SANJIVANI RURAL EDUCATION SOCIETY'S

SANJIVANI COLLEGE OF ENGINEERING KOPARGAON

(An Autonomous Institute Affiliated to SPPU Pune)

DEPARTMENT OF INFORMATION TECHNOLOGY

COURSE STRUCTURE AND SYLLABUS - 2020 PATTERN

SECOND YEAR B. TECH.

Sanjivani College of Engineering, Kopargaon
(An Autonomous Institute affiliated to SPPU, Pune)

DECLARATION

We, the Board of Studies **INFORMATION TECHNOLOGY**, hereby declare that, We have designed the Curriculum of **S .Y. B Tech.** of Pattern **2020** w.e.f. A.Y **2021-2022** as per the guidelines . So, we are pleased to submit and publish this FINAL copy of the curriculum for the information to all the concerned stakeholders.

Submitted by

BoS Chairman

Head
Department of Information Technology
SRES College of Engineering
Kopargaon MS - 423603

Approved by

Dean Academics

Director

PROFILE

Sanjivani College of Engineering (An Autonomous Institute), Kopargaon is one among the premier technical institutes in Maharashtra state in the un-aided sector established in 1983.Department of Information Technology is established in the year 2001 with an intake of 60 students. Department is acquainted with 8 well equipped laboratories with latest hardware and Software, 3 class rooms and one tutorial Hall equipped with modern teaching aids and computing facilities. UG Program in IT department is accredited by NBA New Delhi for Second time in Academic Year 2019-2020 for three Years.

There are 15 experienced & well qualified teaching staff members & 6 supporting staff members who carry out the regular academic activities as well as curricular & extracurricular activities as per the plans prepared in advance at the beginning of every semester.

In the academic year 2019-2020 strength of students in department is 275. Apart from regular academic activities students take part in curricular & co curricular activities conducted by department organization ITERA as well as other department's organization & professional bodies in the institute like CSI, ISTE, and IEEE etc. Apart from the central library the department has its own library with a very good collection of reference book, text books and CSI magazines, IEEE magazines.

Along with regular academics Department of IT has started value added courses like SAP Certification Training Programme in collaboration with Primus Techsystems Pvt. Ltd. Pune and REDHAT Academy Centre, MBPS Infotech Pune.

IT Department has started capsule courses to improve technical skill sets of students. Department is having very good placements in various renowned and multi-national companies like TCS, Infosys, Persistent, Cognizant Wipro and many more.

Also to form well balanced Industry Interaction connect and bridge the gap between Industry and institution Department of IT has organized different events like Sanjivani Though Leader, Sanjivani I-connect and Sanjivani My Story Board.

Various personal and professional skill development programs like Communication and Soft Skill programs, Aptitude Training, Technical Skill enhancement programs, Foreign Language Certification Courses, Personal and Spiritual Development Programs, Entrepreneurship Development Activities, and Preparation courses for competitive Examinations (Gate/GRE/CAT etc.) are made available in campus. Students are given opportunities to develop and nurture their leadership qualities through Student Associations, Student Council, Professional Body activities and working as volunteers in various events organized at Department/ College level.

VISION AND MISSION

Vision of Institute

To develop world class professionals through quality education.

Mission of Institute

To create Academic Excellence in the field of Engineering and Management through Education, Training and Research to improve quality of life of people.

Vision of Department

To develop world class IT professionals through quality education.

Mission of Department

To create Academic Excellence in the field of Information Technology through Education, Industry Interaction, Training and Innovation to improve quality of life of people.

We are committed to develop industry competent technocrats with life-long learning capabilities and moral values.

PROGRAM EDUCATIONAL OBJECTIVES

PEO 1:

Graduates of IT program should possess knowledge of fundamental concepts in mathematics, science, engineering and technology as well as skills in the field of Information Technology for providing solution to complex engineering problem of any domain by analyzing, designing and implementing.

PEO 2:

Graduates of IT program should possess better communication, presentation, time management and teamwork skills leading to responsible and competent research, entrepreneurship and professionals, will be able to address challenges in the field of Information Technology at global level.

PEO 3:

Graduates of IT program should have commitment to societal contributions through communities and life-long learning.

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

PROGRAM SPECIFIC OUTCOMES
PSO1:
Attain the ability to provide software solutions by applying knowledge of Data Structures & Algorithms, Databases, Web Technology, System Software, Soft Computing and Cloud Computing.
PSO2:
Apply the knowledge of Computer Hardware & Networking, Cyber Security, Artificial Intelligence and Internet of Things to effectively integrate IT based solutions.
PSO3:
Apply the knowledge of best practices and standards of Software Engineering for Project Management.

DEPARTMENT OF INFORMATION TECHNOLOGY

COURSE STRUCTURE AND SYLLABUS - 2020 PATTERN

SECOND YEAR B. TECH.

LIST OF ABBREVIATIONS			
Abbreviation	**Full Form**	**Abbreviation**	**Full Form**
ES	Engineering Science	HSMC	Humanity Science
PC	Professional Core	CA	Continuous Assessment
PE	Professional Elective	OR	End Semester Oral Examination
OE	Open Elective	PR	End Semester Practical Examination
ISE	In-Semester Evaluation	TW	Continuous Term work Evaluation
ESE	End-Semester Evaluation	BSC	Basic Science Course
PRJ	Project	MC	Mandatory Course

SEMESTER - III

Course		Course Title	Teaching Scheme Hours/ Week			Credits	Evaluation Scheme - Marks						
							Theory			OR	PR	TW	Total
Cat.	Code		L	T	P		ISE	ESE	CA				
PC	IT201	Discrete Mathematics	3	1	-	4	30	50	20	-	-	-	100
PC	IT202	Digital Electronics & Computer Organization	4	-	-	4	30	50	20	-	-	-	100
PC	IT203	Fundamentals of Data Structures	3	-	-	3	30	50	20	-	-	-	100
PC	IT204	Object Oriented Programming	3	-	-	3	30	50	20	-	-	-	100
HS MC	HS205	Universal Human Values And Ethics	3	-	-	3	30	50	20	-	-	-	100
PC	IT206	Digital Electronics Laboratory	-	-	2	1	-	-	-	-	-	50	50
PC	IT207	Fundamental of Data Structure Laboratory	-	-	2	1	-	-	-	-	50	-	50
PC	IT208	Object Oriented Programming Laboratory	-	-	2	1	-	-	-	50	-	-	50
MC	MC209	Mandatory Course-III	2	-	-	NON Credit	-	-	-	-	-	-	-
		Total	18	1	6	20	150	250	100	50	50	50	650

MC209	Mandatory Course-III	Constitution of India – Basic features and fundamental principles

SEMESTER - IV

Course		Course Title	Teaching Scheme Hours/ Week			Credits	Evaluation Scheme – Marks						
							Theory			OR	PR	TW	Total
Cat.	Code		L	T	P		ISE	ESE	CA				
PC	IT210	Microprocessor & Microcontroller	4	-	-	4	30	50	20	-	-	-	100
PC	IT211	Database Management System	3	-	-	3	30	50	20	-	-	-	100
BS	BS202	Engineering Mathematics - III	4	-	-	4	30	50	20	-	-	-	100
PC	IT213	Data Structures & Files	4	-	-	4	30	50	20	-	-	-	100
PC	IT214	Database Management System Laboratory	-	-	2	1	-	-	-	-	-	50	50
PC	IT215	Microprocessor & Microcontroller Laboratory	-	-	2	1	-	-	-	50	-	-	50
PC	IT216	Data Structures & Files Laboratory	-	-	2	1	-	-	-	-	50	-	50
PRJ	IT217	Seminar	2	-	-	2	-	-	-	50	-	-	50
PRJ	IT218	Mini Project	-	-	4	2	-	-	-	-	-	50	50
MC	MC219	Mandatory Course-IV	2	-	-	NON Credit	-	-	-	-	-	-	-
		Total	19	-	10	22	120	200	80	100	50	100	650

MC219	Mandatory Course-IV	Innovation - Project based – Sc., Tech, Social, Design & Innovation

Total Credits: 42

Total Marks: 1300

S.Y. B. Tech Information Technology Semester III

IT201: Discrete Mathematics		
Teaching Scheme	**Examination Scheme**	
Lectures: 3 Hrs./Week	**Continuous Assessment:**	**20 Marks**
Tutorial: 1 Hr/Week	**In-Sem Exam:**	**30 Marks**
	End-Sem Exam:	**50 Marks**
Credits: 4	**Total:**	**100 Marks**
Prerequisite Course: Basic Mathematics		

Course Objectives

1. To provide the knowledge of Set, proof techniques and determine logical possibilities.
2. To understand relation, functions among various entities in real world.
3. To introduce the basic of Group and Ring.
4. To learn to formulate problems mathematically using graph theory.
5. To understand the fundamental mathematics requirement used in cryptographic algorithms.
6. To comprehend the concept of decodability and prefix-free property.

Course Outcomes (COs):

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

	Course Outcome (s)	Bloom's Taxonomy	
		Level	**Descriptor**
CO1	**Apply**the basic terminology of set, proof techniques and determine logical possibilities in a given situation.	3	Apply
CO2	**Understand** relations & functions and to determine their properties.	2	Understand
CO3	**Solve** problems based on Group and Rings.	3	Apply
CO4	**Demonstrate** the Information Theory.	3	Apply
CO5	**Understand** the fundamental mathematical requirement of cryptographic algorithms.	2	Understand
CO6	**Understand** the basics of Statistics and Probability	2	Understand

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

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

Course Contents			
Unit-I	**COMBINATORICS**	**No. of Hours**	**COs**
	Sets, Combinations of sets, Venn Diagrams, Finite and Infinite sets, Uncountable infinite sets, Principle of inclusion and exclusion, multisets. Propositions, Conditional Propositions, Logical Connectivity, Propositional calculus, Universal and Existential Quantifiers, Normal forms, methods of proofs, Mathematical Induction.	06	CO1
Unit-II	**RELATIONS AND FUNCTIONS**	**No. of Hours**	**COs**
	Relations : Binary Relations, Closure of relations, Warshall's algorithm, Equivalence Relations and partitions, Partial ordering relations and lattices, Chains and Anti chains. Recurrence Relation, Linear Recurrence Relations With constant Coefficients, Generating functions. **Regression Analysis**: Linear, Logistic and Polynomial Regression **Function** Functions, Composition of functions, Invertible functions, Pigeonhole Principle, Discrete Numeric functions and Generating functions, Job scheduling Problem.	06	CO2
Unit-III	**GROUPS, SEQUENCES AND SUMMATIONS**	**No. of Hours**	**COs**
	Group Theory: Elementary properties, subgroups, cosets, normal groups, quotient groups, cyclic groups, homomorphism and isomorphism, Isomorphism theorem, permutation groups, Sylow's theorem and application, Application to Number theory: Lagrange's theorem, Euler's theorem, Fermat's theorem. **Sequences and summations:** Arithmetic progression, Geometric progression, Recursively defined sequences, Fibonacci sequence, Summations, Arithmetic series, Double summations, Geometric series and Infinite geometric series.	06	CO3
Unit-IV	**INFORMATION THEORY**	**No. of Hours**	**COs**
	Information sources and entropy, Relative entropy, Joint and conditional entropy, mutual information, Lossless Source Coding with Variable Codeword Lengths, Best prefix-free codes, Huffman codes, Lossy Source Coding with Fixed Codeword Lengths, Channel Coding and Cyclic Codes.	06	CO4
Unit-V	**INTEGER FOUNDATIONS**	**No. of Hours**	**COs**
	Rings and fields: Rings, Ideals, maximal ideals, quotient rings, Integral domains, principal ideal domain(PID), Euclidean domain(ED), ring of integers as example of PID and ED, Euclidean algorithm for GCD, extended Euclidean algorithm, finding modular inverse of an integer, Chinese Remainder Theorem(CRT), Euler's φ-function, quadratic residues.	06	CO5
Unit-VI	**INTRODUCTION TO STATISTICS AND PROBABILITY**	**No. of Hours**	**COs**
	Statistics, notion of probability, distributions, mean, variance, covariance, covariance matrix, understanding univariate and multivariate normal distributions, introduction to hypothesis testing, confidence interval for	06	CO6

	estimates, Simple linear regression and verifying assumptions used in linear regression, Multivariate linear regression, model assessment, assessing importance of different variables, subset selection.		

Text Books:

1. S. K. Chakraborty, B.K. Sarkar, "Discrete Mathematics and its Applications", Oxford University Press 2011, ISBN9780198065432.
2. C. L. Liu and D. P. Mohapatra, "Elements of Discrete Mathematics", McGraw Hill 4th Edition.

