managing people; The People Capability Maturity Model. Software Cost Estimation: Productivity, Algorithmic cost modelling, Project duration and staffing. **An Overview of Ethics:** What Is Ethics?, Definition of Ethics, The Importance of Integrity, The Difference Between Morals, Ethics, and Laws, Ethics in the Business World ,Corporate Social Responsibility, Why Fostering Corporate Social Responsibility and Good Business Ethics Is Important, Improving Corporate Ethics, Creating an Ethical Work Environment, Including Ethical Considerations in Decision Making, Ethics in Information Technology	**12**	**CO6**

Self-study component:

Note:

1. **Questions for CIE and SEE not to be set from self-study component.**
2. **Assignment Questions should be from self-study component only.**

UNIT 1: Safety critical system, availability and reliability, dependability
UNIT 2: CASE tools
UNIT 3: Behavioral models and object-oriented design process
UNIT 4: Fault-Based Testing, Flow testing, Test cases for the triangle problem and commission problem
UNIT 5: Intellectual Property, the Impact of Information Technology on Productivity and Quality of Life, Ethics of IT Organizations, Ethics for IT Workers and IT Users

TEXT BOOKS:

1. Ian Sommerville: Software Engineering, 8th Edition, Pearson Education, 2007. (Chap 1-1.2, 2, 4, 6, 7, 11, 16 and 17)
2. Paul C. Jorgensen: Software Testing, A Craftsman's Approach, 3rd Edition, Auerbach Publications, 2008. (Chap 1, 2)
3. George W. Reynolds, Ethics in Information Technology, 5th Edition, Strayer University, Cengage Learning, ISBN-13: 978-1-285-19715-9 (Chap 1,2)

REFERENCE BOOKS:

1. Software Engineering: A Practitioners Approach by Rogers S Pressman, 7 editions, McGrawHill, 2007.
2. Aditya P Mathur: Foundations of Software Testing, Pearson Education, 2008.
3. Mauro Pezze, Michal Young: Software Testing and Analysis – Process, Principles and Techniques, Wiley India, 2008.

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SCHEME OF TEACHING AND EXAMINATION 2018-2019

Department of Information Science and Engineering

Assessment Pattern:

CIE –Continuous Internal Evaluation Theory (50 Marks)

Bloom's Category	Tests	Assignments	AAT1	AAT2
Marks (Out of 50)	**30**	**10**	**05**	**05**
Remember	10			01
Understand	08	05	01	01
Apply	07	05	02	01
Analyze	05		02	
Evaluate				
Create				02

AAT 1– Alternate Assessment Tool 1: Quiz
AAT 2 - Alternate Assessment Tool 2: Surprise Test

SEE –Semester End Examination Theory (50 Marks)

Bloom's Category	Marks Theory (50)
Remember	05
Understand	10
Apply	10
Analyze	10
Evaluate	10
Create	05

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ISO 9001:2008 Certified
CHOICE BASED CREDIT SYSTEM (CBCS)
SCHEME OF TEACHING AND EXAMINATION 2018-2019
Department of Information Science and Engineering

ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Course code: 19IS6DCAML **Credits: 03**
L: P: T: S: 3:0:0: 0 **CIE Marks: 50**
Exam Hours: 03 **SEE Marks: 50**
Total Hours: 40

Course objectives:

1. Comprehend the fundamentals of Artificial Intelligence and apply logic for knowledge representation.
2. To develop an understanding of different machine learning techniques and its application
3. To develop the design and programming skills that will help you to build intelligent machines
4. To learn basic concepts of deep learning methods

Course Outcomes: At the end of the course, student will be able to:

CO1	Comprehend the working of intelligent agents and their working environments
CO2	Make use of logic to represent knowledge for reasoning of AI.
CO3	Analyze concept learning and Bayes decision theory
CO4	Ability to preprocess, analyze and apply classification techniques for the dataset
CO5	Evaluate and select suitable clustering technique for problem solving.
CO6	Ability to analyze the performance of neural networks.

Mapping of Course outcomes to Program outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	2	-	-	-	-	-	-	-	-	-	2	-	-
CO4	3	2	2	-	-	-	-	-	-	-	-	-	2	-	-
CO5	3	2	2	-	-	-	-	-	-	-	-	-	2	-	-
CO6	3	2	2	2	-	-	-	-	-	-	-	-	2	-	-

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CHOICE BASED CREDIT SYSTEM (CBCS)
SCHEME OF TEACHING AND EXAMINATION 2018-2019
Department of Information Science and Engineering

Module	Contents of the Unit	Hours	COs
1	**Introduction:** Introduction: What is AI? Differences between AI & ML, Differences between ML & Data Science, Intelligent Agents: Agents and environment; Rationality; the nature of environment; the structure of agents. Logical Agents: Knowledge-based agents; The wumpus world as an example world. First-Order Logic: Inference in First-Order Logic – 1, Representation revisited; Syntax and semantics of first-order logic; Using first-order logic.	**8**	**CO1, 2**
2	**Linear Regression:** Simple Linear Regression: Estimating the Coefficients, Assessing the Accuracy of the Coefficient Estimates, Multiple Linear Regression: Estimating the Regression Coefficients. **Concept Learning:** Concept learning task, Concept learning as search, Find-S algorithm, Version space, Candidate Elimination algorithm.	**8**	**CO3**
3	**Bayesian Learning:** Introduction, Bayes theorem, Naive Bayes classifier. **Dimensionality Reduction**: Subset Selection, Principal Components Analysis. **Nonparametric Methods:** Nonparametric Density Estimation, Generalization to Multivariate Data.	**8**	**CO3, 4**
4	**Clustering**: Mixture densities, K-means clustering, Expectation maximization algorithm, Mixtures of Latent Variable models, Supervised Learning after clustering, Hierarchical clustering, Choosing the number of clusters, **Decision Trees:** Univariate trees, Pruning, Rule extraction from trees, Learning rule from data, Multivariate trees.	**8**	**CO5**
5	**Multilayer Perceptrons:** The Perceptron, Training a Perceptron, Multilayer Perceptron's, Back propagation Algorithm, Training Procedures, Introduction to Deep Learning: Convolutional neural networks (CNN), Recursive (Recurrent) Neural Networks (RNN).	**8**	**CO6**

Self-study component:

1. Logistic regression
2. Super vector machine
3. Spectral Clustering

4. Bayesian Belief Network
5. Reinforcement Learning

Note:

1. Questions for CIE and SEE not to be set from self-study component.
2. Assignment Questions should be from self-study component only.

TEXT BOOKS:

1. Tom M. Mitchell, "Machine Learning", McGraw-Hill Education (INDIAN EDITION), Stuart Russel, Peter Norvig: Artificial Intelligence A Modern Approach, 3rd Edition, Pearson Education, 2003.
2. EthemAlpaydın: Introduction to Machine Learning, 2nd Edition, The MIT Press Cambridge, Massachusetts London, England, 2010.
3. 2018
4. Nikhil Ketkar: Deep Learning with Python: A Hands-on Introduction, the Apress 2017.

REFERENCE BOOKS:

1. An Introduction to Statistical Learning, with Applications in R (2013), by G.James, D. Witten, T. Hastie, and R. Tibshirani.
2. https://towardsdatascience.com/notes-on-artificial-intelligence-ai-machine-learning-ml-and-deep-learning-dl-for-56e51a2071c2

Assessment Pattern:

CIE –Continuous Internal Evaluation Theory (50 Marks)
SEE –Semester End Examination Theory (50 Marks)
CIE=30 marks
Assignment=10 marks
AAT=10 Marks

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SCHEME OF TEACHING AND EXAMINATION 2018-2019
Department of Information Science and Engineering

JAVA AND J2EE

Course code: 19IS6DCJVA **L: P: T: S: 3:0:0:0**
Exam Hours: 03 **Total Hours: 40**
Credits: 03 **CIE Marks: 50**
SEE Marks: 50

Course objectives:

1. To provide an introduction to java and object oriented concepts of java programming.
2. Understand the use and creation of packages and interfaces.
3. Analyze and use exception handling, event handling in java.
4. Create web applications using Servlets and JSP.

Course Outcomes: At the end of the course, student will be able to:

CO1	Express classes, its members and the relationships among them needed for a specific problem.
CO2	Apply the basic concepts of object oriented programming in writing java programs.
CO3	Create and use packages and interfaces in Java programs.
CO4	Analyze and implement exception handling in Java.
CO5	Develop graphical user interface using swings.
CO6	Construct web applications using Servlets and JSP.

Mapping of Course outcomes to Program outcomes:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	1	-	-	-	-	-	-	-	-	1	2	1	-
CO2	3	2	2	-	-	-	-	-	-	-	-	1	3	2	-
CO3	3	2	2	-	-	-	-	-	-	-	-	1	3	1	-
CO4	2	2	1	-	-	-	-	-	-	-	-	1	3	1	1
CO5	2	2	2	-	-	-	-	-	-	-	-	1	3	1	1
CO6	3	2	2	-	-	-	-	-	-	-	-	1	3	2	2

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NAAC Accredited with A Grade
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CHOICE BASED CREDIT SYSTEM (CBCS)
SCHEME OF TEACHING AND EXAMINATION 2018-2019
Department of Information Science and Engineering

Module	Content of the Unit	Hours	COs
1.	**Introduction to Java**: The Creation of Java,Java's Magic: TheBytecode, The Java Buzzwords, Object-Oriented Programming, A First Simple Program, Type Conversion and Casting, Automatic Type Promotion in Expressions, Arrays. **Introducing Classes**: Class Fundamentals, Declaring Objects, Assigning Object Reference Variables, Introducing Methods, Constructors, The this Keyword, The finalize( )Method.	**07**	**CO1 & CO2**
2.	**A Closer Look at Methods and Classes**: Overloading Methods, Using Objects as Parameters, Returning Objects, Introducing Access Control, Understanding static,, Introducing Nested and Inner Classes, Using Command-Line Arguments, Varargs: Variable-Length Arguments. **Inheritance**: Inheritance Basics, Using super, Creating a Multilevel Hierarchy, When Constructors Are Called, Method Overriding, Dynamic Method Dispatch, Using Abstract Classes, Introducing final,Using final with Inheritance.	**08**	**CO1 & CO2**
3.	**Packages and Interfaces**: Packages, Access Protection, Importing Packages, Interfaces.**Exception Handling**: Exception-Handling Fundamentals, Exception Types, Using try and catch, throw, throws,finally, Java's Built-in Exceptions, Creating Your Own Exception Subclasses.**Multithreaded Programming**: The Java ThreadModel,Creating a Thread, Creating Multiple Threads,Synchronization,Suspending, Resuming, and Stopping Threads.	**08**	**CO2, CO3&CO 4**
4.	**Event Handling**: The Delegation Event Model, Event Classes, Sources of Events, Event Listener Interfaces, Using the Delegation Event Model, Adapter Classes, Inner Classes. **Introducing Swing**: Two Key Swing Features, Components and Containers, The Swing Packages, A Simple SwingApplication. **Java 2 Enterprise Edition Overview:**Overview of J2EE and J2SE; J2EE Multitier architecture.	**9**	**CO2 & CO5**

5.	**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; **Servlets:**Background; The Life Cycle of a Servlet; 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.**JSP:**Java Server Pages (JSP): JSP, JSP Tags, Request String, Cookies, Session Objects.	**08**	**CO2 & CO6**

Self-study component:

Note: 1.Questions for CIE and SEE not to be set from self-study component.

2. Assignment Questions should be from self-study component only. UNIT 1: Garbage Collection.

UNIT 2: The Object Class ,java.lang package

UNIT 3:java.io

UNIT 4: Using valueOf(), StringBuffer, StringBuilder, java collection framework

UNIT 5: Tomcat Apache server installation and execution

TEXT BOOKS:

1. The Complete Reference - Java: Herbert Schildt, 7th Edition, McGraw Hill,2017.
2. Jim Keogh: J2EE - The Complete Reference, Tata McGraw Hill,2007.

REFERENCE BOOKS:

1. Y. Daniel Liang: Introduction to JAVA Programming, 10th Edition, Pearson Education,2015.
2. Herbert Schildt:JavaThe Complete Reference, 7th Edition, Tata McGraw Hill,2007.
3. Stephanie Bodoff et al: The J2EE Tutorial, 2nd Edition, Pearson Education,2004.

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SCHEME OF TEACHING AND EXAMINATION 2018-2019
Department of Information Science and Engineering

DIGITAL IMAGE PROCESSING

Course code: 19IS6DEDIP | **Credits: 03**
L: P: T: S: 3:0:0:0 | **CIE Marks: 50**
Exam Hours: 03 | **SEE Marks: 50**
Total Hours: 40

Course objectives:

1. To understand the image fundamentals and transforms necessary for image processing.
2. To study the image enhancement techniques
3. To appreciate the image representation, segmentation and compression techniques.
4. To recognize the use of colour models

Course Outcomes: At the end of the course, student will be able to:

CO1	Understand the essential concepts of digital image processing system
CO2	Interpret the image processing techniques in the spatial and frequency domains
CO3	Analyze the concepts of different image enhancement techniques
CO4	Identify and Analyze the image in the presence of noise
CO5	Examine the principles of colour image processing , Compression,
CO6	Apply the various segmentation algorithms for different problems

Mapping of Course outcomes to Program outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	2	-	-	-	-	-	-	-	-	-	2	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO6	3	2	2	-	-	-	-	-	-	-	-	-	2	-	-

Unit.	Content of the Unit	Hours	COs
1.	**Introduction:** What is Digital Image Processing, Fundamental Steps in Digital Image Processing; Components of an Image Processing System.	**08**	**CO1**

	Digital Image Fundamentals: A Simple Image Formation Model, Basic Concepts in Sampling and Quantization, Representing Digital Images, Spatial and intensity Resolution, image interpolation, Digital Images, Some Basic Relationships Between Pixels.		
2.	**Intensity Transformations and Spatial Filtering :** Some Basic Intensity Transformation Functions, Histogram Processing: Histogram equalization, Histogram Matching, Using Histogram statistics for Image Enhancement, fundamentals of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters.	**08**	**CO2 &CO3**
3.	**Filtering in Frequency Domain:** The Basics of Filtering in the Frequency Domain, Image smoothing using frequency domain filters, Image Sharpening Using Low pass Frequency Domain Filters, Image Sharpening Using High pass Frequency Domain Filters.	**08**	**CO2 &CO3**
4.	**Image Restoration:** A Model of the Image degradation/Restoration process, Noise Models, Restoration in the Presence of Noise Only–Spatial Filtering. **Image Compression:** Fundamentals: Coding Redundancy Spatial and Temporal Redundancy Irrelevant Information Measuring Image Information Fidelity Criteria, Image Compression Models	**08**	**CO4 &CO5**
5.	**Color Image Processing:** Color Fundamentals**;** Color Models, **Image Segmentation:** Point, Line, and Edge Detection, Thresholding, Segmentation by region growing and by region splitting and merging.**Morphological Image processing**: Erosion and dilation , opening and closing and Hit or miss Transform	**08**	**CO5 & CO6**

Self-study component:

Note: 1.Questions for CIE and SEE not to be set from self-study component.

2. Assignment Questions should be from self-study component only.

UNIT 1: Examples of fields that use DIP, Linear and Nonlinear Operations

UNIT 2: Combining Spatial Enhancement Methods

UNIT 3: Wavelets

UNIT 4: Estimating the Degradation Function, Inverse Filtering

UNIT5: Pseudocolor image processing, Color Segmentation, Color Image Compression

TEXT BOOK

1. Digital Image Processing, Rafael C Gonzalez and Richard E. Woods, Pearson 4th Edition @2018

REFERENCES:

1. Fundamentals of Digital Image Processing, A. K. Jain, Pearson, 2004.

2. Digital Image Processing and Analysis, Scott.E.Umbaugh, CRC Press, 2014.

3. Digital Image Processing ,S.Jayaraman, S.Esakkirajan, T.Veerakumar, McGraw Hill, 2013.

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SCHEME OF TEACHING AND EXAMINATION 2018-2019
Department of Information Science and Engineering

UNIX SYSTEM PROGRAMMING

Course code: 19IS6DEUSP **Credits: 03**
L: P: T: S: 3: 0: 0: 0 **CIE Marks: 50**
Exam Hours: 03 **SEE Marks: 50**
Total Hours: 40

Course Objectives:

1. To gain ample understanding of UNIX operating system and its usage.
2. To gain comprehensive knowledge about UNIX architecture.
3. To understand the design principles and significance of UNIX files and processes.
4. To know the basic concepts of Signals and Inter process communication in UNIX.

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

CO1	Analyze and understand the basics and usage of UNIX operating system and Linux kernel.
CO2	Analyze the architecture and apply the various commands of UNIX operating system.
CO3	Outline the features of UNIX files and apply the different APIs for the usage of the same.
CO4	Demonstrate comprehensive knowledge of UNIX processes.
CO5	Summarize the various features of UNIX processes and the various APIs used for the same.
CO6	Summarize the Daemon processes and Inter process communication in UNIX.

Mapping of Course outcomes to Program outcomes:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	3	3	-	3	-	-	-	2	-	-
CO2	3	3	3	-	2	3	-	-	2	-	-	-
CO3	3	3	3	-	-	3	-	-	2	-	-	-
CO4	3	3	3	-	-	-	3	-	3	-	-	-
CO5	3	3	3	-	-	-	3	-	-	2	-	-
CO6	3	3	3	-	-	-	3	-	-	-	-	-

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SCHEME OF TEACHING AND EXAMINATION 2018-2019

Department of Information Science and Engineering

Module	Course Content	Hours	COs
1	**UNIX Operating System:** The Unix Operating System, The UNIX architecture and Command Usage, The File System, Handling Ordinary files, Basic File Attributes, the vi Editor, The Shell, The Process, Essential Shell Programming. **UNIX Standards:** ANSI C Standards, ANSI/ISO C++ standards, Difference between ANSI C and C++, The POSIX Standards **Introduction to the Linux Kernel:** Overview of Operating Systems and Kernels, Linux Versus Classic Unix Kernels, Linux Kernel Versions, The Linux Kernel Development Community.	08	CO1 CO2
2	**UNIX Files:** File Types, The UNIX and POSIX File System, File Attributes, Inodes in UNIX System V, Application Program Interface to Files, UNIX Kernel Support for Files, Relationship of C Stream Pointers and File Descriptors, Directory Files, Hard and Symbolic Links. **UNIX File APIs:** General File APIs, File and Record Locking.	08	CO1 CO3
3	**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.	08	CO1 CO4
4	**Process Control:** Introduction, Process Identifiers, fork, vfork, exit, wait, waitpid, wait3, wait4 Functions, Race Conditions, exec Functions, Changing User IDs and Group IDs, Interpreter Files, system Function, Process Accounting, User Identification, Process Times, I/O Redirection. **Process Relationships:** Introduction, Terminal Logins, Network Logins, Process Groups, Sessions, Controlling Terminal, tcgetpgrp and tcsetpgrp Functions, Job Control, Shell Execution of Programs, Orphaned Process Groups.	08	CO1 CO5
5	**Signals:** The UNIX Kernel Support for Signals, signal, Signal Mask, sigaction, The SIGCHLD Signal and the waitpid Function, The sigsetjmp and siglongjmp Functions, Kill, Alarm, Interval Timers, Timers. **Daemon Processes:** Introduction, Daemon Characteristics, Coding Rules, Error Logging, Client-Server Model. **Inter process Communication:** Overview of IPC Methods, Pipes, popen, pclose Functions, Coprocesses, FIFOs, System V IPC, Message Queues.	08	CO1 CO6

Self-study component:

UNIT 2: Directory File APIs, Device File APIs, FIFO File APIs, Symbolic Link File APIs, General File Class, regfile Class for Regular Files, dirfile Class for Directory Files, FIFO File Class, Device File Class, Symbolic Link File Class, File Listing Program.

UNIT 5: Semaphores, Shared Memory, Client-Server Properties, Stream Pipes, Passing File Descriptors, An Open Server-Version 1, Client-Server Connection Functions.

Assignment:

1. Write a shell script program to display list of user currently logged in.
2. Write a shell script program to display "HELLO WORLD".
3. Write a shell script program to develop a scientific calculator.
4. Write a shell Script program to check whether the given number is even or odd.
5. Shell script Program to search whether element is present is in the list or not.
6. Shell script program to check whether given file is a directory or not, count number of files in a director, copy contents of one file to another.
7. Write a shell script program to display the process attributes, change the priority of processes and change the ownership of processes.
8. Write a program to create a child process and allow the parent to display "parent" and the child to display "child" on the screen.
9. a) Write a program to send back a process from foreground.
   b) Write a program to retrieve a process from background.
10. Write a C program to create a file with 16 bytes of arbitrary data from the beginning and another 16 bytes of arbitrary data from an offset of 48. Display the file contents to demonstrate how the hole in file is handled.

Note:

1. Questions for CIE and SEE not to be set from self-study component.

2. Assignment Questions should be from self-study component only.

TEXT BOOKS

1. Sumitabha Das: UNIX – Concepts and Applications, 4th edition, Tata McGraw Hill.
2. Terrence Chan: UNIX System Programming Using C++, Prentice Hall India. (Chapters 1, 5, 6, 7, 8, 9, 10)
3. W. Richard Stevens: Advanced Programming in the UNIX Environment, 2nd Edition, Pearson Education. (Chapters 7, 8, 9, 13, 14, 15)
4. Robert Love: Linux Kernel Development; Pearson Education; 3rd Edition; 2010, ISBN-8131758182

REFERENCE BOOKS

1. Marc J. Rochkind: Advanced UNIX Programming, 2nd Edition, Pearson Education, 2005.
2. Maurice J Bach: The Design of the UNIX Operating System, Pearson Education, 1987.
3. UreshVahalia: UNIX Internals: The New Frontiers, Pearson Education, 2001.
4. M. Beck et.al; Linux Kernel Programming; Pearson Education; 3rd Edition; 2002, ISBN-110-201-71975-4.