Reference Books:

1. N. Biggs, "Discrete Mathematics", Oxford University Press, 2nd Edition.
2. Singh, "Discrete Mathematical Structures", Wiley ISBN- 9788126527908.
3. Eric Gossett, "Discrete Mathematics with Proof", Wiley 2nd Edition ISBN-9788126527588.
4. Edgar G. Goodaire and Michael M. Parmenter, "Discrete Mathematics with Graph Theory", Pearson Education 3rd Edition, ISBN-13978013167995.
5. Richard Johnsonbaugh, "Discrete Mathematics", Pearson Education, 7th Edition ISBN: 9332535183.

IT202: Digital Electronics & Computer Organization

Teaching Scheme	Examination Scheme	
Lectures: 4 Hrs./Week	**Continuous Assessment:**	**20 Marks**
	In-Sem Exam:	**30 Marks**
	End-Sem Exam:	**50 Marks**
Credits: 4	**Total:**	**100 Marks**

Prerequisite Course: Basic Electronics Engineering, Fundamental of Programming Languages

Course Objectives

1. To design and implement combinational logic circuits.
2. To design and implement sequential logic circuits.
3. To develop VHDL programs.
4. To understand processor organization.
5. To understand memory and I/O Organization.
6. To understand parallel organization..

Course Outcomes (COs):

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

Course Outcome (s)		Bloom's Taxonomy	
		Level	**Descriptor**
CO1	**Design** and implementcombinational logic circuits.	3	Apply
CO2	**Design** and implement sequential logic circuits.	3	Apply
CO3	**Develop** VHDL programs.	3	Apply
CO4	**Understand** processor organization.	2	Understand
CO5	**Understand** memory and I/O Organization.	2	Understand
CO6	**Understand** parallel organization.	2	Understand

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

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

Course Contents			
Unit-I	**COMBINATIONAL LOGIC CIRCUITS**	**No. of Hours**	**COs**
	Number Systems, Boolean Algebra & Logic Minimization, Design of code converters, Design of adders, Multiplexers, Demultiplexer/ Decoders, Encoder.	06	CO1
Unit-II	**SEQUENTIAL LOGIC CIRCUITS**	**No. of Hours**	**COs**
	Introduction to sequential circuits, Flip- Flops, Design of Counters, Modulo counters. Registers, Design of sequence Generator, Pseudo Random Binary Sequence Generator Introduction to SPLD, CPLD, FPGA	06	CO2
Unit-III	**INTRODUCTION TO VHDL PROGRAMMING**	**No. of Hours**	**COs**
	Design flow: Basic Concept of Simulation and Synthesis Introduction to VHDL, Data Objects, Data Types, Attributes, Models of Design, Concurrent Statements Vs Sequential Statements, Design of Digital Circuits	06	CO3
Unit-IV	**PROCESSOR ORGANIZATION**	**No. of Hours**	**COs**
	Computer Evolution, Computer Performance, RISC Vs CISC, Building Data Paths , Pipelined Datapath and Control **Data Hazards:** Forwarding versus Stalling, Control Hazards	06	CO4
Unit-V	**MEMORY AND I/O ORGANIZATION**	**No. of Hours**	**COs**
	Introduction, The Basics of Caches, Measuring and Improving Cache Performance, Virtual Memory, A Common Framework for Memory Hierarchies, Virtual Machines, Parallelism and **Memory Hierarchies:** Cache Coherence, Connecting Processors, Memory, and I/O Devices. Interfacing I/O Devices to the Processor, Memory, and Operating System	06	CO5
Unit-VI	**PARALLEL ORGANIZATIONS**	**No. of Hours**	**COs**
	Introduction, The Difficulty of Creating Parallel Processing Programs, Shared Memory Multiprocessors, Clusters and Other Message-Passing Multiprocessors, Hardware Multithreading, SISD, MIMD, SIMD, SPMD, and Vector, Introduction to Graphics Processing Units, Introduction to Multiprocessor Network Topologies, Multiprocessor Benchmarks	06	CO6

Text Books:

1. M Morris Mano, "Digital Design", Prentice Hall, 3rd Edition, ISBN: 0130621218.
2. Mano, M. Morris, "Digital Design: with an Introduction to the Verilog HDL, VHDL, System Verilog", 6th Edition, Pearson.
3. D. Patterson, J. Hennessy, "Computer Organization and Design: The Hardware Software Interface", 4th Edition, 2013, ISBN 978-0-12-374750-1.
4. W. Stallings, "Computer Organization and Architecture: Designing for Performance", Prentice Hall of India, 8th Edition, 2010, ISBN 13: 978-0-13-607373-4.

Reference Books:

1. Flyod, “Digital Principles”, Pearson EducationISBN:978-81- 7758-643-6.
2. John Yarbrough, “Digital Logic applications and Design”, Thomson Publication ISBN: 978-0314066756.
3. Malvino, D. Leach, “Digital Principles and Applications”, 5th edition, Tata McGraw Hill
4. R.P. Jain, “Modern Digital Electronics “, 3rd Edition, Tata McGraw-Hill, ISBN: 0–07–049492–4.
5. Stephen Brown, ZvonkoVranesic, “Fundamentals of Digital Logic with VHDL Design”, McGraw- Hill, ISBN: 978–0–07–352953–0.
6. J. Bhaskar, “VHDL Primer”, Pearson Education,3rd Edition, ISBN: 0071226249
7. C. Hamacher, V. Zvonko, S. Zaky, “Computer Organization”, McGraw Hill,5th edition, 2002, ISBN: 007-120411-3.
8. M. Usha, T. S. Srikanth, “Computer System Architecture and Organization”, Wiley, 2014, ISBN: 978-81-265-2284-2.
9. A. S. Tanenbaum, “Structured Computer Organization”, Prentice Hall of India, 4th Edition, 1991, ISBN: 81–203–1553–7.
10. J. Hays, “Computer Architecture and Organization”, McGraw-Hill, 2nd Edition, 1988 ISBN 0–07–100479–3.

IT203: Fundamentals of Data Structures		
Teaching Scheme	**Examination Scheme**	
Lectures: 3 Hrs./Week	**Continuous Assessment:**	**20 Marks**
	In-Sem Exam:	**30 Marks**
	End-Sem Exam:	**50 Marks**
Credits: 3	**Total:**	**100 Marks**
Prerequisite Course: Computer Fundamentals & Programming CFP-105		

Course Objectives

1. To learn linear data structure and its application.
2. To learn dynamic memory allocation concepts.
3. To learn fundamentals of data structure and its applications.
4. To learn algorithm design technique with time and space complexity.
5. To learn concept of linked organization for problem solving and programming.
6. To learn the Stack and Queue data structure

Course Outcomes (COs):

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

	Course Outcome (s)	Bloom's Taxonomy	
		Level	Descriptor
CO1	**Apply** appropriate constructs of C language, coding standards for application development.	3	Apply
CO2	**Select** appropriate data structures and algorithmic foundations for problem solving and programming.	3	Apply
CO3	**Apply** appropriate searching and/or sorting techniques in the application development.	3	Apply
CO4	**Use** dynamic memory allocation concepts in various application developments,	3	Apply
CO5	**Analyze** the Stack as Linear and Nonlinear data structure on various applications.	4	Analyze
CO6	Use the Queue as data structure in various ways.	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

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

Course Contents			
Unit-I	**POINTERS**	**No. of Hours**	**COs**
	Multidimensional arrays, Array of structures, storage representation & address calculation of Multidimensional Array, Introduction to Pointers, Dynamic Memory Allocation: malloc(), calloc(), realloc(), free(), pointer to pointer, pointer to single and multidimensional arrays, array of pointers, pointers to string & C string functions using pointers, Structure using pointers, Pointers to functions.	06	CO1
Unit-II	**FUNDAMENTALS OF DATA STRUCTURE**	**No. of Hours**	**COs**
	Fundamentals: Data structure, Abstract Data Types, realization of ADT in 'C'. Types of data structure: Primitive non-primitive, linear Non-linear, static dynamic, persistent ephemeral data structures. Performance Analysis of Algorithm: Space Complexity, Time Complexity.	05	CO2
Unit-III	**SEARCHING & SORTING**	**No. of Hours**	**COs**
	Searching Algorithms: Linear Search, Binary search their comparison. Internal and external sorting, Sorting Algorithms: Bubble Sort, Selection Sort, Quick Sort, Insertion Sort, and Merge Sort. Time complexity of all sorting algorithms and their comparison.	07	CO3
Unit-IV	**LINKED ORGANIZATION**	**No. of Hours**	**COs**
	Linked organization, Types of Linked List: Singly Linked List, Doubly Linked List, Circular Linked List. Linked list as an ADT. Polynomial representation using linked lists.	06	CO4
Unit-V	**STACK**	**No. of Hours**	**COs**
	Concept of Sequential organization. Introduction to Stack, Implementation of Stack using sequential organization. Implementation of Stack using Linked organization, Concept of implicit and explicit stack. Applications: Infix to postfix conversion, infix to prefix conversion, Evaluation of prefix and postfix expression, decimal to binary conversion, well-formedness of parenthesis.	06	CO5
Unit-VI	**QUEUE**	**No. of Hours**	**COs**
	Concept of queues as ADT, Implementation of queue using sequential & linked organization. Concept of circular queue and its implementation, Concept of double ended queue and its implementation, Concept of priority queue. Applications of queues.	06	CO6

Text Books:

1. Ellis Horowitz, SartajSahni, Susan Anderson-Freed “Fundamentals of Data Structures in C”, Universities Press, 2008.
2. Richard F. Gilberg&Behrouz A. Forouzan, “Data Structures: A Pseudocode Approach with C, Second Edition”, Cengage Learning.

Reference Books:

1. Robert Sedgewick and Kevin Wayne, “Algorithms” 4th Edition; Pearson Education,

ISBN-13: 978-0321573513.
2. E. Horowitz, S. Sahni, D. Mehta, “Fundamentals of Data Structures in C”, Galgotia Book
3. Y. Langsam, M. Augenstin, A. Tannenbaum, “Data Structures using C and C++”, Prentice Hall of India.
4. Aaron Tanenbaum, “Data Structures using C”, Pearson Education.
5. Goodrich, “Data Structures and Algorithms in C++”, Wiley.
6. YashavantKanetkar, “Understanding Pointers in C”, BPB Publication.
7. YashavantKanetkar, “Let Us C”, BPB Publication.

IT 204: Object Oriented Programming

Teaching Scheme	Examination Scheme	
Lectures: 3 Hrs./Week	**Continuous Assessment:**	**20 Marks**
	In-Sem Exam:	**30 Marks**
	End-Sem Exam:	**50 Marks**
Credits: 3	**Total:**	**100 Marks**
Prerequisite Course: Computer Fundamentals & Programming CFP-105.		

Course Objectives

1. To understand the basics of Object Oriented Programming using C++.
2. To understand the principles and techniques of Object Oriented Programming.
3. To write a program using classes and objects.
4. To develop C++ classes using Overloading and Inheritance.
5. To use memory allocation and exception handling features.
6. To apply standard template library for problem solving

Course Outcomes (COs):

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

Course Outcome (s)		Bloom's Taxonomy	
		Level	**Descriptor**
CO1	**Understand** the basics of Object Oriented Programming using C++.	2	Understand
CO2	**Understand** the principles and techniques of Object Oriented Programming.	2	Understand
CO3	**Write** a program using classes and objects.	3	Apply
CO4	**Develop** C++ classes using Overloading and Inheritance.	3	Apply
CO5	**Use** memory allocation and exception handling features.	3	Apply
CO6	**Apply** standard template library for problem solving	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

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

Course Contents			
Unit-I	**INTRODUCTION TO C++**	**No. Of Hours**	**COs**
	C++ Syntax and Semantics, The program development process, Numeric Types, expressions and Output in C++, Macros, Enumerations, Strings, Signatures of functions, passing variables to functions - Reference vs. pointers, Reference vs. value, Keyword const, Default arguments.	06	CO1
Unit-II	**OBJECT-ORIENTED PROGRAMMING BASICS**	**No. of Hours**	**COs**
	Basic class design principles - collaborations and responsibilities; separating interface and implementation; decoupling. Object-oriented principles and techniques - using a polymorphic class hierarchy; abstract base classes for common interface. Major object-oriented idioms and design patterns - providing extensibility and code stability simultaneously.	06	CO2
Unit-III	**CLASSES AND OBJECTS**	**No. Of Hours**	**COs**
	Structures, Pointers to structures, Classes- private and public members, Constructors – Types of constructors, Destructors, The this pointer, Friend functions, Friend classes Conditions, Logical Expressions and Selection Control Structures, Loops, functions, structured types, data abstraction and classes, Arrays, Default parameters, references, bidirectional function parameters.	06	CO3
Unit-IV	**OVERLOADING AND INHERITANCE**	**No. Of Hours**	**COs**
	Pointers to overloaded functions, Overloading constructors, Operator overloading, overloading binary operators, Overloading unary operators, overloading using friend operators, Inheritance, types of inheritance, Constructors, destructors and inheritance, Pointers to derived classes, Virtual functions, Friend functions and inheritance, Polymorphism.	6	CO4
Unit-V	**MEMORY ALLOCATION**	**No. Of Hours**	**COs**
	Dynamic allocation and memory management, destructors, Exception handling, Introduction to the STL, Implementation of basic data structures such as linked lists, stacks, and queues using C++.	6	CO5
Unit-VI	**TEMPLATE**	**No. Of Hours**	**COs**
	Templates, C++ Standard library, Programming for efficiency and Testability, performance measurement, and debugging, standard library string and vector, Stream.	6	CO6

Text Books:

1. E. Balagurusamy, Object Oriented Programming with C++, McGraw Hill Edition 5th Edition.

Reference Books:

1. Bjarne Stroustrup, “The C++ Programming Language”, 4th Edition ISBN-13: 978-0321563842.
2. Erich Gamma, Richard Helm, Ralph Johnson, John Vlissides, “Design Pattern-Elements of Reusable Object Oriented Programming”, Pearson.
3. Alice E. Fischer and David W. Eggert, “Applied C and C++ Programming”, University of New Haven, and Michael J. Fischer, Yale University, August 2018.

4. Dale. N and Weems. C., "Programming and Solving with C++", 4th Edition Jones and Bartlett Publishers, 2004.
5. Daniel Du_y, "Introduction to C++ for Financial Engineers: An Object-oriented Approach", 2006.
6. Steve Oualline, "Practical C++ Programming", 1995.
7. Andrew Haigh, "Object Oriented Analysis & Design", Tata McGraw Hill Edition.
8. Herbert Schildt, "Teach Yourself C++", 1992.
9. Jesse Liberty, "Teach Yourself C++ in 24 hours", 1999.
10. Schildt. H., "C++ from the Ground up", 2nd Edition, Osborne McGraw-Hill, 1998.
11. Shtern. V, "Core C++ A Software Engineering Approach", Prentice Hall Publisher, 2000.
12. Mary Delemater, Joel Murach, "Murach's C++ Programming", Pub 2018 ISBN: 9781-943872-27-5.
13. Bjarne Stroustrup, "A Tour of C++ (C++ In-Depth)", 1st Edition, ISBN-13: 978-0321958310.
14. Stanley Lippman, "C++ Primer", 5th Edition ISBN-13: 978-0321714114.

HS205: UNIVERSAL HUMAN VALUES AND PROFESSIONAL ETHICS

Teaching Scheme	Examination Scheme	
Lectures: 3 Hrs./Week	Continuous Assessment:	20 Marks
	In-Sem Exam:	30 Marks
	End-Sem Exam:	50 Marks
Credits: 3	Total:	100 Marks

Course Objectives

1. To make the students aware about the concept and need of value education.
2. To help the students appreciate the essential complementarity between values and skills to ensure sustained happiness and prosperity.
3. To facilitate the development of a holistic perspective among the students towards life and profession.
4. To facilitate the understanding of harmony at various levels staring from self and going towards family, society and nature.
5. To make the students aware about the correlation between engineering ethics and social experimentation in various situations.
6. To highlight the importance of professional ethics in the wake of global realities.

Course Outcomes (COs):

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

	Course Outcome (s)	Bloom's Taxonomy	
		Level	Descriptor
CO1	**Understand** the concept of self exploration as the process of value education.	2	Understand
CO2	**Understand** the human being as the coexistence of self and body.	2	Understand
CO3	**Apply** the holistic approach for fulfilling human aspirations for the humans to live in harmony at various levels.	3	Apply
CO4	**Analyze** the universal human order in correlation with professional ethics.	4	Analyze
CO5	**Apply** ethical practices in engineering profession.	3	Apply
CO6	**Evaluate** the importance of various ethical practices in the wake of global realities.	5	Evaluate

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

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

Course Contents			
Unit-I	**INTRODUCTION TO VALUE EDUCATION**	**No. of Hours**	**COs**
	Values, Morals and Ethics; Concept and need of value education; Self-exploration as the process for value education; Guidelines for value education; Basic human aspirations and their fulfillment.	06	CO1
Unit-II	**HARMONY IN HUMAN BEING**	**No. of Hours**	**COs**
	Human being as the coexistence of self and the body; Discrimination between the needs of the self and the body; The body as an instrument; Harmony in the self; Harmony of the self with the body.	06	CO2
Unit-III	**HARMONY IN THE FAMILY, SOCIETY AND NATURE**	**No. of Hours**	**COs**
	Harmony in the family- The basic unit of human interaction; Values in the human to human relationship; Harmony in the society; Vision for the universal human order; Harmony in the nature; Realizing existence as coexistence at all levels.	06	CO3
Unit-IV	**PROFESSIONAL ETHICS**	**No. of Hours**	**COs**
	Natural acceptance of human values; Definitiveness of ethical human conduct; Humanistic education and universal human order; Competence in professional ethics; Transition towards value-based life and profession.	06	CO4
Unit-V	**ENGINEERING ETHICS AND SOCIAL EXPERIMENTATION**	**No. of Hours**	**COs**
	Need of engineering ethics; Senses of engineering ethics; Variety of moral issues; Moral autonomy; Utilitarianism; Engineering as experimentation. Engineers as responsible experimenters; Codes of ethics.	06	CO5
Unit-VI	**GLOBAL ISSUES**	**No. of Hours**	**COs**
	Globalization and multi-national corporations; Cross-cultural issues; Business ethics; Environmental ethics; Computer ethics; Bio-ethics; Ethics in research; Intellectual property rights and plagiarism.	06	CO6

Text Books:

1. R. R. Gaur, R. Sangal, G. P. Bagaria, "A Foundation Course in Human Values and Professional Ethics", Excel Books Pvt. Ltd.
2. R. S. Naagarazan, "A Textbook on Professional Ethics and Human Values", New Age International (P) Ltd. Publishers.

Reference Books:

1. B. P. Banerjee, "Foundations of Ethics and Management", Excel Books Pvt. Ltd.
2. P. L. Dhar, R. R. Gaur, "Science and Humanism", Commonwealth Publishers.
3. M. K. Gandhi, "The Story of my Experiments with Truth", Discovery Publisher.
4. http://uhv.org.in/.

Considering the specific nature of this course, the methodology is explorational and thus universally adaptable. In order to connect the content of this course with practice, minimum 6 group activities should be conducted with active involvement of the students. The teacher's assessment should be strictly based on the participation of the students in these activities.

IT206 : Digital Electronics Laboratory

Teaching Scheme	Examination Scheme	
Lectures: 2 Hrs./Week	**Term Work:**	**50 Marks**
	Oral :	**NA**
	Practical:	**NA**
Credits: 1	**Total:**	**50 Marks**

Prerequisite Course: Basic Electronics Engineering

Course Objectives

1. To design Combinational logic circuits using SSI & MSI chips.
2. To design Asynchronous and Synchronous Counters, MOD Counters.
3. To implement and simulate using different modelling styles digital circuits in VHDL.
4. To use digital circuit simulator to simulate digital circuits.

Course Outcomes (COs):

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

Course Outcome (s)		Bloom's Taxonomy	
		Level	**Descriptor**
CO1	**Design** Combinational logic circuits using SSI & MSI chips.	3	Apply
CO2	**Design** Asynchronous and Synchronous Counters, MOD Counters.	3	Apply
CO3	**Implement** and **Simulate** using different modelling styles digital circuits in VHDL.	3	Apply
CO4	**Use** Digital circuit simulator to simulate digital circuits.	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

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

Guidelines: This Digital Laboratory course has Digital Electronics & Logic Design as a core subject. The problem statements should be framed based on Group A, B, C, D mentioned in the syllabus. The teacher will frame the problem statements with due consideration that students have two hours to complete that. The practical examination will comprise of implementation and related theory. All assignments From Group A & Group B are to be performed on Digital Trainer Kit and from Group C are to be performed on Xilinx software.

Term work: Staff in-charge will suitably frame the above assignments and flexibility may be incorporated. Students will submit term work in the form of journal. Each assignment has to be well documented with problem definition, code documented with comments. Staff in-charge will assess the assignments continuously and grade or mark each assignment on completion date. All the assignments should be conducted on Digital Trainer Kit, Latest version of Open Source Operating Systems and tools.

Suggested List of Assignments

Group A	**COMBINATIONAL LOGIC DESIGN**	**No. of Hours**	**COs**
1	Assignment on Code Conversion using Gates.	2	CO1
2	Assignment on Adder.	2	CO1
3	Assignment on Multiplexer & Decoder.	2	CO1
Group B	**SEQUENTIAL LOGIC DESIGN**	**No. of Hours**	**COs**
4	Assignment on Up and Down Asynchronous/Synchronous Counters.	2	CO2
5	Assignment on Module ‘n’ Counter.	2	CO2
Group C	**VHDL PROGRAMMING (**Implement any two from this group)	**No. of Hours**	**COs**
7	Simulation using Behavioral Modeling.	2	CO3
8	Simulation using Data Flow & Structural Modeling.	2	CO3
9	Simulation of Counter/Shift Registers. (Use any modeling Style)	2	CO3
Group D	**DIGITAL SIMULATION TOOLS**	**No. of Hours**	**COs**
10	Design, construct digital logic circuits and analyze their behavior through simulation of any one assignment from either Group A or Group B with simulation software like Digital Works 3.0	2	CO4

Text Books:

1. R.P. Jain, “Modern Digital Electronics”, 3rd Edition, Tata McGraw-Hill, ISBN: 0–07–049492–4.
2. J. Bhaskar, “VHDL Primer”, Pearson Education, 3rd Edition, ISBN: 0071226249.

Reference Books:

1. Stephen Brown, ZvonkoVranesic, "Fundamentals of Digital Logic with VHDL Design", McGraw-Hill, ISBN: 978-0-07-352953-0.
2. John Yarbrough, "Digital Logic applications and Design", Thomson Publication, ISBN: 978-0314066756.

IT207 : Fundamental of Data Structure Laboratory

Teaching Scheme	Examination Scheme	
Lectures: 2 Hrs./Week	**Term Work:**	**NA**
	Oral :	**NA**
	Practical:	**50 Marks**
Credits: 1	**Total:**	**50 Marks**

Prerequisite Course: Computer Fundamentals and Programming

Course Objectives

1. To apply knowledge of pointers in different application development.
2. To apply appropriate sorting and searching techniques in the application development.
3. To implement Linear data structures and Use it for different applications.

Course Outcomes (COs):

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

Course Outcome (s)		Bloom's Taxonomy	
		Level	**Descriptor**
CO1	**Apply** knowledge of pointers in different application development.	3	Apply
CO2	**Apply** appropriate sorting and searching techniques in the application development.	3	Apply
CO3	**Implement** Linear data structures and **Use** it for different applications.	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

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

Guidelines: This Fundamentals of Data Structures Laboratory course has Fundamentals of Data Structures as a core subject. The problem statements should be framed based on assignments mentioned in the syllabus. The teacher will frame the problem statements with due consideration that students have three hours to complete that. The practical examination will comprise of implementation and related theory. All assignments are to be performed in C Language or C++.
Use of open source platform and tools is encouraged

Term work: Staff in-charge will suitably frame the above assignments and flexibility may be incorporated. Students will submit term work in the form of journal. Each assignment has to be well documented with problem definition, code documented with comments. Staff in-charge will assess the assignments continuously and grade or mark each assignment on completion date. All the assignments should be conducted in C or C++ Language

Suggested List of Assignments

Sr. No.	Assignment	No. of Hours	COs
1.	Assignment based on matrix operations using pointer.	2 Hrs.	CO1
2.	Assignment based on string operations using pointer.	2 Hrs.	CO1
3.	Assignment based on array of structures using with and without pointers.	2 Hrs.	CO1
4.	Assignment based on Linear or Binary Search.	2 Hrs.	CO2
5.	Assignment based on Bubble Sort or Selection Sort.	2 Hrs.	CO2
6.	Assignment based on Quick Sort or Insertion Sort.	2 Hrs.	CO2
7.	Assignment based on Implementation of Stack and Queue and Circular Queue using array.	4 Hrs.	CO3
8.	Assignment based on implementation Singly Linked list, DLL and Circular LL.	4 Hrs.	CO3
9.	Assignment based on applications of Stack & Queue.	4 Hrs.	CO3
10.	Assignment based on Implementation of Stack and Queue using Linked List.	4 Hrs.	CO3

Text Books:

1. Ellis Horowitz, SartajSahni, Susan Anderson-Freed, “Fundamentals of Data Structures in C”, Universities Press, 2008.
2. Richard F. Gilberg&Behrouz A. Forouzan, “Data Structures: A Pseudocode Approach with C, Second Edition”, Cengage Learning.