Assessment Pattern:

CIE –Continuous Internal Evaluation Theory (50 Marks)

Bloom's Category	**Tests**	**Assignments**	**AAT1**	**AAT2**
Marks (Out of 50)	**30**	**10**	**05**	**05**
Remember	08	--	02	01
Understand	08	--	01	01
Apply	02	05	--	01
Analyze	05	05	02	02
Evaluate	05			
Create	02			

***AAT 1– Alternate Assessment Tool 1: Quiz**
AAT 2 - Alternate Assessment Tool 2: Open Book Test

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SCHEME OF TEACHING AND EXAMINATION 2018-2019
Department of Information Science and Engineering

SEE –Semester End Examination Theory (50 Marks)

Bloom's Category	**Marks Theory (50)**
Remember	10
Understand	10
Apply	10
Analyze	10
Evaluate	08
Create	02

*AAT 1– Alternate Assessment Tool 1: Quiz
AAT 2 - Alternate Assessment Tool 2: Open Book Test

SEE –Semester End Examination Theory (50 Marks)

Bloom's Category	**Marks Theory (50)**
Remember	10
Understand	10
Apply	10
Analyze	10
Evaluate	08
Create	02

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5G AND INTERNET OF THINGS

Sub Code: 19IS6DEIOT	CIE:50
hrs/ Week: 03	SEE:50
Total hrs: 40	Exam Hours: 03

Course objectives:

1. To understand fundamentals and architecture of internet of things.
2. To understand the significance of Software Engineering in IOT
3. Wireless connectivity design principles for IoT devices,
4. To know IoT security, threats and vulnerabilities
5. To understand various sensors, data acquisition and wireless networks

Course Outcomes: At the end of the course, student will be able to:

CO1	Understand the working and properties of IoT devices and its application.
CO2	Develop web based applications to access/control IoT devices using 5G technology
CO3	Analyze applications of IoT in real time scenario.
CO4	Analyze the security aspects and approaches to overcome the vulnerabilities of IoT.
CO5	Apply the latest computing technologies like cloud computing to communicate between M2M
CO6	Interfacing IoT with sensors to design simple applications

Mapping of Course outcomes to Program outcomes:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	2	2	1	0	0	0	0	0	1	1	1
CO2	2	1	2	1	0	0	0	0	0	1	1	1
CO3	2	2	2	1	1	0	0	0	1	2	1	2
CO4	3	2	3	1	2	1	0	0	2	2	2	3
CO5	3	3	3	2	3	2	2	0	2	2	2	2
CO6	2	2	2	0	0	0	0	0	0	0	0	0

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Module	Contents of the Module	Hours	COs
1.	**Wireless Connectivity Technology Options:** LTE - Introduction to LTE Architecture and protocol, LTE - Advance, 5G : General introduction and IoT specific features Communication, M2M and IoT World Forum standardized architecture	**08**	**CO1**
2.	**Software Engineering:** Software Development Life Cycle , Software Testing **WIFI :** WIFI Technology	**08**	**CO2**
3.	**IoT : Introduction and end to end architecture:** LoRA & SigFox, WIFI, ZigBee, GSMR , Cellular IoT- 1, Cellular IoT-2 **Security** : Security in IOT	**08**	**CO3, CO4**
4.	**Cloud and IoT Platforms:** Cloud and Virtualization: Kubernetics and Dockers **Cloud, Virtualization, Analytics):** Analytics: Tool and Technologies and IoT use case , Application and Analytics layer, Key design consideration	**08**	**CO5, CO3**
5.	**Sensors, Participatory Sensing, RFID's and Wireless Sensor Networks** : Introduction, Sensor Technology, Actuators, Sensor Data Communication Protocols, Radio Frequency Identification Technology, Wireless Sensor Networks Technology	**08**	**CO6**

Lecture Series Delivered by Nokia
Modules: 1, 2, 3 and 4

TEXT BOOKS:

1. Raj Kamal, "Internet of Things: Architecture and Design Principles", 1st Edition, McGrawHill Education, 2017. (ISBN: 978-9352605224). Chapters: 1, 2, 3, 4,7, 10
2. Internet of Things - A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti,Universities Press, 2015, ISBN: 9788173719547.
3. Practical Internet of Things Security by Brian Russel and Drew Van Duren;

PACKTpublishing, 2016

4. Designing the Internet of Things by Adrian McEwen and Hakim Cassimally, Wileypublication, 2014
5. Security of Things –An implementers guide to Cyber-Security for Internet of Things,Ollie Lighthouse, NCC Group, 2014.
6. Handbook of Modern Sensors – Physics, Designs and Applications; by Jacob Fraden;Springer publication, 3rd edition
7. Ad Hoc and Sensor Networks – Theory and Applications, Carlos Corderio DharmaP.Aggarwal, World Scientific Publications / Cambridge University Press, March 2006
8. Adaptive Security for the Internet of Things, H Abie, Elsevier, 2015.
9. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly(SPD), 2014, ISBN: 9789350239759.
10. NETWORKING PROTOCOLS AND STANDARDS FOR INTERNET OF THINGS By Tara Salman and Raj Jain; https://www.cse.wustl.edu/~jain/cse570-15/ftp/iot_prot.pdf

Self Study Components:

1. Data Acquiring, organizing, Processing and Analytics
2. Data Collection, Storage and Computing Using a Cloud Platform
3. Business Models and Processes using IoT
4. IOT case studies

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SCHEME OF TEACHING AND EXAMINATION 2018-2019
Department of Information Science and Engineering

USER INTERFACE DESIGN

Course code: 19IS5DEUID **Credits: 03**
L: P: T: S: 3:0:0: 0 **CIE Marks: 50**
Exam Hours: 03 **SEE Marks: 50**
Total Hours: 40

Course objectives:

1. To understand the importance of UI in Software development
2. To study the characteristics of Graphics and Web User Interfaces
3. To study the components of UI – Menus, Windows, Lists
4. To understand the screen based controls
5. To study about various problems in windows design with colour, text, graphics.
6. To study the UI testing methods

Course Outcomes: At the end of the course, student will be able to:

CO1	Understand the need and importance of UID in software Development process
CO2	Study the characteristics of Graphics and Web User interfaces
CO3	Design the user interface, menu creation and windows creation and connection between menu and windows
CO4	Understand screen based controls
CO5	Learn aspects of internationalization, multimedia and coloring in UI
CO6	Learn UI testing methods

Mapping of Course outcomes to Program outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-	-	-	-	-	-	-	2	-	-	-	-	-
CO2	2	3	-	-	-	-	-	-	-	2	-	-	-	-	-
CO3	-	2	3	2	-	-	-	-	-	2	-	-	-	-	3
CO4	-	2	3	2	-	-	-	-	-	2	-	-	-	-	3
CO5	-	2	3	-	-	-	-	-	-	2	-	-	-	-	3
CO6	-	3	3	-	-	-	-	-	-	2	-	-	-	-	3

Module	Contents of the Module	Hours	COs
1	Introduction-Importance-Human-Computer interface-characteristics of graphics interface-Direct manipulation graphical system - web user interface-popularity characteristic & principles.	**08**	**CO1** **CO2**
2	User interface design process- obstacles-usability-human characteristics in design - Human interaction speed-business functions-requirement analysis-Direct- Indirect methods-basic business functions-Design standards-system timings Human consideration in screen design - structures of menus - functions of menus-contents of menu-formatting -phrasing the menu - selecting menu choice navigating menus-graphical menus.	**08**	**CO5** **CO3** **CO6**
3	Windows: Characteristics-components-presentation styles-types-managements organizations- operations-web systems-device-based controls: characteristics- Screen -based controls: operate control - text boxes-selection control combination control-custom control-presentation control.	**08**	**CO4** **CO3**
4	Text for web pages - effective feedback-guidance & assistance-Internationalization-accessibility -Icons-Image-Multimedia-coloring.	**08**	**CO2** **CO5**
5	Windows layout-test: prototypes - kinds of tests – retest-Information search - visualization - Hypermedia - www - Software tools.	**08**	**CO2** **CO6**

Self-study component:

Note: 1. Questions for CIE and SEE not to be set from self-study component.

2. Assignment Questions should be from self-study component only.

3. Every student should develop a mini project on User Interface Design.

TEXT BOOK:

1. Wilbent. O. Galitz,"The Essential Guide to User Interface Design", John Wiley& Sons, 2001.

REFERENCE BOOKS:

1. Ben Sheiderman, "Design the User Interface", Pearson Education, 1998.

2. Alan Cooper, "The Essential of User Interface Design", Wiley - Dream Tech Ltd.,2002

Assessment Pattern:

1. CIE –Continuous Internal Evaluation Theory (50 Marks)

Bloom's Category	Tests	Assignments	AAT1	AAT2
Marks (Out of 50)	**30**	**10**	**05**	**05**
Remember	10			01
Understand	10	05	01	01
Apply	10	05	02	01
Analyze			02	
Evaluate				
Create				02

***AAT 1– Alternate Assessment Tool 1: Quiz**

AAT 2 - Alternate Assessment Tool 2: Surprise Test

2. SEE –Semester End Examination Theory (50 Marks)

Bloom's Category	Marks Theory (50)
Remember	05
Understand	10
Apply	10
Analyze	10
Evaluate	10
Create	05

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INTRODUCTION TO JAVA

SHOULD NOT BE OFFERED TO:

- **COMPUTER SCIENCE & ENGINEERING**
- **ELECTRONICS & TELECOMMUNICATION ENGINEERING**
- **ELECTRONICS AND INSTRUMENTATION ENGINEERING**
- **ELECTRICAL & ELECTRONICS ENGINEERING**
- **MEDICAL ELECTRONICS ENGINEERING**
- **MECHANICAL ENGINEERING**

Sub Code: 19IS6IEJVA	**Credits: 03**
L: T: P: S: 3: 0:0:0	**CIE Marks: 50**
ExamHours:03	**SEE Marks:50**
Total hours: 40	

Objectives:

1. To provide an introduction to java and object-oriented concepts of java programming.
2. Understand the use and creation of packages and interfaces.
3. Analyze and use exception handling in java.
4. A better understanding of string libraries.

Course Outcomes

After completion of the course, the graduates will be able to:

CO1	Articulate classes, its members and the relationships among them needed for a specific problem.
CO2	Apply the basic concepts of object-oriented programming in writing java programs.
CO3	Create and use packages/ interfaces in Java programs.
CO4	Analyze and implement exception handling in Java.
CO5	Use various Input/output packages effectively.
CO6	Design programs using String libraries.

Mapping of Course outcomes to Program outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	1	-	-	-	-	-	-	-	-	1
CO2	3	2	2	-	-	-	-	-	-	-	-	1
CO3	3	2	2	-	-	-	-	-	-	-	-	1
CO4	2	2	1	-	-	-	-	-	-	-	-	1
CO5	2	2	2	-	-	-	-	-	-	-	-	1
CO6	3	2	2	-	-	-	-	-	-	-	-	1

COURSE CONTENTS

Unit	Contents of the Unit	Hours	CO's
1	**Introduction**: Creation of Java, Byte code, Java Buzzwords, Object Oriented Programming, A simple program, Two Control statements, Lexical Issues, Type conversion and casting, Arrays. **Operators:** Arithmetic operators, Bitwise operators, Relational operators, the assignment operator, The ? Operator, operator precedence. Control Statements: Selection statements, iteration statements, Jump statements.	9	CO1
2	**Classes:** Class fundamentals, declaring Objects, assigning object reference variables, introducing methods, constructors, this keyword, garbage collection, the finalize() method. **A Closer Look at Methods and Classes:** Overloading methods, using objects as parameters, returning objects, introducing access control, understanding static, introducing final.	9	CO2
3	**Inheritance:** inheritance basics, using super, creating multilevel hierarchy, method overriding, using abstract classes, using final with inheritance. **Interfaces:** Defining an Interface, Implementing Interface, Applying	8	CO3 CO4

	interfaces, Variables in interfaces. **Exception handling:** Fundamentals, Exception types, using try and catch, nested try statements, throw, throws, finally.		
4	**Input/Output:** I/O Basics, Reading Console Input, Writing Console Output, Reading and Writing files. **Packages:** Defining a package, Access protection; importing packages.	7	CO5
5	**String handling:** String Constructors, String Length, Special string operators, Character extraction, String comparison, Searching Strings, Modifying a string,StringBuffer,StringBuffer Constructors.	7	CO6

SELF-STUDY COMPONENT:

Note: 1. Questions for CIE and SEE not to be set from self-study component.