Reference Books:

1. Y. Langsam, M. Augenstin, A. Tannenbaum, “Data Structures using C and C++”, Prentice Hall of India.
2. Aaron Tanenbaum, “Data Structures using C”, Pearson Education.
3. Goodrich, “Data Structures and Algorithms in C++”, Wiley.
4. YashavantKanetkar, “Understanding Pointers in C”, BPB Publication.
5. YashavantKanetkar, “Let Us C”, BPB Publication.

IT208 : Object Oriented Programming Laboratory

Teaching Scheme	Examination Scheme	
Lectures: 2 Hrs./Week	**Term Work:**	**NA**
	Oral :	**50 Marks**
	Practical:	**NA**
Credits: 1	**Total:**	**50 Marks**

Prerequisite Course: Computer Fundamentals and Programming

Course Objectives

1. To develop programs by applying concepts of constructors, friend function, inline functions and data abstraction.
2. To apply OOP principles polymorphism and inheritance to solve problems.
3. To use C++ features templates, exceptions and dynamic memory allocation for solution of various problems.

Course Outcomes (COs):

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

	Course Outcome (s)	Bloom's Taxonomy	
		Level	**Descriptor**
CO1	**Develop** programs by applying concepts of constructors, friend function, inline functions and data abstraction.	3	Apply
CO2	**Apply** OOP principles polymorphism and inheritance to solve problems.	3	Apply
CO3	**Use** C++ features templates, exceptions and dynamic memory allocation for solution of various problems.	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

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

Guidelines: This Object Oriented Programming Laboratory course has Object Oriented Programming as a core subject. The problem statements should be framed based on mentioned assignments in the syllabus for conduction of practical examination. The teacher will frame the problem statements with due consideration that students have three hours to complete that. The practical examination will comprise implementation and related theory. All assignments are to be performed in C++ Language.

Term Work: Staff in-charge will suitably frame the above assignments and flexibility may be incorporated. Students will submit term work in the form of a journal. Each assignment has to be well documented with problem definition, code documented with comments. Staff in-charge will assess the assignments continuously and grade or mark each assignment on completion date. All the assignments should be conducted in C++ Language.

Suggested List of Assignments

Sr. No.	Assignments	No. of Hours	COs
1	Write a menu driven program with class, object and different types of constructors.	2 Hrs.	CO1
2	Write a program to demonstrate use of Friend function, inline function.	2 Hrs.	CO1
3	Write a program to demonstrate compile time polymorphism (Operator Overloading/ Function Overloading).	2 Hrs.	CO2
4	Write a program to demonstrate runtime polymorphism (Virtual Function Concept).	2 Hrs.	CO2
5	Write a program to demonstrate Encapsulation and Inheritance Concept.	2 Hrs.	CO2
6	Write a program to demonstrate Memory allocation in C++.	2 Hrs.	CO3
7	Write a program to demonstrate use of Template in C++.	2 Hrs.	CO3
8	Write a program to demonstrate Exception Handling concept.	2 Hrs.	CO3

Text Books:

1. E. Balagurusamy, "Object Oriented Programming with C++", McGraw Hill Edition 5th Edition.
2. Maureen Spankle, "Problem Solving and Programming Concepts", Pearson, 2011, ISBN-13: 978-0132492645.

Reference Books:

1. Robert Lafore, "Object Oriented Programming in Turbo C++", Sams Publishing Edition 4th Edition.
2. Ira Pohl, "Object Oriented Programming using C++", Pearson Education Edition 2nd Edition Reprint 2004.

MC 209 : Indian Constitution (Mandatory Course – III)		
Teaching Scheme	**Examination Scheme**	
Lectures: 2 Hrs./Week	**Term Work:**	**NA**
	Oral :	**NA**
	Practical:	**NA**
Credits: Non Credit	**Total:**	**NA**

Course Objectives

1. To study the historical background, salient features, preamble and union territories of Indian constitution.
2. To study the provision of fundamental right in the Indian constitution.
3. To study the directive principle of state policy and fundamental duties.
4. To study the system of government through parliamentary and federal system.
5. To understand the formation, structure and legislative framework of central government.
6. To understand the formation, structure and legislative framework of state government.

Course Outcomes (COs):

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

	Course Outcome (s)	**Bloom's Taxonomy**	
		Level	**Descriptor**
CO1	**Describe** background, salient features of constitution of India.	1	Remember
CO2	**Explain** the system of government, it's structure and legislative framework.	2	Understand
CO3	**Apply** the fundamental rights and duties in their life.	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

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

Course Contents			
Unit-I	**INTRODUCTION TO CONSTITUTION OF INDIA**	**No. of Hours**	**COs**
	Historical background, Salient features, Preamble of constitution, Union and its territory.	7	CO1
Unit-II	**FUNDAMENTAL RIGHTS**	**No. of Hours**	**COs**
	Features of fundamental rights, Basic rights: 1. Right to equality; 2. Right to freedom; 3. Right against exploitation; 4. Right to freedom of religion; 5. Cultural and educational rights; 6.Right to property; 7. Right to constitutional remedies.	5	CO3
Unit-III	**DIRECTIVE PRINCIPLE OF STATE POLICY AND FUNDAMENTAL DUTIES**	**No. of Hours**	**COs**
	Directive principle of state policy: Features of directive principle, Classification of directive principle, Criticism of directive principle, Utility of directive principle, Conflict between Fundamental rights and directive principle. **Fundamental duties:** List of fundamental duties, Features of fundamental duties, Criticism of fundamental duties, Significance of fundamental duties, Swaran Singh Committee Recommendations.	5	CO3
Unit-IV	**SYSTEM OF GOVERNMENT**	**No. of Hours**	**COs**
	Parliamentary system: Features of parliamentary government, Features of presidential government, merits and demerit of Parliamentary system. **Federal system:** Federal features of constitution, unitary features of constitution. **Centre and state relation:** Legislative relation, administrative relations and financial relation. **Emergency provision:** National emergency, Financial emergency and criticism of emergency provision.	5	CO2
Unit-V	**CENTRAL GOVERNMENT**	**No. of Hours**	**COs**
	President: Election of president, powers and functions of president, and Veto power of president. **Vice-president:** Election of vice-president, powers and functions of vice-president. **Prime minister:** Appointment of PM, powers and functions of PM, relationship with president. **Central council of ministers:** Appointment of ministers, responsibility of ministers, features of cabinet committees, functions of cabinet committees. **Parliament:** Organization of parliament, composition of the two houses , duration two houses, membership of parliament, session of parliament, joint sitting of two houses, budget in parliament. **Supreme court (SC):** Organization of supreme court, independence of supreme court, jurisdiction and powers of supreme court.	5	CO2

Unit-VI	STATE GOVERNMENT	No. of Hours	COs
	Governor: Appointment of governor, powers and functions of governor, constitutional position. **Chief minister:** Appointment of CM, powers and functions of CM, relationship with governor. **State council of ministers:** Appointment of ministers, responsibility of ministers, cabinet. **High court (HC):** Organization of HC, independence of HC, jurisdiction and powers of HC. **Sub-ordinate court:** Structure and jurisdiction, LokAdalats, Family court, Gram Nyayalayas.	5	CO2

Text Books:

1. M Laxmikanth, "Indian Polity for Civil Service Examination", McGrawHill Education, 5th Edition.
2. Durga Das Basu, LexisNexis, "Introduction to the Constitution of India", 22nd Edition.

S.Y. B. Tech Information Technology Semester II

IT210: Microprocessor & Microcontroller

Teaching Scheme	Examination Scheme	
Lectures: 4 Hrs./Week	**Continuous Assessment:**	**20 Marks**
	In-Sem Exam:	**30 Marks**
	End-Sem Exam:	**50 Marks**
Credits: 4	**Total:**	**100 Marks**

Prerequisite Course: Computer Organization & Digital Electronics

Course Objectives

1. To use ALP concepts to write the programs.
2. To understand architectural details of 8086 and 80386 microprocessors.
3. To understand segmentation mechanism w.r.t. 80386 microprocessor.
4. To understand paging and protection in 80386 microcontroller.
5. To understand features of 8051 microcontroller.
6. To make use of 8051 microcontroller for interfacing I/O devices.

Course Outcomes (COs):

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

Course Outcome (s)		Bloom's Taxonomy	
		Level	**Descriptor**
CO1	**Use** ALP concepts to write the programs.	3	Apply
CO2	**Explain** architectural details of 8086 and 80386 microprocessors.	2	Understand
CO3	**Demonstrate** segmentation w.r.t. 80386 microprocessor.	3	Apply
CO4	**Demonstrate** the Paging and Protection concepts.	3	Apply
CO5	**Explain** features of 8051 microcontroller.	2	Understand
CO6	**Use** 8051 for Interfacing I/O devices.	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

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

Course Contents			
Unit-I	**INTRODUCTION TO ASSEMBLY LANGUAGE PROGRAMMING**	**No. of Hours**	**COs**
	Introduction to assembly language programming. **ALP Tools:** Assembler, Linker, Loader, Debugger, Emulator. Assembler directives, Far and near procedure, Macros, DOS Interrupts.	08	CO1
Unit-II	**INTRODUCTION TO 8086 & 80386 PROCESSOR**	**No. of Hours**	**COs**
	Introduction to 8086 Processor: Features, Architecture, Pin configuration, Instruction set, Addressing modes. **80386 Processor:** 80386 Family, Features, Architecture, Pin Description, Register Set, Addressing modes, Instruction set.	08	CO2
Unit-III	**SEGMENTATION**	**No. of Hours**	**COs**
	Segmentation: Introduction, Real mode segmentation. **80386 Protected Mode Segmentation:** Segment Selector & Descriptors, Descriptor Types, System Tables (IDT, LDT, GDT), Logical to linear/physical address translation.	08	CO3
Unit-IV	**PROTECTION MECHANISM & PAGING**	**No. of Hours**	**COs**
	Protection in segmentation: Protection Levels, Privileged instructions, Inter-privilege level transfer using Call gates and conforming code segment. **Paging:** support registers, Data structures, Descriptors, Linear to physical address translation, Page level protection. **Multitasking:** TSS, Task Switching.	08	CO4
Unit-V	**INTRODUCTION TO 8051 MICROCONTROLLER**	**No. of Hours**	**COs**
	Microprocessor Vs Microcontroller. **8051 microcontroller:** 8051 family, Features, Architecture, Pin Description, Register bank and Special Function Registers (SFRs), Addressing modes, Instruction set, External data memory and program memory organization. **I/O ports programming:** Structures, Related SFRs and Configuration.	08	CO5
Unit-VI	**8051 INTERFACING & APPLICATIONS**	**No. of Hours**	**COs**
	Timers/counters programming: Structure, Related SFRs, Operating modes, Delay calculations and Configuration. **Serial port programming**: Related SFRs, Operating modes, Baud rate calculation and Configuration. **Interfacing of displays:** LED, LCD, keys, ADC & DAC, stepper motor, Sensors (temperature, pressure). Design of minimum system using 8051 micro-controller for an applications.	08	CO6

Text Books:

1. Peter Abel, NiyazNizamuddin, "IBM PC Assembly Language and Programming", Pearson Education.
2. James Turley, "Advanced 80386 Programming Techniques", McGraw Hill Education.
3. A. Ray, K.Bhurchandi, “Advanced Microprocessors and peripherals: Arch, Programming & Interfacing”, Tata McGraw Hill, 2004, ISBN 0-07-463841-6.
4. M. A. Mazidi, J. G. Mazidi, "The 8051 Microcontroller and Embedded Systems", Pearson Education.