2. Assignment Questions should include programming from self-study components.

Module 1: Data types and other tokens: Boolean Variables, int, long, char, white spaces, literals.

Module 2: nested and inner classes, using command line arguments

Module 3: Interfaces can be extended, multiple catch clauses, Java's built-in exceptions

Module 4: The Print Writer Class,

Module 5: StringBuffer, StringBuilder

.

TEXT BOOKS:

- Herbert Schildt: Java The Complete Reference, 7th Edition, Tata McGraw Hill, 2007.

REFERENCES BOOKS:

- Y. Daniel Liang: Introduction to JAVA Programming, 6th Ed, Pearson Education, 2007.

- Programming with JavaE Balagurusamy, 6th Ed, McGraw-Hill Education, 2019.

ASSESSMENT PATTERN:

CIE –Continuous Internal Evaluation Theory (50 Marks)

Bloom's Category	**Tests**	**Assignments**	**AAT1**	**AAT2**
Marks (Out of 50)	**30**	**10**	**05**	**05**
Remember	--	--	--	--
Understand	--	--	---	--
Apply	10	05	01	01
Analyze	10	--	02	02
Evaluate		--	02	
Create	10	05		02

***AAT 1– Alternate Assessment Tool 1: Quiz**

AAT 2 - Alternate Assessment Tool 2: Develop a Java application related to their engineering major of study.

SEE –Semester End Examination Theory (50 Marks)

Bloom's Category	**Marks Theory (50)**
Remember	--
Understand	10
Apply	10
Analyze	10
Evaluate	--
Create	20

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Department of Information Science and Engineering

AI & MACHINE LEARNING LABORATORY

Course code:19IS6DLAML **Credits: 02**
L: P: T: S: 0: 2: 1: 0 **CIE Marks: 50**
Exam Hours: 03 **SEE Marks:50**

Course Objectives:

1. Implement supervised and unsupervised machine learning algorithms
2. Perform classification on the preprocessed dataset.
3. Implement the machine learning concepts and algorithms in Python Programming

Course Outcomes: At the end of the course, student will be able to:

CO1	Understand and implement supervised and unsupervised machine learning algorithms
CO2	Analyze and Implement Machine Learning algorithms on a given dataset
CO3	Construct the linear regression model as a method for prediction
CO4	Develop Bayesian concepts and clustering algorithms using Python program
CO5	Design and implement decision tree using information gain and entropy calculations
CO6	Analyze and build Artificial neural network.

Mapping of Course outcomes to Program outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	-	3	-	-	-	-	-	-	2	2	-	-
CO2	3	3	-	-	3	-	-	-	-	-	-	2	2	-	-
CO3	3	2	2	-	3	-	-	-	-	-	-	2	2	-	-
CO4	3	2	2	-	3	-	-	-	-	-	-	2	2	-	-
CO5	3	2	2	-	3	-	-	-	-	-	-	2	2	-	-
CO6	3	2	2	-	3	-	-	-	-	-	-	2	2	-	-

Unit	Course Content	Hours	COs
1.	Implement simple linear regression using python program and estimate statistical quantities from training data	3	**CO1, CO2, CO3**
2.	Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.	3	**CO1, CO2**

<table>
<tr><td>3.</td><td>For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.</td><td>3</td><td>CO1, CO2</td></tr>
<tr><td>4.</td><td>Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.</td><td>3</td><td>CO1, CO2</td></tr>
<tr><td>5.</td><td>Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.</td><td>3</td><td>CO2,CO5</td></tr>
<tr><td>6.</td><td>Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set.</td><td>3</td><td>CO2,CO4</td></tr>
<tr><td>7.</td><td>For the given table, write a python program to perform K-Means Clustering.
<table>
<tr><td>X1</td><td>3</td><td>1</td><td>1</td><td>2</td><td>1</td><td>6</td><td>6</td><td>6</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>8</td><td>9</td><td>9</td><td>8</td></tr>
<tr><td>X2</td><td>5</td><td>4</td><td>6</td><td>6</td><td>5</td><td>8</td><td>6</td><td>7</td><td>6</td><td>7</td><td>1</td><td>2</td><td>1</td><td>2</td><td>3</td><td>2</td><td>3</td></tr>
</table></td><td>3</td><td>CO2,CO4</td></tr>
<tr><td>8.</td><td>Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same dataset for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering.</td><td>3</td><td>CO2,CO4</td></tr>
<tr><td>9.</td><td>For the given customer dataset, using the dendogram to find the optimal number of clusters and finding Hierarchical Clustering to the dataset</td><td></td><td>CO2,CO4</td></tr>
<tr><td>10.</td><td>Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.</td><td>3</td><td>CO2, CO6</td></tr>
</table>

TEXT BOOKS

1. EthemAlpaydın: Introduction to Machine Learning, 2nd Edition, The MIT Press Cambridge, Massachusetts London, England, 2010.
2. Tom M. Mitchell, "Machine Learning", McGraw-Hill Education (INDIAN EDITION), 2018

Assessment Pattern:

CIE –Continuous Internal Evaluation Lab (50 Marks)

Continual Internal Evaluation Marks (25)	IA Test Marks (25)	Final Marks (50)

SEE –Semester End Examination Theory (50 Marks)

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Department of Information Science and Engineering

JAVA AND J2EE LAB

Course code: 19IS6DLJVA **Credits: 02**
L: P: T: S: 0: 2: 1: 0 **CIE Marks: 50**
Exam Hours: 03 **SEE Marks: 50**

Course Objectives:

1. To provide an introduction to java and object oriented concepts in java programming.
2. Understand the creation and use of packages and interfaces.
3. Analyze and use exception handling in java.
4. Create web applications using Servlets and JSP.

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

CO1	Write, compile and execute java programs.
CO2	Apply the basic concepts of object oriented programming in writing java programs.
CO3	Design and use classes, packages and interfaces
CO4	Analyze and implement exception handling, event handling
CO5	Develop graphical user interface using swings
CO6	Construct web applications using Servlets and JSP

Mapping of Course outcomes to Program outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	-	2	-	-	-	-	-	-	2	-	1	-
CO2	3	2	1	-	2	-	-	-	-	-	-	2	-	1	-
CO3	3	2	-	-	2	-	-	-	-	-	-	2	-	1	-
CO4	3	3	-	-	2	-	-	-	-	-	-	2	-	1	-
CO5	2	2	-	-	2	-	-	-	-	-	-	2	-	2	-
CO6	2	3	2	-	2	-	-	-	-	-	-	2	-	3	3

Experiment No.	Contents of the experiment	Hours	COs
1.	(a) Write a Java program to implement linear search. (b) Write a java program for sorting a given list of names.	3	CO1 CO2
2.	(a) Write a java program that illustrates the multilevel inheritance. (b) Write a java program that illustrates the multiple inheritances by using interfaces.	3	CO1 CO2

3.	(a) Write a Java program to implement the concept of importing classes from user defined package and creating packages. (b) Write a Java program that reads a line of integers and then displays each integer and the sum of all integers. (use StringTokenizer class)	3	CO1 CO3
4.	(a) Write a program to perform arithmetic operations using static members (b) Write a program to read and print n numbers using arrays	3	CO1 CO2
5.	(a) Write a Java program to display the use of String class and its methods. (b) Write a Java program to practice using String Buffer class and its methods.	3	CO1 CO2
6.	Write a java program that implements a multi-thread application that has three threads. First thread generates random integer every 1 second and if the value is even, second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of cube of the number.	3	CO1 CO2 CO3
7.	Write a program to implement the concept of Exception Handling by creating user defined exceptions.	3	CO1 CO4
8.	Write a Java Program to demonstrate Mouse events.	3	CO1 CO2 CO4
9.	Write a Java program with Servlets to create a dynamic HTML form to accept and display user name and password with the help of 'get()' and 'post()' methods.	3	CO3 CO5
10.	Write a Java Servlet program to demonstrate session tracking.	3	CO3 CO5
11.	Write a JAVA JSP program to implement verification of a particular user login and display a welcome page.	3	CO2 CO3 CO5
12	Write simple JSP program to display a phrase with increasing font size.	3	CO2 CO3 CO5

TEXT BOOKS:

1. The Complete Reference - Java: Herbert Schildt, 7th Edition, McGraw Hill, 2017.
2. Jim Keogh: J2EE - The Complete Reference, Tata McGraw Hill, 2007.

REFERENCE BOOKS:

1. Y. Daniel Liang: Introduction to JAVA Programming, 10th Edition, Pearson Education, 2015.
2. Herbert Schildt: Java The Complete Reference, 7th Edition, Tata McGraw Hill, 2007.
3. Stephanie Bodoff et al: The J2EE Tutorial, 2nd Edition, Pearson Education, 2004.

Assessment Pattern:

CIE –Continuous Internal Evaluation Lab (50 Marks)

Continual Internal Evaluation Marks (25)	IA Test Marks (25)	Final Marks (50)

SEE–Semester End Examination Theory(50Marks)

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SCHEME OF TEACHING AND EXAMINATION 2018-2019
Department of Information Science and Engineering

VII SEMESTER

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Department of Information Science and Engineering

SOFTWARE TESTING AND QUALITY METRICS

Course code: 19IS7DCSTQ **Credits: 04**

L: P: T: S: 4: 0: 0: 0 **CIE Marks: 50**

Exam Hours: 03 **SEE Marks: 100**

Total Hours: 50

Course Objectives:

1. To provide foundations in the area of Software Testing Methodologies.
2. To analyze and apply the different testing methods for various types of software applications.
3. To design qualitative test cases within project constraints.
4. To analyze and apply the basic types of testing.
5. To bring awareness about software quality metrics and its significance

Course Outcomes: At the end of the course, student will be able to:

CO1	Bring an awareness to generate test cases based on the given specifications.
CO2	Compare different testing techniques.
CO3	Design test cases with techniques such as Equivalence Class, Boundary Value Analysis etc.
CO4	Understand the appropriate technique for the design of control flow graph.
CO5	Understand and design test cases for Integration Testing and OO Testing.
CO6	Comprehend the significance of quality and metrics in software projects.

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SCHEME OF TEACHING AND EXAMINATION 2018-2019
Department of Information Science and Engineering

Mapping of Course outcomes to Program outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	3
CO2	3	-	-	-	-	-	-	-	-		-	3
CO3	3	2	2	-	-	-	-	-	-	-	-	3
CO4	3	2	2	-	-	-	-	-	-	-	-	2
CO5	3	2	2	-	-	-	-	-	-	-	-	1
CO6	3	2	3	-	-	-	-	-	-	-	-	3

Module	Course Content	Hours	CO's
1	**Introduction to software testing:** Basics of Software Testing: Basic definitions, Software Quality, Requirements, Behavior and Correctness, Correctness versus Reliability, Testing and Debugging, Test cases, Insights from a Venn diagram, Identifying test cases, Test-generation Strategies, Test Life Cycle, Levels of testing, Testing and Verification, Static Testing. **Problem Statements:** Generalized pseudo code, the triangle problem, the NextDate function, the commission problem, the SATM (Simple Automatic Teller Machine) problem, the currency converter, Saturn wind shield wiper	**10**	**CO1**
2	**Functional Testing:** Boundary value analysis, Robustness testing, Worst-case testing, Robust Worst testing for triangle problem, Nextdate problem and commission problem, Equivalence classes, Equivalence test cases for the triangle problem, NextDate function, and the commission problem, Guidelines and observations. Decision tables, Test cases for the triangle problem, NextDate function and	**10**	**CO2, CO3**

	commission problem, Guidelines and observations.		
3	**Structural Testing:** Overview, Statement testing, Branch testing, Condition testing. **Path testing:** DD paths, Test coverage metrics, Basis path testing, guidelines and observations. **Data–Flow testing:** Definition-Use testing, Slice based testing. Guidelines and observations, Cyclomatic complexity and Examples.	**10**	**CO2, CO4**
4	**Model Based Testing:** FSM & EFSM **Integration Testing:** Introduction, Top Down, Bottom Up and Sandwich approaches. Introduction to Neighborhood, Pairwise and Combinatorial Testing, Object Oriented Testing, System, Acceptance and Regression Testing, MM Path Testing and Test adequacy	**10**	**CO2, CO5**
5	Views on quality, Cost of quality, Quality models, Ishikawa's Seven Basic Tools, Product Quality Metrics, The Defect Density Metric, Lines of Code, Function Points, Example: Function Point, Halstead's Software Science.	**10**	**CO5, CO6**

SELF STUDY COMPONENT:

1. Discrete Mathematics for Testers: Set Theory, Functions, Relations, Propositional Logic, Graph Theory for Testers

TEXT BOOKS:

1. Paul C. Jorgensen: Software Testing, A Craftsman's Approach, 3rd Edition, Auerbach Publications, 2008.
2. Stephen H. Kan, "Metrics and Models in Software Quality Engineering, 2nd Edition, Pearson, 2003
3. Mauro Pezze, Michal Young: Software Testing and Analysis – Process, Principles and Techniques, Wiley India, 2009.
4. Aditya P Mathur: Foundations of Software Testing, Pearson Education, 2008.

REFERENCE BOOKS:

1. Aditya P Mathur: Foundations of Software Testing, Pearson Education, 2008.
2. Mauro Pezze, Michal Young: Software Testing and Analysis – Process, Principles and Techniques, Wiley India, 2008.
3. Pressman, R.S., Software Engineering: A Practitioner & Approach, 7^{th} (Alternate) Edition, McGraw Hill International Edition, 2010
4. Kshirasagar Naik and Priyadarshi Tripathy (Eds); Software Testing and Quality Assurance: Theory and Practice ", John Wiley, 2008
5. Gordon G Schulmeyer, "Handbook of Software Quality Assurance", Third Edition, Artech House Publishers 2007.

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SCHEME OF TEACHING AND EXAMINATION 2018-2019
Department of Information Science and Engineering

WEB TECHNOLOGIES

Course code: 19IS7DEWTS **Credits: 03**
L: P: T: S: 3:0:0: 0 **CIE Marks: 50**
Exam Hours: 03 **SEE Marks: 50**
Total Hours: 50

Course Objectives:

1. To gain ample understanding on designing static web pages.
2. To understand the need and different techniques for programming the web.
3. To understand concept of java scripting, perl, cgi Ajax and rails.
4. Use scripting languages, to create dynamic web pages with event handling.

Course Outcomes: At the end of the course, student will be able to:

CO1	To gain an insight of the internet and related internet concepts that are vital in understanding web development
CO2	Discuss the insights of internet programming and implement complete application over the web.
CO3	Demonstrate the important HTML tags for designing static pages and separate design from content using Cascading Style sheet.
CO4	Use scripting languages such as JavaScript to validate and create dynamic web pages with event handling
CO5	Develop server side programs and illustrate text manipulation using Perl.
CO6	Use of Ajax and Rails framework for web application development.

Mapping of Course outcomes to Program outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	1
CO2	3	-	-	-	-	-	-	-	-		-	-	-	-	3
CO3	3	2	2	-	-	-	-	-	-	-	-	-	-	-	2
CO4	3	2	2	-	1	-	-	-	-	-	-	1	-	-	2
CO5	3	2	2	1	3	-	-	-	-	-	-	1	-	-	3
CO6	3	2	3	1	2	-	-	-	1	1	-	1	-	-	2

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SCHEME OF TEACHING AND EXAMINATION 2018-2019

Department of Information Science and Engineering

Module No.	Content	Hours	Cos
1.	**Fundamentals of Web, XHTML – 1**: Internet, WWW, Web Browsers and Web Servers, URLs, MIME, HTTP, Security. XHTML: Basic syntax, Standard structure, Basic text markup, Images, Hypertext Links, Lists.	**08**	**CO1 CO2 CO3**
2.	**XHTML:** (continued)Tables, Forms, Syntactic differences between HTML and XHTML.**CSS**: Introduction, Levels of style sheets, Style specification formats, Selector forms, Property value forms, Font properties, List properties, Color, Alignment of text, Background images, Conflict resolution. **JavaScript**:	**08**	**CO1 CO2 CO3**
3.	**JavaScript:**Overview of JavaScript, Object orientation and JavaScript, General Syntactic characteristics, Primitives, operations, and expressions.Screen output and keyboard input, Control statements,Arrays,Functions,Pattern matching using regular expressions, Errors in scripts. **JavaScript and HTML Documents:** The JavaScript execution environment, The Document Object Model, Element access in JavaScript, Events and event handling, Handling events from the Body elements, Button elements, Text box and Password elements.	**10**	**CO2, CO3& CO4**
4.	**Dynamic Documents with JavaScript:** Introduction to dynamic documents, Positioning elements, Moving elements, Element visibility, Dynamic content, Stacking elements**. Perl, CGI Programming:** Origins and uses of Perl, Scalars and their operations, Assignment statements and simple input and output, Control statements, Fundamentals of arrays, Hashes.	**08**	**CO2 CO5 &CO6**
5.	**Using Perl for CGI Programming:** The Common Gateway Interface; CGI linkage; Query string format; **Introduction to Ajax:** Overview of Ajax, The Basics of Ajax, Rails with Ajax.	**6**	**CO2 CO5 &CO6**

Self-study component:

Unit 1: Frames

Unit 2: The and tags,

Unit 3: Changing colors and fonts, Locating the mouse Cursor, reacting to a mouse click, Slow movement of elements.

Unit 4: CGI.pm module.

Unit 5:PHP:Passing Variables between Pages, Using if/else Arguments, rails application layout.

To develop Mini project using various web application frameworks.

Note: 1.Questions for CIE and SEE not to be set from self-study component and illustrative examples.
2. Assignment Questions should be from self-study component only.

TEXT BOOK:

1. Robert W. Sebesta: Programming the World Wide Web, 4th Edition, Pearson Education, 2008. (Listed topics only from Chapters 1 to 9, 11 to 15).

REFERENCE BOOKS:

1. M. Deitel, P.J. Deitel, A. B. Goldberg: Internet & World Wide Web How to Program, 4th Edition, Pearson Education, 2004.
2. Chris Bates: Web Programming Building Internet Applications, 3rd Edition, Wiley India, 2007.
3. XueBai et al: The web Warrior Guide to Web Programming, Cengage Learning, 2003.

E –Book :

1. The Web Book: How to create Web sites and applications with HTML, CSS, JavaScript, PHP and MySQL by Robert Schifreen, 2010.

Assessment Pattern:
CIE –Continuous Internal Evaluation Theory (50 Marks)

Bloom's Category	**Tests**	**Assignments**	**AAT**
Marks (Out of 50)	**30**	**10**	**10**
Remember	10		
Understand	10	05	02
Apply	10	05	04
Analyze			04
Evaluate			
Create			

***AAT – Alternate Assessment Tool**

SEE –Semester End Examination Theory (50 Marks)

Bloom's Category	**Marks Theory(50)**
Remember	10
Understand	10
Apply	10
Analyze	10
Evaluate	10

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SCHEME OF TEACHING AND EXAMINATION 2018-2019
Department of Information Science and Engineering

VIRTUAL & AUGMENTED REALITY

COURSE CODE: 19IS7DEVAR **Credits: 03**
L:P:T:S: 3:0:0:0 **CIE Marks:50**
Exam Hours: 03 **SEE Marks: 5**
Total Hours: 40
Course outcomes: At the end of the course the student will be able to:

Unit	Contents of the Unit	Hours	Cos
1	**Fundamental Concept and Components of Virtual Reality:** Primary Features and Present Development on Virtual Reality. Multiple Models of Input and Output Interface in Virtual Reality **Input --Tracker**, Sensor, Digital Glove, Movement Capture, Video-based Input, 3D Menus & 3DScanner etc. **Output** -- Visual /Auditory / Haptic Devices.	10	
2	**Visual Computation in Virtual Reality:** Fundamentals of Computer Graphics. Software and Hardware Technology on Stereoscopic Display. Advanced Techniques in CG: Management of Large Scale Environments & Real Time Rendering.	07	
3	**Interactive Techniques in Virtual Reality**: Body Track, Hand Gesture, 3D Manus, Object Grasp. Augmented and Mixed Reality, Taxonomy, technology and features of augmented reality, difference between AR and VR, Challenges with AR	07	
4	Development Tools and Frameworks in Virtual Reality: Frameworks of Software Development Tools in VR, Introduction and Overview of OpenGL and Unity Application of VR in Digital Entertainment:	08	

5	VR Technology in Film & TV Production, Demonstration of Digital Entertainment by VR, Technological Online-Education enhancement by AR and VR A short course project in OpenGL or Unity Total Contact Time	08	

Text Books;

1. Burdea, G. C. & P. Coffet. Virtual Reality Technology, Second Edition. Wiley-IEEE Press, 2003/2006.

2. Alan B. Craig, Understanding Augmented Reality, Concepts & Applications, Morgan Kaufmann, 2013.

3. Alan Craig, William Sherman and Jeffrey Will, Developing Virtual Reality Applications, Foundations of Effective Design, Morgan Kaufmann, 2009.

4. LaValle "Virtual Reality", Cambridge University Press, 2016.

5. John Vince, “Virtual Reality Systems “, Pearson Education Asia, 2007.

6. Anand R., “Augmented and Virtual Reality”, Khanna Publishing House, Delhi. 7. Stanford Course: Virtual Reality (https://stanford.edu/class/ee267/syllabus

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SCHEME OF TEACHING AND EXAMINATION 2018-2019
Department of Information Science and Engineering

DATA SCIENCE AND ANALYTICS

Course code: 19IS7DEDSA **Credits: 03**
L: P: T: S: 3: 0: 0: 0 **CIE Marks: 50**
Exam Hours: 03 **SEE Marks: 50**
Total Hours: 40

Course Objectives:

1. Understand what Data Science is and the skill sets needed to be a data scientist.
2. Identify probability distributions commonly used as foundations for statistical modeling.
3. Use APIs and other tools to scrap the Web and collect data.
4. To gain knowledge on fundamental mathematical and algorithmic ingredients that constitute a Recommendation Engine.

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

CO1	Describe the significance of exploratory data analysis (EDA) in data science
CO2	Apply the Data Science Process and how its components interact.
CO3	Apply basic machine learning algorithms for predictive modeling.
CO4	Identify basic Feature Selection algorithms and use in applications.
CO5	Create effective visualization of given data.
CO6	Solve different data analysis problems.