Reference Books:

1. Intel Datasheets of 8086, 80386 Microprocessors & 8051 Microcontroller.
2. Walter A. Tribel, Avtar Singh, "The 8088 and 8086 Microprocessors", 4th Edition, Prentice Hall of India.
3. Ray Duncan, "Advanced MS DOS Programming", 2nd Edition, BPB Publications.
4. Kenneth Ayala, "The 8051 Micro Controller", 3rd Edition, Delmar Cengage Learning.
5. I. Scott MacKenzie, Raphael C.-W. Phan, "8051 Microcontroller", 4th Edition, Pearson Education
6. Joshi, “Processor Architecture and Interfacing”, Wiley, ISBN-9788126545605.
7. Douglas Hall, “Microprocessors and Interfacing”, 2nd Edition, 1992, McGraw-Hill, ISBN-0-07-100462-9.

IT 211: Database Management Systems		
Teaching Scheme	**Examination Scheme**	
Lectures: 3 Hrs./Week	**Continuous Assessment:**	**20 Marks**
	In-Sem Exam:	**30 Marks**
	End-Sem Exam:	**50 Marks**
Credits: 3	**Total:**	**100 Marks**
Prerequisite Course: Data Structures		

Course Objectives

1. To understand the fundamental concepts of database management.
2. To study systematic database design approaches.
3. To devise queries using Relational Algebra, SQL.
4. To study basic issues of transaction processing, concurrency control.
5. To evaluate query and query optimization technique and learn recovery techniques.
6. To learn and understand specialty databases.

Course Outcomes (COs):

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

Course Outcome (s)		Bloom's Taxonomy	
		Level	**Descriptor**
CO1	**Explore** fundamental concepts of database management	2	Understand
CO2	**Apply** relational algebra and SQL to database.	3	Apply
CO3	**Design** systematic database schema	3	Apply
CO4	**Understand** transaction management and concurrency control protocols.	2	Understand
CO5	**Optimize** the queries and compare recovery scheme	3	Apply
CO6	**Understand** large scale databases	2	Understand

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

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

Course Contents			
Unit-I	**INTRODUCTION TO DBMS**	**No. of Hours**	**COs**
	Introduction: Introduction to database systems application, purpose of database system. Introduction to Data models, Three-schema architecture of a database, Components of a DBMS. **E-R model**: modeling, entity, attributes, relationships, constraints, components of E-R model. **Relational model:** basic concepts, attributes and domains, concept of integrity and referential constraints, schema diagram.	06	CO1
Unit-II	**RELATIONAL ALGEBRA, SQL and QUERY PROCESSING**	**No. of Hours**	**COs**
	Relational Algebra: Basic Operations, Selection, projection, joining, outer join, union, difference, intersection, Cartesian product, division operations (examples of queries in relational algebraic using symbols). **Introduction to SQL:** Characteristics and advantages, SQL Data Types and Literals, DDL, DML, DCL, SQL Operators, Tables: Creating, Modifying, Deleting, Views: Creating, Dropping, Updating using Views, Indexes, Nulls, SQL DML Queries: SELECT Query and clauses, Set Operations, Predicates and Joins, Set membership, Tuple Variables, Set comparison, Ordering of Tuples, Aggregate Functions, Nested Queries, Database Modification using SQL Insert, Update and Delete Queries. procedure and functions, triggers and cursors, Embedded SQL.	06	CO2
Unit-III	**DATABASE DESIGN USING NORMALIZATION**	**No. of Hours**	**COs**
	Functional Dependency, Purpose of Normalization, Data Redundancy and Update Anomalies, Single Valued Normalization: 1NF, 2NF, 3NF, BCNF. Decomposition: lossless join decomposition and dependency preservation, Decomposition Algorithms. Multi valued Normalization (4NF), Join Dependencies and the Fifth Normal Form.	06	CO3
Unit-IV	**TRANSACTION MANAGEMENT AND CONCURRENCY CONTROL**	**No. of Hours**	**COs**
	Transactions: Basic concept of a Transaction, Transaction Management, Properties of Transactions, Concept of Schedule, Serial Schedule, **Serializability:** Conflict and View, Cascaded Aborts, Recoverable and No recoverable Schedules. **Concurrency Control:** Time-stamps and locking protocols, validation-based protocols, multiple granularity protocols, deadlock handling.	06	CO4
Unit-V	**RECOVERY SYSTEM AND QUERY OPTIMIZATION**	**No. of Hours**	**COs**
	Recovery System: Shadow-Paging and Log-Based Recovery, Checkpoints. **Query Processing:** Overview, Measures of query cost, Evaluation of expression, Materialization and Pipelining algorithm. **Query Optimization:** Transformation of Relational Expressions, Cost-based optimization, Heuristics in Optimization	6	CO5
Unit-VI	**EMERGING DATABASE TECHNOLOGIES**	**No. of Hours**	**COs**
	JSON: Overview, Data Types, Objects, Schema, JSON with	6	CO6

	Java/PHP/Ruby/Python. **Introduction to No SQL Databases**: SQLite Database, XML Databases, **MongoDB:** MongoDB CRUD Operations, MongoDB Operators, Aggregation, Indexes, MongoDB Cloud, MongoDB Connectivity		

Text Books:

1. Abraham Silberschatz, Henry F. Korth and S. Sudarshan, "Database System Concepts", 6th Edition, McGraw Hill, 2010.
2. Raghu Ramkrishnan and Johannes Gehrke, "Database Management Systems", 2nd Edition, McGraw Hill International Editions, ISBN 978-0072465631.
3. Kristina Chodorow and MongoDB, "The Definitive Guide", 2nd Edition, O'Reilly Publications, ISBN: 978-93-5110-269-4.

Reference Books:

1. RamezElmasri and Shamkant B. Navathe, "Fundamental Database Systems", 3rd Edition, Pearson Education, 2003, ISBN 978-0321204486.
2. "Big Data Black Book", DT Editorial services, 2015 Edition.
3. Hellerstein, Joseph, and Michael Stonebraker, "Readings in Database Systems (The Red Book)", 4th Edition, MIT Press, 2005, ISBN: 9780262693141.

BS 202 : ENGINEERING MATHEMATICS - III

Teaching Scheme	Examination Scheme	
Lectures: 4 Hrs./Week	**Continuous Assessment:**	**20 Marks**
	In-Sem Exam:	**30 Marks**
	End-Sem Exam:	**50 Marks**
Credits: 4	**Total:**	**100 Marks**

Prerequisite Course: Basic of Mathematics

Course Objectives

1. **To Know** and **recall** core knowledge of Scalar and vector function.
2. **To Understand** the concept of Vector integral.
3. **To Apply** core concept Higher Order Differential Equation applied problems in engineering.
4. **To Analyse** the Problem of Series Solution Of Differential Equations.
5. **To Understand** the core concept of Partial Differential Equation.
6. To **Use PDEs** in Various Applications .

Course Outcomes (COs):

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

	Course Outcome (s)	Bloom's Taxonomy	
		Level	**Descriptor**
CO1	**Know** and **recall** core knowledge of Scalar and vector function	1	Remember
CO2	**Understand** the concept of Vector integral	2	Understand
CO3	**Apply** core concept Higher Order Differential Equation applied problems in engineering.	3	Apply
CO4	**Analyse** the problem of Series Solution Of Differential Equation.	3	Apply
CO5	**Understand** the core concept of Partial Differential Equation	2	Understand
CO6	**Use** of PDEs in various Application	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

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

Course Contents			
Unit-I	**VECTOR DIFFERENTIATION**	**No. of Hours**	**COs**
	Scalar and vector point function, Derivative of a vector point function, Gradient of scalar function ∅, Directional derivative, Divergence and Curl of vector point function, Solenoidal and irrotational vector field and scalar potential, vector identities.	08	CO1
Unit-II	**VECTOR INTEGRATION**	**No. of Hours**	**COs**
	Line integral, Greens theorem, Work done, Conservative field, surface integral, Stokes theorem, volume integral, Gauss Divergence theorem.	08	CO2
Unit-III	**HIGHER ORDER DIFFERENTIAL EQUATION**	**No. of Hours**	**COs**
	Homogeneous and non homogeneous linear differential equation of n^{th} order and its solution, Method of variation of parameter, operator method for particular integral, solution of certain types of linear differential equation:-Cauchy's and Legendre's differential equation.	08	CO3
Unit-IV	**SERIES SOLUTION OF DIFFERENTIAL EQUATION**	**No. of Hours**	**COs**
	Linear differential equations with variable coefficients, solution about ordinary point, about singular point (Frobenius method) series solution of Bessel's equation, series solution of Legendre's equation.	08	CO4
Unit-V	**PARTIAL DIFFERENTIAL EQUATION**	**No. of Hours**	**COs**
	Formation of partial differential equation, Partial differential equation of order one (linear and nonlinear), Charpit method, PDE of higher order with constant coefficient.	08	CO5
Unit-VI	**APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATION**	**No. of Hours**	**COs**
	One dimensional heat equation, Wave equation, Two dimensional heat equation (Laplace equation), Telephone equation, Radio equations.	08	CO6

Text Books:

1. B. S. Grewal, "Higher Engineering Mathematics", 42/e, Khanna Publishers, 2012, **ISBN-13: 978-8174091154.**
2. N. P. Bali and Manish Goyal, "A Text Book of Engineering, Mathematics", 8/e, Lakshmi Publications, 2012. **ISBN: 9788131808320.**
3. H. K. Das, "Engineering Mathematics", S Chand, 2006, **ISBN-8121905209.**

Reference Books:

1. K.A. Stroud & D. S. Booth, "Advanced Engineering Mathematics", Industrial Press, 5/e, 2011, **ISBN-9780831134495.**
2. P. C. Matthews, "Vector Calculus", Springer, 2/e, 2012, **ISBN-9783540761808.**
3. Robert C. Wrede, "Introduction to vector and tensor analysis", Dover, 2013.
4. W. E. Boyce, R. C. Diprima, "Elementary differential equation and boundary value problems", John Wiley & Sons, 2012, ISBN-978-0-470-45831-0833.
5. R. K. Jain and S. R. K. Iyengar, "Advanced Engineering Mathematics", Narosa Publishing House, 2014. **ISBN-13: 978-1842653418.**
6. Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley, 9/e, 2013.

IT213: Data Structures and Files		
Teaching Scheme	**Examination Scheme**	
Lectures: 4 Hrs./Week	**Continuous Assessment:**	**20 Marks**
	In-Sem Exam:	**30 Marks**
	End-Sem Exam:	**50 Marks**
Credits: 4	**Total:**	**100 Marks**
Prerequisite Course: Fundamentals of Data Structures		

Course Objectives

1. To apply appropriate data structures to implement Trees.
2. To apply appropriate data structures to implement Graphs.
3. To apply heap data structure for problem solving.
4. To apply the different hashing functions.
5. To understand the different types of Search tree
6. To understand and Implement different File organizations.

Course Outcomes (COs):

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

Course Outcome (s)		Bloom's Taxonomy	
		Level	**Descriptor**
CO1	**Apply** appropriate data structures to implement Trees.	3	Apply
CO2	**Apply** appropriate data structures to implement Graphs.	3	Apply
CO3	**Apply** heap data structure for problem solving.	3	Apply
CO4	**Apply** the different hashing functions.	3	Apply
CO5	**Understand** the different types of Search tree.	2	Understand
CO6	**Understand** and **Implement** different File organizations.	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

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

Course Contents			
Unit-I	**TREES**	**No. of Hours**	**COs**
	Trees and binary trees-concept and terminology. Expression tree. Conversion of general tree to binary tree. Binary tree as an Abstract Data Type(ADT). Recursive and non-recursive algorithms for binary tree traversals, construction of tree from its traversals, Binary search trees, Binary search tree as ADT, Applications of trees.	08	CO1
Unit-II	**GRAPHS**	**No. of Hours**	**COs**
	Graph as an ADT, Representation of graphs using adjacency matrix and adjacency list, Depth First Search and Breadth First Search traversal. Prim's and Kruskal's algorithms for minimum spanning tree, shortest path using Warshall's and Dijkstra's algorithm, topological sorting.	08	CO2
Unit-III	**TABLES**	**No. of Hours**	**COs**
	Symbol Table: Notion of Symbol Table, OBST, Huffman's algorithm, Heap data structure, Min and Max Heap, Heap sort implementation, applications of heap: priority queue.	08	CO3
Unit-IV	**HASH TABLES**	**No. of Hours**	**COs**
	Hash tables and scattered tables: Basic concepts, hash function, characteristics of good hash function, different key-to-address transformations techniques, synonyms or collisions, collision resolution techniques- linear probing, quadratic probing, rehashing, chaining without replacement and chaining with replacement.	08	CO4
Unit-V	**SEARCH TREE**	**No. of Hours**	**COs**
	Concept of threaded binary tree, AVL Trees, Concept of red and black trees, Multiway Trees: B trees, B+ trees, Splay trees.	08	CO5
Unit-VI	**FILE ORGANIZATION**	**No. of Hours**	**COs**
	External storage devices, File, File types and file organization: Sequential, Index sequential and Direct access, Primitive operations and implementations for each type. Comparison of file organizations.	08	CO6

Text Books:

1. Thomas H. Cormen, Charles E. Leiserson and Ronald L. Rivest, "Introduction to Algorithms", 2nd Edition, The MIT Press, 2001, ISBN 0-262-03293-7.
2. R. Gilberg, B. Forouzan, "Data Structure: A Pseudo code approach with C++", Cengage Learning.
3. SartajSahni, "Data Structures, Algorithms and Applications in C++", 2nd Edition, Universities Press.