Mapping of Course outcomes to Program outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	-	-	2	-	-	-
CO2	3	2	2	-	-	-	-	-	-	-	-	-	2	-	-
CO3	3	2	2	-	-	-	-	-	-	-	-	-	2	-	-
CO4	3	2	2	-	-	-	-	-	-	-	-	-	2	-	-
CO5	2	2	2	-	-	-	-	-	-	-	-	-	2	-	-
CO6	2	3	3	-	-	-	-	-	-	-	-	-	2	2	-
	3	2	2	-	-	-	-	-	-	-	-	2	2	2	-

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SCHEME OF TEACHING AND EXAMINATION 2018-2019
Department of Information Science and Engineering

Unit	Contents of the Unit	Hours	Cos
1	Introduction: What is Data Science?, Big Data and Data Science hype, getting past the hype - Why now?, Current landscape, A data science profile, Meta definition, What is a data scientist? Statistical Inference : Statistical thinking in the age of Big data, Exploratory Data Analysis, Data Science Process, Thought experiment, Case Study: RealDirect.	08	CO1 & C02
2	Time Stamps and Financial Modeling: Kyle Teague and GetGlue,Timestamps: Exploratory Data Analysis (EDA), Metrics and New Variables or Features, What's Next?, Cathy O'Neil, Thought Experiment, Financial Modeling, Exercise: GetGlue and Timestamped Event Data, Exercise: Financial Data, Spam filters: Thought experiment: Learning by example, Naive Bayes, Fancy it up, Comparing, Sample code, Scraping the web, Jakes exercise.	08	CO3
3	Extracting Meaning From Data: Feature Selection, Recommendation Engines: A real world Recommendation Engine, Thought experiment, Exercise: build your own recommendation system.	08	CO4
4	Data Visualization: Data Visualization History, What is data science, Redux?, A sample of Data Visualization projects, Marks Data Visualization projects, Data science and risk, Data Visualization at square, Ians thought experiment, Data Visualization for rest of us. Next-generation data scientists: What just happenend? What are Next-generation data scientists?	08	CO5
5	Analytics and data science: Data and models for research, Model evaluation, Multifold cross-validation, Bootstrap resampling, Market basket analysis: Market basket prevalence, Market basket prevalence by category, Scatter plot, Matrix bubble chart, Economic data analysis: multiple time series, horizon plot, Different forecasts.	08	CO6

Self study component:

Note: 1.Questions for CIE and SEE not to be set from self-study component.

2. Assignment Questions should be from self-study component only.

UNIT 1: Data and Models for Research.

UNIT2 : Logistic Regression

UNIT3 : The Kaggle model

UNIT4 : Visualizing causality

UNIT5 : Text analytics

Text books:

1. Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk From The Frontline. O'Reilly. 2014.
2. Thomas W Miller, Modeling techniques in predictive analytics with Python and R- A Guide to Data Science, Pearson, 2019.

Reference books:

4. Jure Leskovek, AnandRajaraman and Jeffrey Ullman. Mining of Massive Datasets. v2.1, Cambridge University Press. 2014.
5. Kevin P. Murphy. Machine Learning: A Probabilistic Perspective. ISBN 0262018020. 2013.
6. Foster Provost and Tom Fawcett. Data Science for Business: What You Need to Know about Data Mining and Data-analytic Thinking.

Assessment Pattern:

CIE –Continuous Internal Evaluation Theory (50 Marks)

Bloom's Category	**Tests**	**Assignments**	**AAT1**	**AAT2**
Marks (Out of 50)	**30**	**10**	**05**	**05**
Remember	--	--	--	--
Understand	10	05	01	01
Apply	10	--	02	01
Analyze	10	05	01	--
Evaluate	--	--	01	02
Create	--	--	--	01

***AAT 1– Alternate Assessment Tool 1: Quiz**

AAT 2 - Alternate Assessment Tool 2: Case Study, Implementation of theoretical concepts

SEE –Semester End Examination Theory (50 Marks)

Bloom's Category	**Marks Theory(50)**
Remember	10
Understand	10
Apply	10
Analyze	10
Evaluate	10
Create	

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SCHEME OF TEACHING AND EXAMINATION 2018-2019
Department of Information Science and Engineering

BLOCKCHAIN

Course code: 19IS7DEBLC **Credits: 03**
L:P:T:S: 3:0:0:0 **CIE Marks:50**
Exam Hours: 03 **SEE Marks: 50**
Total Hours 03

Course Objectives:

1. Understand the basic principles of Blockchain technology
2. Understand the methods and platforms used in Blockchain
3. To be familiar with the first and the largest Blockchain - Bitcoin
4. Understand Blockchain Smart Contracts
5. To become familiar with the alternative Blockchains like Ethereum
6. To learn the Blockchain development tools and Frameworks

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

CO1	Comprehend the basic principles of Blockchain technology
CO2	Understand the Blockchain methods and platforms
CO3	Build familiarity with Blockchains like Bitcoin
CO4	Learn and Understand Smart Contracts
CO5	Understand alternative Blockchains like Ethereum
CO6	Learn Block Chain Development tools and frameworks

Mapping of Course outcomes to Program outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	2	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	2	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	2	-	-	-	-	-	-	-	-	-	-	-	1
CO5	3	2	2	-	-	-	-	-	-	-	-	-	-	-	1
CO6	3	2	2	-	3	-	-	-	-	-	-	-	-	-	1

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CHOICE BASED CREDIT SYSTEM (CBCS)
SCHEME OF TEACHING AND EXAMINATION 2018-2019

Department of Information Science and Engineering

Module	Content of the Unit	Hours	COs
1.	**Blockchain (BC) 101:** Introduction, Distributed Systems, History of BC and Bitcoin – Electronic cash, Blockchain, Generic Elements of BC, Benefits and limitations of BC, Tiers and Features of BC, Types of BC, Consensus **Decentralization:** Decentralization using BC, Methods of decentralization, Routes to decentralization, BC and ecosystem decentralization, Smart Contracts, Decentralized Organizations, Platforms for decentralization, Symmetric Cryptographic - Cryptographic primitives, Public Key Cryptography - Asymmetric cryptography, public and private keys.	8	CO1, CO2
2.	**Introducing Bitcoin:** Bitcoin, Digital keys and addresses, Transactions, Blockchain, Mining **Bitcoin Network and Payments:** The Bitcoin network, Wallets, Bitcoin payments, Innovation in Bitcoin,	8	CO3
3.	**Bitcoin Clients and APIs:** Bitcoin Installation, Alternative Coins. **Smart Contracts:** History, Definition, Ricardian Contracts, - Smart Contract templates, Oracles, Smart Oracles, Deploying smart contracts on a BC. The DAO	8	CO4
4.	**Ethereum 101:** Introduction, Ethereum bird's eyeview, The Ethereum network, Components of the Ethereum ecosystem, Ether Cryptocurrency, The Ethereum VM (EVM), Smart Contracts, Ethereum Development Environment - Test networks, Setting up a private net, starting up the private network.	8	CO5
5.	**Development Tools and Framework:** Languages, Solidity Language **HyperLedger:** Hyperledger – Fabric, Reference architecture, Services. **Alternative Blockchains**: Blockchains, **Blockchain** - Outside of Currencies.	8	CO6

Self Study Component:

1. Bitcoin Clients and API – Setup the bitcoin.

2. Hash functions, public key cryptography, digital signatures

3. Platforms and frameworks

TEXT BOOK:

1. Imran Bashir, "Mastering Blockchain", 2nd edition, Packt Publishing Company, 2018

REFERENCE BOOKS:

1. Narayan Prusty, "Building BlockChain Projects", Packt Publishing Company, 2017.

2. Arvind Narayanan, Joseph Bonneau, Edward Felten, AndrewMiller, And Steven Goldfeder, "Bitcoin and Cryptocurrency Technologies", A Comprehensive Introduction, Princeton University Press.

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SCHEME OF TEACHING AND EXAMINATION 2018-2019

Department of Information Science and Engineering

OPERATIONS RESEARCH

Course Code: 19IS7DEORS **Credits: 03**
L: P: T: S: 3: 0: 0: 0 **CIE Marks: 50**
Exam Hours: 03 **SEE Marks: 50**
Total Hours: 40

COURSE OBJECTIVES:

1. To appreciate the concepts of Operations Research for problem solving.
2. To learn formulating linear programming models.
3. To analyze different algorithms on networks.
4. To illustrate the usage of simulation.

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

CO1	Illustrate the importance and usage of Operations research in solving problems.
CO2	Solve linear programming problems using Simplex method.
CO3	Analyze and competently use resources to optimize profit.
CO4	Explore the networks using various algorithms.
CO5	Examine simulation and meta heuristic approaches.
CO6	Interpret and use operations research to solve problems.

Mapping of Course outcomes to Program outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	-	-	-	-	-	-	-	-	1	2	-	-
CO2	3	2	2	-	-	-	-	-	-	-	-	1	2	-	-
CO3	3	2	2	-	-	-	-	-	-	-	-	1	2	-	-
CO4	2	2	1	-	-	-	-	-	-	-	-	1	2	-	-
CO5	3	3	2	-	-	-	-	-	-	-	-	1	2	-	-
CO6	3	3	2	-	-	-	-	-	-	-	-	1	2	-	-

Unit	Course Content	Hours	COs
1	**Introduction to Operations Research:** The Origins and Applications of Operations Research, System Modeling Principles, Optimality and	08	CO1 &

	Practicality, Software for Operations Research, Illustrative Applications. **Linear Programming:** The Linear Programming Model, The Art and Skill of Problem Formulation, Graphical Solution of Linear Programming Problems		CO2
2	**Linear Programming:** Preparation for the Simplex Method, The Simplex Method, Initial Solutions for General Constraint	08	CO2
3	**Linear Programming:** Information in the Tableau, Analyzing the Optimal Tableau: Shadow Prices, Duality and Sensitivity Analysis, Software for Linear Programming. **Network analysis**: Graphs and Networks: Preliminary Definitions, Maximum Flow in Networks, Minimum Cost Network Flow Problems.	08	CO2 & CO3
4	**Network analysis:** Network connectivity, Shortest Path Problems, Dynamic Programming, Project Management, Software for Network Analysis**.**	08	CO3 & CO6
5	**Simulation:** Purposes and Applications, Discrete Simulation Models, Observations of Simulations, Software for Simulation. **Heuristic and Metaheuristic Techniques for Optimization:** Other Metaheuristics, Software for Metaheuristics.	08	CO5 & CO6

Self-Study Component:

- An Introduction to Game Theory
- Decision Trees
- Software for Decision Analysis
- Greedy Heuristics
- Genetic Algorithms

Text Book

1. Michael W. Carter, Camille C. Price,GaithRabadi, Operations Research: A Practical Introduction, Second Edition, CRC Press, 2019.
(http://dl.booktolearn.com/ebooks2/engineering/industrial/9781498780100_Operations_Research_b83e.pdf)

Reference Books

1. Taha, H. A., Operations Research: An Introduction, 10th edition, Prentice Hall, 2016.
2. D.S. Hira and P.K. Gupta, Operations Research, (Revised Edition), Published by S. Chand & Company Ltd, 2014.

Assessment Pattern:

CIE –Continuous Internal Evaluation Theory (50 Marks)
SEE –Semester End Examination Theory (50 Marks)
CIE=30 marks
Assignment=10 marks
AAT=10 Marks

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SCHEME OF TEACHING AND EXAMINATION 2018-2019
Department of Information Science and Engineering

COMPUTER ARCHITECTURE

Course code: 19IS7DECAR **Credits: 03**
L: P: T: S: 3: 0: 0: 0 **CIE Marks: 50**
Exam Hours: 03 **SEE Marks: 50**
Total Hours: 40

Course Objectives:-

1. To understand the basic concepts of computer architecture.
2. To understand the need for pipelining and parallelism at instruction level
3. To impart knowledge related to memory, virtualization of memory
4. To understand the recent trends in the field of Computer Architecture and identify performance related parameters

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

CO1	Understand the basic structure and operation of digital computer.
CO2	Familiarize with hierarchical memory system including cache memories and virtual memory.
CO3	Understand ways to take advantage of instruction level parallelism for high performance processor design.
CO4	Understand dynamic scheduling methods and their adaptation to contemporary Microprocessor design.
CO5	Acquire the knowledge on various architectures such as vector, SIMD and GPU.
CO6	Gain knowledge on Symmetric and Distributed Shared-Memory multiprocessors.

Mapping of Course outcomes to Program outcomes:-

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	3	3	-	-	-	-	-	-	-	-	-
CO2	3	3	1	2	-	-	-	-	-	-	-	-
CO3	3	2	2	-	-	-	-	-	-	-	-	-
CO4	2	2	3	-	-	-	-	-	-	-	-	-
CO5	2	3	3	-	-	-	-	-	-	-	-	-
CO6	3	1	2	-	-	-	-	-	-	-	-	-

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SCHEME OF TEACHING AND EXAMINATION 2018-2019
Department of Information Science and Engineering

Unit	Course Content	Hours	Cos
1	**Fundamentals Of Computer Design:** Introduction; Classes of computers; Defining computer architecture, Trends in technology, Trends in Power and Energy in Integrated Circuits, Dependability; Measuring, reporting and summarizing Performance; Quantitative Principles of computer design.	**08**	**CO1**
2	**Pipelining: Basic and Intermediate Concepts:** Introduction, The Major Hurdle of Pipelining—Pipeline Hazards, How Is Pipelining Implemented?, What Makes Pipelining Hard to Implement?	**08**	**CO3**
3	**Memory Hierarchy design:** Introduction; Ten Advanced Optimizations of Cache Performance; Memory Technology and Optimizations; Protection: Virtual memory and virtual machines; Crosscutting Issues: The Design of Memory Hierarchies.	**08**	**CO2**
4	**Instruction –Level Parallelism and its Exploitation:** Instruction-Level Parallelism: Concepts and Challenges, Basic Compiler Techniques for Exposing ILP, Reducing Branch Costs with Advanced Branch Prediction, Overcoming Data Hazards with Dynamic Scheduling, Dynamic Scheduling: Examples and the Algorithm, Hardware-Based Speculation, Exploiting ILP Using Multiple Issue and Static Scheduling, Exploiting ILP Using Dynamic Scheduling, Multiple Issue, and Speculation, Advanced Techniques for Instruction Delivery and Speculation, Studies of the Limitations of ILP.	**08**	**CO4**
5	**Thread-Level Parallelism:** Introduction, Centralized Shared-Memory Architectures, Performance of Symmetric Shared-Memory Multiprocessors, Distributed Shared-Memory and Directory-Based Coherence, Synchronization: The Basics, Models of Memory Consistency: An Introduction.	**08**	**CO5 & CO6**

Self-study component:-
Note:-
1. Questions for CIE and SEE not to be set from self-study component.
2. Assignment Questions should be from self-study component only.
UNIT – 1: Trends in Cost
UNIT – 2: Extending the MIPS Pipeline to Handle Multicycle Operations
UNIT – 3: Memory Hierachies in the ARM Cortex-A8 and Intel Core i7

UNIT– 4: ILP Approaches and the Memory System, Multithreading: Exploiting Thread-Level Parallelism to Improve uniprocessor Throughput.

UNIT – 5: Multicore Processors and Their Performance

TEXT BOOKS:-

1. John L. Hennessey and David A. Patterson: Computer Architecture, A Quantitative Approach, 5th Edition, Elsevier, 2007.

REFERENCE BOOKS:-

1. Kai Hwang: Advanced Computer Architecture Parallelism, Scalability, Programability, 2nd Edition, Tata McGraw Hill, 2010.
2. David E. Culler, Jaswinder Pal Singh, Anoop Gupta: Parallel Computer Architecture, A Hardware / Software Approach, Morgan Kaufman, 1999.

Assessment Pattern:

CIE –Continuous Internal Evaluation Theory (50 Marks)

Bloom's Category	**Tests**	**Assignments**	**AAT1**	**AAT2**
Marks (Out of 50)	**30**	**10**	**05**	**05**
Remember	10			01
Understand	10	05	01	01
Apply	10	05	02	01
Analyze			02	
Evaluate				
Create				02

***AAT 1– Alternate Assessment Tool 1: Quiz**

AAT 2 - Alternate Assessment Tool 2: Surprise Test

SEE –Semester End Examination Theory (50 Marks)

Bloom's Category	**Marks Theory(50)**
Remember	05
Understand	10
Apply	10
Analyze	10
Evaluate	10
Create	05

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SCHEME OF TEACHING AND EXAMINATION 2018-2019
Department of Information Science and Engineering

GREEN COMPUTING

Course code: 18IS7DEGCT | **Credits: 03**

L: P: T: S: 3: 0: 0: 0 | **CIE Marks: 50**

Exam Hours: 03 | **SEE Marks: 50**

Total Hours: 40

Course Outcomes: After completion of the course, the graduates will beable to

CO1	Able to understand the importance of Green Computing
CO2	Understand the Significance Green Computing Framework
CO3	Analyze the impact of Green Computing In Industries
CO4	Understand the challenges related to Green Computing
CO5	Significance of Green Computing in Socio- Cultural Environment
CO6	Understand the importance of Green Computing through Case Studies

Mapping of Course outcomes to Program outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	1	-	1	-	-	-	1	-	1	-	-	-
CO2	2	2	-	2	-	-	-	-	-	2	-	2	-	-	-
CO3	3	3	-	1	-	-	-	-	-	1	-	1	-	-	-
CO4	2	2	-	1	1	-	-	-	-	2	-	1	-	-	-
CO5	2	3	-	2	1	-	-	-	-	1	-	2	-	-	-
CO6	3	3	-	1	-	-	-	-	-	1	-	1	-	-	-

Unit	Course Content	Hours	Cos
1	**FUNDAMENTALS** Green IT Fundamentals: Business, IT, and the Environment –Green computing: carbon foot print, scoop on power – Green IT Strategies: Drivers, Dimensions, and Goals –Environmentally Responsible Business: Policies, Practices ,and Metrics.	**08**	**CO1& CO2**

2	Green Assets: Buildings, Data Centers, Networks, and Devices – Green Business Process Management: Modeling, Optimization, and Collaboration	**08**	**CO3& CO4**
3	Green Enterprise Architecture: Environmental Intelligence – Green Supply Chains – Green Information Systems: Design and Development Models.	**08**	**CO3& CO4**
4	Socio-cultural aspects of Green IT :Green Enterprise Transformation Roadmap- Green Compliance: Protocols, Standards, and Audits – Emergent Carbon Issues: Technologies and Future.	**08**	**CO4& CO6**
5	The Environmentally Responsible Business Strategies (ERBS) – Case Study Scenarios for Trial Runs – Case Studies – Applying Green IT Strategies and Applications toHome, Hospital, Packaging Industry and Telecom Sector.	**08**	**CO5 &CO6**

TEXT BOOKS:

1. Bhuvan Unhelkar, ―Green IT Strategies and Applications-Using EnvironmentalIntelligence, CRC Press, June 2014.

REFERENCE BOOKS:

1. Alin Gales, Michael Schaefer, Mike Ebbers, ―Green Data Center: steps for the Journey,Shroff/IBM rebook, 2011.
2. John Lamb, ―The Greening of IT, Pearson Education, 2009.
3. Jason Harris, ―Green Computing and Green IT- Best Practices on regulations &industry, Lulu.com, 2008
4. Carl speshocky, ―Empowering Green Initiatives with IT, John Wiley & Sons, 2010.
5. Wu Chun Feng (editor), ―Green computing: Large Scale energy efficiency, CRC Press

CIE –Continuous Internal Evaluation Theory (50 Marks)

Bloom's Category	**Tests**	**Assignments**	**AAT1**	**AAT2**
Marks (Out of 50)	30	10	05	05
Remember	10			01
Understand	10	05	01	01
Apply	10	05	02	01
Analyze			02	
Evaluate				
Create				02

***AAT 1– Alternate Assessment Tool 1: Quiz**

AAT 2 - Alternate Assessment Tool 2: Surprise Test

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SCHEME OF TEACHING AND EXAMINATION 2018-2019

Department of Information Science and Engineering

SEE –Semester End Examination Theory (50 Marks)

Bloom's Category	**MarksTheory(50)**
Remember	05
Understand	10
Apply	10
Analyze	10
Evaluate	10
Create	05

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SCHEME OF TEACHING AND EXAMINATION 2018-2019
Department of Information Science and Engineering

CRYPTOGRAPHY AND NETWORK SECURITY

Course code: 19IS7DECNS **Credits: 03**
L: P: T: S: 3: 0: 0: 0 **CIE Marks: 50**
Exam Hours: 03 **SEE Marks: 50**
Total Hours: 40

Course Objectives:

1. To understand OSI security architecture and classical encryption techniques.
2. To acquire fundamental knowledge on the concepts IP and Email security.
3. To understand various block cipher and stream cipher models.
4. To describe the principles of public key cryptosystems, hash functions and digital signature.

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

CO1	Identify different types of attacks and encryption techniques
CO2	Design secure applications
CO3	Implement secure coding in the developed applications
CO4	Design various IP security technology.
CO5	Evaluate and apply various security services such as PGP, S/MIME, authentication, confidentiality and key management.
CO6	Design and distinguish between various symmetric and asymmetric encryption techniques.

Mapping of Course outcomes to Program outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	-	-	-	-	-	-	-	-	2	-	-	2
CO2	2	3	-	-	-	-	-	-	-	-	-	1	-	2	2
CO3	3	3	2	2	-	-	-	-	-	-	-	2	-	2	2
CO4	3	3	2	2	-	-	-	-	-	-	-	2	-	2	2
CO5	3	3	-	-	-	-	-	-	-	-	-	2	-	2	1
CO6	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**1**

Unit	Course Content	Hours	COs
1	**INTRODUCTION & NUMBER THEORY** Security Attacks, Services, Mechanisms Network security model. Symmetric Cipher Model ,Substitution Techniques- Ceaser cipher,	**8**	**CO1,CO6**

	Monoalphebetic cipher, Playfair cipher , Transposition Techniques, Groups, Rings, Fields-Modular arithmetic-Euclid's algorithm-Finite fields- Polynomial Arithmetic		
2	**Block Ciphers and the Data Encryption Standard:** Block cipher Principles, The Data Encryption Standard(DES) **Public-Key Cryptography and RSA:** Principles of Public-Key Cryptosystems, The RSA Algorithm-description of the algorithm **Other Public-Key Cryptosystems:**Diffie-hellman key exchange	**8**	**CO1,CO2,CO3**
3	**HASH FUNCTIONS AND DIGITAL SIGNATURES** Applications of Cryptographic Hash Functions . Two Simple Hash Functions, Hash Functions Based on Cipher Block Chaining,Secure Hash Algorithm (SHA), Digital Signatures , ElGamal Digital Signature Scheme, Digital Signature Standard (DSS)	**8**	**CO5,CO6**
4	**Key Management and Distribution:** Symmetric key distribution using Symmetric encryption, A key distribution scenario, Hierarchical key control, session key lifetime, a transparent key control scheme, Decentralized key control, Controlling key usage, Symmetric key distribution using Asymmetric encryption	**8**	**CO5,CO6**
5	**IP Security:**IP Security Overview; IP Security Policy; Encapsulating Security Payload; Combining Security Associations; **Firewalls:** Firewall Characteristics, Types of Firewalls, Firewall basing, Firewall Location and Configurations	**8**	**CO4**

Self study component:

Note: 1.Questions for CIE and SEE not to be set from self-study component.