Reference Books:

1. Robert Sedgewick and Kevin Wayne, "Algorithms", 4th Edition; Pearson Education, ISBN-13: 978-0321573513.
2. E. Horowitz, S. Sahni, S. Anderson-freed, "Fundamentals of Data Structures in C", 2nd Edition, University Press, ISBN 978-81-7371-605-8.
3. E. Horowitz, S. Sahni, D. Mehta, "Fundamentals of Data Structures in C++", Galgotia

Book.
4. Alan Tharp, “File Organization and Processing”, Willey India edition.
5. Y. Langsam, M. Augenstin, A. Tannenbaum, “Data Structures using C and C++”, Prentice Hall of India.
6. Goodrich, “Data Structures and Algorithms in C++”, Wiley.

IT214 : Database Management Systems Laboratory

Teaching Scheme	Examination Scheme	
Lectures: 2 Hrs./Week	**Term Work:**	**50 Marks**
	Oral :	**NA**
	Practical:	**NA**
Credits: 1	**Total:**	**50 Marks**

Prerequisite Course: Database Management Systems

Course Objectives

1. To implement ER models using DDL, DML and DCL commands.
2. To develop applications using stored procedures, triggers and cursors.
3. To populate and query a database using MongoDB commands.

Course Outcomes (COs):

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

	Course Outcome (s)	Bloom's Taxonomy	
		Level	**Descriptor**
CO1	**Implement** ER models using DDL, DML and DCL commands.	3	Apply
CO2	**Develop** applications using stored procedures, triggers and cursors.	3	Apply
CO3	**Populate** and query a database using MongoDB commands.	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

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

Guidelines: This Database System Laboratory course has Database Systems as a core subject. The problem statements should be framed based on assignments mentioned in the syllabus. The teacher will frame the problem statements with due consideration that students have two hours to complete that. The oral examination will comprise of implementation and related theory. All assignments are to be performed in open source software tools. Use of open source platform and tools is encouraged.

Term work: Staff in-charge will suitably frame the above assignments and flexibility may be incorporated. Students will submit term work in the form of journal. Each assignment has to be well documented with problem definition, code documented with comments. Staff in-charge will assess the assignments continuously and grade or mark each assignment on completion date. All the assignments should be conducted on open source software tools

Suggested List of Assignments

Sr. No.	Assignment	No. of Hours	COs
1	Design any database with at least 3 entities and relationships between them. Apply DCL and DDL commands.	2	CO1
2	Design and implement a database and apply at least 10 different DML queries. Make use of wild characters and LIKE operator, Make use of Boolean and arithmetic operators.	2	CO1
3	Design and implement a database and apply the aggregate functions like count, sum, avg etc. Use group by and having clauses.	2	CO1
4	Implement nested sub queries. Perform a test for set membership (in, not in), set comparison (<some, >=some, <all etc.).	2	CO2
5	Write and execute triggers on suitable database.	2	CO2
6	Write and execute PL/SQL stored procedure/function using cursors to perform a suitable task on the database.	2	CO2
7	Create a database with suitable example using MongoDB and implement CRUD operations. ● Inserting and saving document ● Removing document ● Updating document (document replacement, using modifiers, upserts, updating multiple documents, returning updated documents)	2	CO3
8	Execute at least 10 queries on any suitable MongoDB database that demonstrates following querying techniques: ● Find and findOne (specific values) ● Query criteria (Query conditionals, OR queries, $not, Conditional semantics) ● Type-specific queries (Null, Regular expression, Querying arrays)	2	CO3
9	Execute at least 10 queries on any suitable MongoDB database that demonstrates following: ● $ where queries ● Cursors (Limits, skips, sorts, advanced query options)	2	CO3
10	Implement Map reduce example with suitable example.	2	CO3

Reference Books:

1. Ivan Bayross, “SQL, PL/SQL: The Programming Language of Oracle”, BPB Publication.
2. Weinberg, Paul N., et al. “SQL, the Complete Reference”, McGraw-Hill, 2010.
3. Kristina Chodorow, “MongoDB The definitive guide”, O’Reilly Publications, ISBN: 978-93-5110-269-4, 2nd Edition.
4. Dr. P. S. Deshpande, “SQL and PL/SQL for Oracle 10g Black Book”, Dream Tech.
5. George Reese and Randy Jay Yarger, “Managing And Using MySQL”, O Reilly.

IT215 : Microprocessor & Micro-controller Laboratory

Teaching Scheme	Examination Scheme	
Lectures: 2 Hrs./Week	**Term Work:**	**NA**
	Oral :	**50 Marks**
	Practical:	**NA**
Credits: 1	**Total:**	**50 Marks**

Prerequisite Course: Microprocessor & Micro-controller.

Course Objectives

1. To develop ALP using macros and procedures.
2. To use DOS interrupts for file operations.
3. To develop 8051 based programs.
4. To develop 8051 interface with I/O

Course Outcomes (COs):

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

	Course Outcome (s)	Bloom's Taxonomy	
		Level	**Descriptor**
CO1	**Develop** ALP using macros and procedures.	3	Apply
CO2	**Use** DOS interrupts for file operations.	3	Apply
CO3	**Develop** 8051 based programs.	3	Apply
CO4	**Develop** 8051 interface with I/O devices	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

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

Guidelines: This Microprocessor & Micro-controller Laboratory course has Microprocessor & Micro-controller as a core subject. The problem statements should be framed based on assignments mentioned in the syllabus. The teacher will frame the problem statements with due consideration that students have three hours to complete that. The practical examination will comprise of implementation and related theory. All assignments are to be performed in MASM/TASM, TURBO DEBUGGER, 8051 Simulator and 8051 Trainer kit with interfacing devices. Use of open source platform and tools is encouraged

Term work: Staff in-charge will suitably frame the above assignments and flexibility may be incorporated. Students will submit term work in the form of journal. Each assignment has to be well documented with problem definition, code documented with comments. Staff in-charge will assess the assignments continuously and grade or mark each assignment on completion date. All the assignments should be conducted in 8086 and 8051 ALP.

Suggested List of Assignments

Group A	MICROPROCESSOR PROGRAMMING USING 8086	No. of Hours	COs
1.	Assignment on addition of N numbers stored in the memory using macros.	2 Hrs.	CO1
2.	Assignment on number conversion using macros.	2 Hrs.	CO1
3.	Assignment on string manipulations using near and far procedure.	2 Hrs.	CO2
4.	Assignment on File operation using DOS interrupts.	2 Hrs.	CO2
Group B	**MICRO-CONTROLLER PROGRAMMING**	**No. of Hours**	**COs**
5.	Assignment on memory block transfer.	2 Hrs.	CO3
6.	Assignment on Timer programming: ISR based.	2 Hrs.	CO3
7.	Assignment on ADC and Sensor (Eg. Temperature) Interfacing.	2 Hrs.	CO4
8.	Assignment on LCD interfacing.	2 Hrs.	CO4

Reference Books:

1. Peter Abel, NiyazNizamuddin, "IBM PC Assembly Language and Programming", Pearson Education.
2. Ray Duncan, "Advanced MS DOS Programming", 2nd Edition, BPB Publications.
3. Intel 8051 Micro-controller Manual.
4. M. A. Mazidi, J. G. Mazidi, "The 8051 Microcontroller and Embedded Systems", Pearson Education.

IT216 : Data Structures & Files Laboratory

Teaching Scheme	Examination Scheme	
Lectures: 2 Hrs./Week	**Term Work:**	**NA**
	Oral :	**NA**
	Practical:	**50 Marks**
Credits: 1	**Total:**	**50 Marks**

Prerequisite Course: Fundamentals of Data Structures, C++ Programming.

Course Objectives

1. To implement Trees and perform traversals.
2. To implement Graphs and Heap.
3. To apply hashing concepts and manipulate databases using different file organizations.

Course Outcomes (COs):

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

	Course Outcome (s)	Bloom's Taxonomy	
		Level	**Descriptor**
CO1	**Implement** Trees and perform traversals.	3	Apply
CO2	**Implement** Graphs and Heap.	3	Apply
CO3	**Apply** hashing concepts and manipulate databases using different file organizations.	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

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

Guidelines: This Advanced Data Structures Laboratory course has Advanced Data Structures as a core subject. The problem statements should be framed based on mentioned assignments in the syllabus for conduction of practical examination. The teacher will frame the problem statements with due consideration that students have three hours to complete that. The practical examination will comprise implementation and related theory. All assignments are to be performed in C++ Language.

Term Work: Staff in-charge will suitably frame the above assignments and flexibility may be incorporated. Students will submit term work in the form of a journal. Each assignment has to be well documented with problem definition, code documented with comments. Staff in-charge will assess the assignments continuously and grade or mark each assignment on completion date. All the assignments should be conducted in C++ Language.

Suggested List of Assignments			
Sr. No.	**Assignments**	**No. of Hours**	**COs**
1	Assignment based on implementation of tree.	2 Hrs.	CO1
2	Assignment based on traversal of tree.	2 Hrs.	CO1
3	Assignment based on minimum spanning tree.	2 Hrs.	CO1
4	Assignment based on shortest path in graph.	2 Hrs.	CO2
5	Assignment based on implementation of priority queue as application of heap.	2 Hrs.	CO2
6	Assignment based on Implement hash table.	2 Hrs.	CO3
7	Assignment based on implementation of advanced tree.	2 Hrs.	CO3
8	Assignment based on file organizations.	2 Hrs.	CO3

Books:

Reference Books:

1. R. Gilberg, B. Forouzan, "Data Structure: A Pseudo code approach with C++", Cengage Learning.
2. E. Horowitz, S. Sahni, D. Mehta, "Fundamentals of Data Structures in C++", Galgotia Book.
3. SartajSahni, "Fundamentals of Data Structures", University Press.
4. Robert Sedgewick and Kevin Wayne, "Algorithms" 4th Edition; Pearson Education, ISBN-13: 978-0321573513.
5. Y. Langsam, M. Augenstin, A. Tannenbaum, "Data Structures using C and C++", Prentice Hall of India.
6. Goodrich, "Data Structures and Algorithms in C++", Wiley.
7. A. Tharp, "File Organization and Processing", Willey India Edition.
8. G. A.V, Pai, "Data Structures and Algorithms", McGraw Hill.

IT217 : Seminar			
Teaching Scheme		**Examination Scheme**	
Lectures: 2 Hrs./Week		**Term Work:**	**NA**
		Oral :	**50 Marks**
		Practical:	**NA**
Credits: 2		**Total:**	**50 Marks**

Prerequisite Course: Basic Communication, Reading Skill and writing skill.

Course Objectives

1. To acquaint with basic technical writing concepts and terms, such as audience analysis, jargon, format, visuals, and presentation.
2. To reframe the literature and present using multimedia and presentation skills.
3. To analyze and summarize the literature survey and prepare technical reports.

Course Outcomes (COs):

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

	Course Outcome (s)	Bloom's Taxonomy	
		Level	**Descriptor**
CO1	**Acquaint** with basic technical writing concepts and terms, such as audience analysis, jargon, format, visuals, and presentation.	2	Understand
CO2	**Reframe** the literature and present using multimedia and presentation skills.	3	Apply
CO3	**Analyze** and **summarize** the literature survey and prepare technical reports.	4	Analyze

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

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

Course Content
Context
● Each student will select a multidisciplinary topic in the area of Engineering and Technology preferably keeping track with recent technological trends and development beyond scope of syllabus avoiding repetition in consecutive years. ● The topic must be selected in consultation with the institute guide. ● Each student will make a seminar presentation using audio/visual aids for a duration of 20-25 minutes and submit a seminar report prepared in Latex only. ● Seminar Log book should be compulsorily maintained. ● Seminar should make the student attain skills like: a) Gathering of literature in a specific area in a focused manner. b) Effectively summarizing the literature to find state-of-the-art in the proposed area. c) Identifying scope for future work. d) Reporting literature review and proposed work in a scientific way using good English.
Guidelines for Seminar Work Evaluation:
A panel of examiners along with a guide will assess the seminar work based on following parameters: a) Relevance of topic - 05 Marks b) Relevance + depth of literature reviewed- 10 Marks c) Seminar report (Technical Content) - 10 Marks d) Seminar report (Language) - 05 Marks e) Presentation Slides - 05 Marks f) Communication Skills - 05 Marks g) Question and Answers - 10 Marks **Note:** Student will prepare a seminar report as per the template given by the department. They should prepare and public a review paper based on their seminar work and publish/present it in a suitable journal/conference. ● Oral examination in the form of presentation will be based on the project and seminar work completed by the candidates. ● Seminar report must be presented during the presentation.
Reference Books:
1. Rebecca Stott, Cordelia Bryan, Tory Young, “Speaking Your Mind: Oral Presentation and Seminar Skills (Speak-Write Series)”, Longman, ISBN-13: 978-0582382435. 2. Johnson-Sheehan, Richard, “Technical Communication”, Longman, ISBN 0-321-11764-6. 3. VikasShirodka, “Fundamental skills for building Professionals”, SPD, ISBN: 978-93-5213-146-5.