2. Assignment Questions should be from self-study component only.

UNIT 1: A DES example, results, the avalanche effect, the strength of DES

UNIT 2: Elliptic curve cryptography, The algorithm, key exchange protocols, man in the middle attack

UNIT 3: Simple secret key distribution, secret key distribution with confidentiality and authentication

UNIT 4: Key Management and Distribution - User Authentication

UNIT 5: Electronic mailing service

TEXT BOOKS

1. William Stallings: Network Security Essentials: Applications and Standards, 6th Edition, Pearson Education, 2013.
2. Michael E. Whitman and Herbert J. Mattord: Principles of Information Security, 2nd Edition, Cengage Learning, 2005.

REFERENCE BOOKS

1. Behrouz A. Forouzan: Cryptography and Network Security, Special Indian Edition, Tata McGraw-Hill, 2007.
2. V k Pachghare: Cryptography and Information Security, 2013

Assessment Pattern:

CIE –Continuous Internal Evaluation Theory (50 Marks)

Bloom's Category	**Tests**	**Assignments**	**AAT1**	**AAT2**
Marks (Out of 50)	**30**	**10**	**05**	**05**
Remember	10			01
Understand	10	05	01	01
Apply	10	05	02	01
Analyze			02	
Evaluate				
Create				02

***AAT 1– Alternate Assessment Tool 1: Quiz**
AAT 2 - Alternate Assessment Tool 2: Surprise Test

SEE –Semester End Examination Theory (50 Marks)

Bloom's Category	**Marks Theory(50)**
Remember	10
Understand	20
Apply	10
Analyze	10
Evaluate	
Create	

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SCHEME OF TEACHING AND EXAMINATION 2018-2019
Department of Information Science and Engineering

DATABASE MANAGEMENT SYSTEMS

Course code: 19IS7IEDBS | **Credits: 03**
L: P: T: S: 3: 0: 0: 0 | **CIE Marks: 50**
Exam Hours: 03 | **SEE Marks: 50**
Total Hours: 40

Course Objectives:

1. Know the fundamentals of database management systems, transactions and related concepts
2. Study E-R model and relational model for designing database.
3. Understand normalization techniques for good database design.
4. Learn writing SQL queries for the given requirements.

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

CO1	Gain knowledge on database management systems, transactions and related concepts.
CO2	Apply E-R and relational modeling techniques for designing database.
CO3	Design good database using normalization techniques.
CO4	Gain skills in writing queries using SQL for the given requirements.
CO5	Understand basic issues of transaction processing and concurrency control.
CO6	Evaluate a business situation and designing & building a database applications

Mapping of Course outcomes to Program outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	-	2
CO2	3	2	1	-	-	-	-	-	-	-	-	-	-	-	2
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	-	2
CO4	3	2	-	-	-	-	-	-	-	-	-	-	-	-	2
CO5	3	2	-	-	-	-	-	-	-	-	-	-	-	-	2
CO6	3	2	2	-	-	-	-	-	-	-	-	-	-	-	1

Unit	Course Content	Hours	Cos
1	**Introduction:** Characteristics of Database approach; Actors on the scene; Workers behind the scene; Advantages of using DBMS approach; When not to use DBMS; Data models, schemas and instances; Three schema architecture and data independence; Database languages and Interfaces,	**8**	**CO1**

	Database System environment, Centralized and Client/Server architectures for DBMSs, Classification of Database management systems.		
2	**Entity-Relationship model**: Entity types, Entity Sets, Attributes and Keys; Relationship types, Relationship Sets, Roles and structural Constraints; Weak Entity types; ER Diagrams, Naming Conventions and Design issues; Relational Database Design Using ER-to-Relational mapping.	**8**	**CO2 CO6**
3	**Relational Model and SQL:** Relational Model Concepts; Relational Model constraints and Relational Database Schemas; update operations. SQL data definition and data types, Specifying constraints in SQL, Basic retrieval queries in SQL; Insert, Delete and Update statements in SQL; More complex SQL retrieval queries, Views (Virtual Tables) in SQL; Schema change statements in SQL.	**8**	**CO4**
4	**Relational Algebra**: Unary Relational Operations; SELECT and PROJECT; Relational Algebra Operations from Set Theory; Binary Relational Operations: JOIN and DIVISION; Additional Relational Operations; Examples of Queries in Relational Algebra.	**8**	**CO3**
5	**Database Design:** Informal Design Guidelines for Relation Schemas; Functional Dependencies; Normal Forms Based on Primary Keys; General Definitions of Second and Third Normal Forms; Boyce-Codd Normal form, Multivalued Dependency and Fourth Normal Form. Transactions and schedules.	**8**	**CO3 CO5**

Self-study component:

Note: 1. Questions for CIE and SEE not to be set from self-study component.

2. Assignment Questions should be from self-study component only.

UNIT 1: A brief history of database applications; Using High-Level Conceptual Data Models for Database Design

UNIT 2: An Example Database Application; Relational Algebra Operations from Set Theory; Examples of Queries in Relational Algebra

UNIT 3: Database programming issues and techniques; Embedded SQL, Dynamic SQL; Database stored procedures and SQL / PSM, More complex SQL Queries

UNIT 4: Algorithms for Relational Database Schema Design

UNIT 5: Introduction to ARIES; Recovering from a System Crash; Media Recovery.

TEXT BOOKS:

1. Elmasri and Navathe, Fundamental of Database Systems, 6th Edition, Addison-Wesley, 2011.
2. Silberschatz, Korth and Sudharshan, Database System Concepts, 6th Edition, McGrawHill, 2015.

REFERENCE BOOKS:

1. Hector Garcia-Molina, Jeffrey D. Ullman, Jennifer Widom, Database Systems: The Complete Book ,Second edition, Pearson, 2013.
2. SeemaKedar, Database Management Systems-A Conceptual Approach Technical Publications, 2014

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SCHEME OF TEACHING AND EXAMINATION 2018-2019
Department of Information Science and Engineering

SOFTWARE TESTING LAB

Course code: 19IS7DLSTL **Credits: 02**
L: P: T: S: 0: 2: 1: 0 **CIE Marks: 50**
Exam Hours: 03 **SEE Marks: 50**

Course objectives: **St**udents undergoing this course are expected to:

1. Understand the requirements for a given problem statement
2. Design and conduct a software test process for a software testing project
3. Use different software testing techniques to test the projects
4. Understand the usage of modern software testing tools

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

CO1	List out the requirements of any given project
CO2	Design and implement the solution for a given problem in any language
CO3	Develop qualitative test cases within project constraints
CO4	Analyze and apply the various types of testing under different scenarios
CO5	Create appropriate documents for the software
CO6	Understand and apply software testing tools and solutions

Mapping of Course outcomes to Program outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	3	3	-	-	-	-	-	-	-	-	-	-	2	-
CO3	3	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO4	2	1	1	-	-	-	-	-	-	-	-	-	-	3	-
CO5	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO6	3	2	2	-	2	-	-	-	-	-	-	-	-	3	-

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CHOICE BASED CREDIT SYSTEM (CBCS)
SCHEME OF TEACHING AND EXAMINATION 2018-2019

Department of Information Science and Engineering

Prog.	Program Description	Hours	CO's
PART A: DESIGNING AND EXECUTING TEST CASES USING MANUAL TESTING			
1.	Design and develop a program in a language of your choice to solve the triangle problem defined as follows: Accept three integers which are supposed to be the three sides of a triangle and determine if the three values represent an equilateral triangle, isosceles triangle, scalene triangle, or they do not form a triangle at all. Assume that the upper limit for the size of any side is 10. Derive test cases for your program based on boundary-value analysis, execute the test cases and discuss the results.	2	**CO1, CO2, CO3, CO6**
2.	Design, develop, code and run the program in any suitable language to implement the NextDate function. Analyze it from the perspective of boundary value testing, derive different test cases, execute these test cases and discuss the test results.	2	**CO1, CO2, CO3, CO6**
3.	Design, develop, code and run the program in any suitable language to solve the commission problem. Analyze it from the perspective of boundary-value analysis, derive different test cases, execute these test cases and discuss the test results.	2	**CO1, CO2, CO3, CO5**
4.	Design, develop, code and run the program in any suitable language to implement the NextDate function. Analyze it from the perspective of equivalence class testing, derive different test cases, execute these test cases and discuss the test results.	2	**CO1, CO2, CO3, CO6**
5.	Design, develop, code and run the program in any suitable language to solve the commission problem. Analyze it from the perspective of equivalence class testing, derive different test cases, execute these test cases and discuss the test results.	2	**CO1, CO2, CO3, CO5**
6.	Design and develop a program in a language of your choice to solve the triangle problem defined as follows: Accept three integers which are supposed to be the three sides of triangle and determine if the three values represent an equilateral triangle, isosceles triangle, scalene triangle, or they do not form a triangle at all. Derive test cases for your program based on decision-table approach, execute the test cases and discuss the results.	2	**CO1, CO2, CO3, CO5, CO6**
7.	Design, develop, code and run the program in any suitable language to solve the commission problem. Analyze it from the perspective of decision table-based testing, derive different test cases, execute these test cases and discuss the test results.	2	**CO1, CO2, CO3**
8.	Design, develop, code and run the program in any suitable language to solve the commission problem. Analyze it from the perspective of dataflow testing, derive different test cases, execute these test cases and discuss the test results.	2	**CO1, CO2, CO3, CO6**
9.	Design, develop, code and run the program in any suitable language to implement the binary search algorithm.	2	**CO1, CO2, CO3, CO6**

	Determine the basis paths and using them derive different test cases, execute these test cases and discuss the test results.		
10.	Design, develop, code and run the program in any suitable language to implement an absolute letter grading procedure, making suitable assumptions. Determine the basis paths and using them derive different test cases, execute these test cases and discuss the test results.	2	**CO1, CO2, CO3, CO6**
PART B: AUTOMATED TESTING			
11.	Using Selenium tool, generate a test plan document for any known application (Banking / Library Management system etc.)	2	**CO1, CO2, CO3, CO5, CO6**

TEXT BOOKS:

1. Paul C. Jorgensen: Software Testing, A Craftsman's Approach, 3rd Edition, Auerbach Publications, 2008. (Chap 1,2, chap 5-5.1, chap 6-6.1, chap 7-7.1, chap 9,10,12)

REFERENCE BOOKS:

1. Aditya P Mathur: Foundations of Software Testing, Pearson Education, 2008.
2. Mauro Pezze, Michal Young: Software Testing and Analysis – Process, Principles and Techniques, Wiley India, 2008.

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