IT218 : Mini Project

Teaching Scheme	Examination Scheme	
Lectures: 4 Hrs./Week	Term Work:	50 Marks
	Oral :	NA
	Practical:	NA
Credits: 2	Total:	50 Marks

Prerequisite Course: Fundamental of Programming Languages.

Course Objectives

1. To use modular programming approach and programming skills in diversified problem domains.
2. To use specialized features of the technological tools to provide effective solutions.
3. To analyze real world problem using domain knowledge and analytical skills.
4. To demonstrate the concepts, principles, strategies and methodologies of web applications.

Course Outcomes (COs):

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

	Course Outcome (s)	Bloom's Taxonomy	
		Level	Descriptor
CO1	**Use** modular programming approach and programming skills in diversified problem domains.	3	Apply
CO2	**Use** specialized features of the technological tools to provide effective solutions.	3	Apply
CO3	**Analyze** real world problem using domain knowledge and analytical skills.	4	Analyze
CO4	**Demonstrate** the concepts, principles, strategies and methodologies of web applications.	2	Understand

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

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

Guidelines: This Mini Project Laboratory course has Programming Languages as a core subject. The problem statements should be framed based on mentioned assignments in the syllabus for conduction of practical examination. The teacher will frame the problem statements with due consideration that students will develop a web application mini project at the end of the course. All assignments are to be performed in in any one of the three tools viz: **PHP based technology**, **Java based technology** or **Python based technology** with a suitable back-end.

Term Work: Staff in-charge will suitably frame the above assignments and flexibility may be incorporated. Students will submit term work in the form of journal. Each assignment has to be well documented with problem definition, code documented with comments. Staff in-charge will assess the assignments continuously and grade or mark each assignment on completion date. All the assignments should be conducted in PHP/Java/Python and MySQL or suitable database.

Suggested List of Assignments

Sr. No.	Assignments	No. of Hours	COs
1	Assignment on Operators, Data types, Variables and Constants.	4 Hrs.	CO1
2	Assignment on Arrays, Control Structures, Looping Structures.	4 Hrs.	CO1
3	Assignment on Conditional Statements, User Defined Functions.	4 Hrs.	CO1
4	Assignment on String Function, Math library functions.	4 Hrs.	CO2
5	Assignment on Graphical User Interface and validation.	4 Hrs.	CO2
6	Assignment on State Management: Cookies, Session management.	4 Hrs.	CO2
7	Assignment on Embedded SQL: Creating Database & Tables, Dropping Database & Tables, Adding Fields, Selecting Tables.	4 Hrs.	CO2
8	Assignment on Mini-project Part-I: Problem definition and Analysis.	4 Hrs.	CO3
9	Assignment on Mini-project Part-II: Design and Implementation.	4 Hrs.	CO4
10	Assignment on Mini-project Part-III: Testing and Deployment.	4 Hrs.	CO4

Books:

Reference Books:

1. Steve Holzner, “The Complete Reference PHP”, TATA McGraw Hill.
2. Ivan Bayross, “Web Enabled Commercial Application Development Using HTML, JavaScript, DHTML and PHP”, 4th Edition, BPB Publications. ISBN: 9788183330084.
3. “Web Technologies Black Book: HTML, JavaScript, PHP, Java, JSP, XML and AJAX”, Kogent Learning Solutions Inc. ISBN: 9788126554560, 8126554568.
4. VikramWaswani, “The Complete Reference MySQL”, TATA McGraw Hill.
5. Luke Welling and Laura Thomson, “PHP and MySQL Web Development”, Addison Wesley, 5th Edition, 2017.
6. Herbert Schildt, “The Complete Reference: Java2”, 5th Edition, Tata McGraw-Hill, 2011, ISBN: 978-0-07-049543-2.
7. Jim Keogh, “The Complete Reference: J2EE”, Tata McGraw-Hill, 2012, ISBN: 978-0-07-052912-0.

MC 219 : Innovation - Project based – Sc., Tech, Social, Design & Innovation (Mandatory Course – IV)

Teaching Scheme	Examination Scheme	
Lectures: 2 Hrs./Week	**Term Work:**	**NA**
	Oral :	**NA**
	Practical:	**NA**
Credits: Non Credit	**Total:**	**NA**

Course Objectives

1. To develop strategic thinking to solve social problems.
2. Understand the role of innovation and technical change in enterprise and national level economic performance.
3. Understand the technological, human, economic, organizational, social and other dimensions of innovation.
4. Understand the effective management of technological innovation requires the integration of people, processes and technology.
5. Recognize opportunities for the commercialization of innovation.

Course Outcomes (COs):

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

	Course Outcome (s)	Bloom's Taxonomy	
		Level	**Descriptor**
CO1	**Understand** the role of innovation and technical change in enterprise and national level economic performance	2	Understand
CO2	**Develop** strategic thinking to solve social problems	3	Apply
CO3	**Recognize** opportunities for the commercialization of innovation	6	Create

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

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

Course Contents
Many students, when they enter engineering, are full of enthusiasm to understand new areas, to build systems and to experiment and play with them. This enthusiasm is to be tapped and to direct it to exploration and sustained pursuit by the student, which may result in development of a working system, a prototype, or a device or material, etc. They are not required or even expected to produce research or an innovation. Students may be encouraged to take up projects which are aimed at providing solutions to societal problems, reduce drudgery and improving efficiency in rural work, green technologies, utilization of rural and urban waste, sanitation and public health, utilizing non-conventional energy sources, technologies for the benefit of the differently abled people and technologies ready to be implemented in the Institute. Two types of activities may be undertaken under this (a) Exposure to social problems (which are amenable to technological solutions) (b) Design & Innovation (to address above problems) After this students be encouraged to undertake technology projects of social relevance.

SANJIVANI RURAL EDUCATION SOCIETY'S

SANJIVANI COLLEGE OF ENGINEERING KOPARGAON

(An Autonomous Institute Affiliated to SPPU Pune)

DEPARTMENT OF INFORMATION TECHNOLOGY

COURSE CURRICULUM - 2020 PATTERN

THIRD YEAR B. TECH.

PROFILE

Sanjivani College of Engineering (An Autonomous Institute), Kopargaon is one among the premier technical institutes in Maharashtra state in the un-aided sector established in 1983. Department of Information Technology is established in the year 2001 with an intake of 60 students. Department is acquainted with 8 well equipped laboratories with latest hardware and Software, 3 class rooms and one tutorial Hall equipped with modern teaching aids and computing facilities. UG Program in IT department is accredited by NBA New Delhi for Second time in Academic Year 2019-2020 for three Years.

There are 15 experienced & well qualified teaching staff members & 6 supporting staff members who carry out the regular academic activities as well as curricular & extracurricular activities as per the plans prepared in advance at the beginning of every semester.

In the academic year 2019-2020 strength of students in department is 275. Apart from regular academic activities students take part in curricular & co curricular activities conducted by department organization ITERA as well as other department's organization & professional bodies in the institute like CSI, ISTE, and IEEE etc. Apart from the central library the department has its own library with a very good collection of reference book, text books and CSI magazines, IEEE magazines.

Along with regular academics Department of IT has started value added courses like SAP Certification Training Programme in collaboration with Primus Techsystems Pvt. Ltd. Pune and REDHAT Academy Centre, MBPS Infotech Pune.

IT Department has started capsule courses to improve technical skill sets of students. Department is having very good placements in various renowned and multi-national companies like TCS, Infosys, Persistent, Cognizant Wipro and many more.

Also to form well balanced Industry Interaction connect and bridge the gap between Industry and institution Department of IT has organized different events like Sanjivani Though Leader, Sanjivani I-connect and Sanjivani My Story Board.

Various personal and professional skill development programs like Communication and Soft Skill programs, Aptitude Training, Technical Skill enhancement programs, Foreign Language Certification Courses, Personal and Spiritual Development Programs, Entrepreneurship Development Activities, and Preparation courses for competitive Examinations (Gate/GRE/CAT etc.) are made available in campus. Students are given opportunities to develop and nurture their leadership qualities through Student Associations, Student Council, Professional Body activities and working as volunteers in various events organized at Department/ College level.

VISION AND MISSION

Vision of Institute

To develop world class professionals through quality education.

Mission of Institute

To create Academic Excellence in the field of Engineering and Management through Education, Training and Research to improve quality of life of people.

Vision of Department

To develop world class IT professionals through quality education.

Mission of Department

To create Academic Excellence in the field of Information Technology through Education, Industry Interaction, Training and Innovation to improve quality of life of people.

We are committed to develop industry competent technocrats with life-long learning capabilities and moral values.

PROGRAM EDUCATIONAL OBJECTIVES

PEO 1:

Graduates of IT program should possess knowledge of fundamental concepts in mathematics, science, engineering and technology as well as skills in the field of Information Technology for providing solution to complex engineering problem of any domain by analyzing, designing and implementing.

PEO 2:

Graduates of IT program should possess better communication, presentation, time management and teamwork skills leading to responsible and competent research, entrepreneurship and professionals, will be able to address challenges in the field of Information Technology at global level.

PEO 3:

Graduates of IT program should have commitment to societal contributions through communities and life-long learning.

PROGRAM OUTCOMES

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

PROGRAM SPECIFIC OUTCOMES

PSO1:
Attain the ability to provide software solutions by applying knowledge of Data Structures & Algorithms, Databases, Web Technology, System Software, Soft Computing and Cloud Computing.
PSO2:
Apply the knowledge of Computer Hardware & Networking, Cyber Security, Artificial Intelligence and Internet of Things to effectively integrate IT based solutions.
PSO3:
Apply the knowledge of best practices and standards of Software Engineering for Project Management.

LIST OF ABBREVIATIONS			
Abbreviation	**Full Form**	**Abbreviation**	**Full Form**
ES	Engineering Science	HSMC	Humanity Science
PC	Professional Core	CA	Continuous Assessment
PE	Professional Elective	OR	End Semester Oral Examination
OE	Open Elective	PR	End Semester Practical Examination
ISE	In-Semester Evaluation	TW	Continuous Term work Evaluation
ESE	End-Semester Evaluation	BSC	Basic Science Course
PRJ	Project	MC	Mandatory Course

COURSE STRUCTURE- 2020 PATTERN
THIRD YEAR B. TECH. INFORMATION TECHNOLOGY

SEMESTER- V

Course		Course Title	Teaching Scheme Hours/ Week			Credits	Evaluation Scheme - Marks						
							Theory			OR	PR	TW	Total
Cat.	Code		L	T	P		ISE	ESE	CIA				
PC	IT301	Software Engineering, Modeling and Design	4	-	-	4	30	50	20	-	-		100
PC	IT302	Computer Network	4	-	-	4	30	50	20	-	-	-	100
PC	IT303	Internet of Things	3	-	-	3	30	50	20	-	-	-	100
PC	IT304	Theory of Computation	3	-	-	3	30	50	20	-	-	-	100
PE	IT305	Professional Elective-I	3	-	-	3	30	50	20	-	-	-	100
PC	IT306	Software Modeling and Design Laboratory	-	-	2	1	-	-	-	-	50	-	50
PC	IT307	Computer Network Laboratory	-	-	2	1	-	-	-	50	-	-	50
PC	IT308	Internet of Things Laboratory	-	-	2	1	-	-	-	-	-	50	50
PRJ	IT309	Mini Project Based on Skill Based Credit Course	-	-	2	1	-	-	50	-	-	-	50
MC	MC310	Mandatory Course-V	1	-	-	NON Credit	-	-	-	-	-	-	Pass/ Fail
		Total	18	-	08	21	150	250	150	50	50	50	700

IT310	Skill Based Credit Course	Minimum 12 week course to be conducted in association with the industry on software product development.
MC311	Mandatory Course-V	Behavioral and Interpersonal skills (non-verbal skills / behaviors, nonaggression)

IT 305 Professional Elective- I	
Course Code	Course
IT305A	Software Testing and Quality Assurance
IT305B	Foundation of Data Science
IT305C	Data Mining Techniques

SEMESTER- VI

Course		Course Title	Teaching Scheme Hours/ Week			Credits	Evaluation Scheme-Marks						
							Theory			OR	PR	TW	Total
Cat.	Code		L	T	P		ISE	ESE	CIA				
PC	IT311	Cryptography and Cyber Security	3	-	-	3	30	50	20	-	-	-	100
PC	IT312	Artificial Intelligence	3	-	-	3	30	50	20	-	-	-	100
PC	IT313	System Programming and Operating System	4	-	-	4	30	50	20	-	-	-	100
PE	IT314	Professional Elective-II	3	-	-	3	30	50	20	-	-	-	100
HSMC	HS315	Corporate Readiness	2	-	-	2	-	-	50	-	-	-	50
PRJ	PR316	IPR & EDP	1	-	2	2	15	25	10	-	-	-	50
PC	IT317	Cryptography and Cyber Security Laboratory	-	-	2	1	-	-	-	-	50	-	50
PC	IT318	Artificial Intelligence Laboratory	-	-	2	1	-	-	-	50	-	-	50
PC	IT319	System Programming & Operating System Lab	-	-	2	1	-	-	-	-	50	-	50
PRJ	IT320	Creational Activity#	-	-	2	1	-	-	-	-	-	50	50
MC	MC321	Mandatory Course-VI	1	-	-	Non Credit	-	-	-	-	-	-	Pass /Fail
		Total	17	-	10	21	135	225	140	50	100	50	700

IT314 Professional Elective- II	
Course Code	Course
IT314A	Project Management
IT314B	Big Data Analytics
IT314C	Natural Language Processing

Mandatory Course-VI

MC321	**Suitable Technical / Non-Technical Activities finalized by Department**

T.Y. B. Tech Information Technology Semester V

IT301: Software Engineering, Modeling and Design	
Teaching Scheme	**Examination Scheme**
Lectures: 4 Hrs./Week	**Continuous Assessment: 20 Marks**
	In-Sem Exam: 30 Marks
	End-Sem Exam: 50 Marks
Credits: 4	**Total: 100 Marks**
Prerequisite Course: Problem Solving, Object Oriented Programming, Fundamentals of Data Structures	

Course Objectives

1. To understand the nature of Software and comprehend software development life cycle through different models.
2. To analyze software requirements by applying various modeling techniques.
3. To describe principles of agile software development, the SCRUM process and agile practices.
4. To Explore and analyze use case modeling, domain/ class modeling.
5. To teach the student Interaction and Behavior Modeling,
6. To make aware students with design process in software development.

Course Outcomes (COs):

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

	Course Outcome (s)	Bloom's Taxonomy	
		Level	**Descriptor**
CO1	**Understand** the nature of Software and comprehend software development life cycle through different models.	**2**	**Understand**
CO2	**Understand** software requirements by applying various modeling techniques.	**2**	**Understand**
CO3	**Understand** principles of agile software development, the SCRUM process and agile practices	**2**	**Understand**
CO4	**Apply** use case modeling, domain/ class modeling	**3**	**Apply**
CO5	**Demonstrate** Interaction and Behavior Modeling	**3**	**Apply**
CO6	**Apply** design process in software development	**3**	**Apply**

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

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

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO3	3	1	3	2	2	3	-	2	-	-	2	3	2	-	3
CO4	3	3	1	2	1	1	-	1	1	2	2	1	1	-	3
CO5	3	1	3	2	1	1	-	1	1	2	2	1	1	-	3
CO6	3	1	3	2	1	1	-	1	1	2	2	1	1	-	3

Course Contents			
Unit-I	**INTRODUCTION TO SOFTWARE ENGINEERING**	**No. of Hours**	**COs**
	Introduction to Software, Product vs. Process, Difference between hardware and Software, Nature of Software, Software Process, Software Engineering Practice, Software Development Life Cycle (SDLC), Software Myths, Generic Process model. **Process Models:** Waterfall Model, V-Model, Incremental Model, Evolutionary Models, RAD model, Concurrent, Specialized Process Models, Personal and Team Process Models.	06	CO1
Unit-II	**REQUIREMENT ANALYSIS**	**No. of Hours**	**COs**
	Requirements Capturing: Requirements Engineering, Requirement Engineering Tasks, Different Techniques of Inception & Elicitation, Prioritizing Requirements (Kano diagram). **Requirements Analysis:** Basics, Elements of analysis model, Data modeling, Scenario based modeling, Functional modeling & Information flow (DFD, CFD), Behavioral modeling. Software Requirement Specification. The software crisis, Examples of large-scale project failure, such as the London Ambulance Service system and the NHS National Programme for IT. Intrinsic difficulties with complex software.	06	CO2
Unit-III	**AGILE DEVELOPMENT**	**No. of Hours**	**COs**
	Agile Development: Agile manifesto, agility and cost of change, agility principles, myth of planned development. **Extreme Programming:** XP values, process, industrial XP. **SCRUM:** process flow, scrum roles, scrum cycle description, product backlog, sprint planning meeting, sprint backlog, sprint execution, daily scrum meeting, maintaining sprint backlog and burn-down chart, sprint review and retrospective. **Agile Practices:** test driven development, refactoring, pair programming, continuous integration, exploratory testing versus scripted testing.	**06**	**CO3**
Unit-IV	**OBJECT ORIENTED ANALYSIS**	**No. of Hours**	**COs**
	Object Oriented Analysis Process. **Use Case Modeling**: Actor Identification, Actor Classification, Actor Generalization, Use Cases Identification, Communication, Uses/Include and Extend Associations, Writing a Formal Use Cases, Use Case realizations. **Domain / Class Modeling**: Approaches For Identifying Classes (Noun-Phase Approach, Common Class Pattern Approach, Class Responsibilities Collaboration Approach, Naming Classes, Class Associations and Identification of Associations, Generalization/Specialization Relationship, Aggregation and Composition Relationships, Attributes and Methods Identification.	06	CO4

Unit-V	INTERACTION AND BEHAVIOR MODELING	No. of Hours	COs
	Activity Diagram: Activity and Actions, Initial and Final Activity, Activity Edge, Decision and Merge Points, Fork and Join, Input and Output Pins, Activity Group, Activity Partitions, Constraints on Action, Swim Lanes. **Sequence Diagram:** Context, Objects and Roles, Links, Object Life Line, Message or stimulus, Activation/Focus of Control, Modeling Interactions. **Collaboration Diagram:** Objects and Links, Messages and stimuli, Active Objects, Communication Diagram, Iteration Expression, Parallel Execution, Guard Expression, Timing Diagram. **State Diagram:** State Machine, Triggers and Ports, Transitions, Initial and Final State, Composite States, Submachine States.	06	CO5
Unit-VI	**OBJECT ORIENTED DESIGN**	**No. of Hours**	**COs**
	Object Oriented Design Process: Designing Business Layer, Object Oriented Constraints Language (OCL). **Designing Business Classes:** The Process, Designing Well Defined Class Visibility, Attribute Refinement, Method Design Using UML Activity Diagram, Packaging and Managing Classes. **Designing Access Layer:** Object Relational Systems, Object Relation Mapping, Table Class Mapping, Table – Inherited Classes Mapping, Designing the Access Layer Classes- The Process. **Designing View Layer:** View Layer Classes Design, Identifying View Classes by Analyzing Use Cases, Macro-Level Design Process, Prototyping the User Interface Component and Deployment Design using Component and Deployment Diagram.	06	CO6

Text Books:

1. Roger S Pressman, "Software Engineering: A Practitioner's Approach", McGraw-Hill, 7th or 8th Edition, ISBN: 0073375977.
2. Pankaj Jalote, "Software Engineering: A Precise Approach", Wiley India, ISBN: 9788126523115.
3. Ali Bahrami, "Object Oriented System Development: Using Unified Modeling Language", McGraw-Hill, International Edition 1999, ISBN:0-07-116090-6.

Reference Books:

1. Ian Sommerville, "Software Engineering", Pearson Education, 6th Edition.
2. R. Mall, "Fundamentals of Software Engineering", Prentice Hall of India.
3. Craig Larman, "Applying UML and Patterns", Pearson Education, 2nd Edition, ISBN:978- 0130925695.
4. Martin Fowler, "UML Distilled, Pearson", 3rd Edition, ISBN:978-81-317-1565-9.
5. Dan Pilone, Neil Pitman, "UML in Nutshell", O'reilly Pub., ISBN:8184040024, 9788184040029.
6. Roger S. Pressman, Software Engineering: A Practitioner's Approach, McGraw Hill, 7th Edition, ISBN:9339212088, 9789339212087.
7. Erich Gamma et al, "Design Patterns: Elements of Reusable Object", Pearson, 1st Edition, ISBN:9789332555402, 9332555400.
8. Hassan Gomaa, "Software Modeling And Design UML, Use Cases, Pattern, & Software Architectures", Cambridge University Press, ISBN:978-0-521-76414-8.
9. JIM Arlow, Ila Neustadt, "UML 2 and the Unified Process", Pearson, 2nd Edition, ISBN:978813170054.
10. Tom Pender, "UML 2 Bible", Wiley India, ISBN:9788126504527.

IT302: Computer Network		
Teaching Scheme	**Examination Scheme**	
Lectures: 3 Hrs./Week	**Continuous Assessment:**	**20 Marks**
	In-Sem Exam:	**30 Marks**
	End-Sem Exam:	**50 Marks**
Credits: 3	**Total:**	**100 Marks**
Prerequisite Course: Digital Electronic & Computer Organization		

Course Objectives

1. To learn about computer network fundamentals.
2. To learn different techniques for error control and flow control.
3. To learn about channel allocations and multiple access protocols.
4. To understand various routing algorithm.
5. To learn transportation in network programming.
6. To learn different protocols of application layer.

Course Outcomes (COs):

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

	Course Outcome (s)	Bloom's Taxonomy	
		Level	**Descriptor**
CO1	**Understand** computer network fundamentals.	**2**	**Understand**
CO2	**Detect** different techniques for error control and flow control.	**2**	**Understand**
CO3	**Understand** channel allocations and multiple access protocols.	**2**	**Understand**
CO4	**Understand** various routing algorithm.	**2**	**Understand**
CO5	**Apply** transportation in network programming.	**3**	**Apply**
CO6	**Analyze** different protocols of application layer.	**4**	**Analyze**

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

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

Course Contents			
Unit-I	**INTRODUCTION**	**No. of Hours**	**COs**
	Introduction of LAN; MAN; WAN; PAN, The OSI reference model, TCP/IP reference model, Data and transmission techniques, CAT5, 5e, 6, OFC and Radio Spectrum, Network Devices: Hub, Bridge, Switch, Router, Reference Model: Multiplexing: FDM, WDM, TDM.	06	CO1
Unit-II	**PHYSICAL & DATALINK LAYER**	**No.of Hours**	**COs**
	Topologies: Star and Hierarchical, Transmission media: Guided media & Unguided Media, Layer design issues, services provided to network layers, Error Control: Parity Bits, Hamming Codes, CRC Data link control and protocols – Simplex protocol, Stop-and Wait Protocol, Piggybacking.	06	CO2
Unit-III	**MEDIUM ACCESS LAYER**	**No. of Hours**	**COs**
	Channel Allocations, Multiple Access protocols- ALOHA, CSMA, CSMA/CD, CSMA/CA, Controlled Access protocol: Reservation, Polling, Token Passing, IEEE 802.11 Project: Architecture, MAC Sublayer, Bluetooth: Architecture, Layers.	06	CO3
Unit-IV	**NETWORK LAYER**	**No. of Hours**	**COs**
	Network Layer design issues, IP: IPv4 & IPv6, NAT, Routing algorithms and protocols: Unicast Distance Vector Routing, Link State Routing, Unicast Routing Protocols: RIP, EIGRP, OSPF, BGP, Congestion Control Algorithms, N/W Layer Protocols: ARP Protocol, RARP, DHCP, ICMPv4.	06	CO4
Unit-V	**TRANSPORT LAYER**	**No. of Hours**	**COs**
	Transport services, Design issues, Transport Layer Protocols: UDP: Datagram, Services, Applications: Header, Services, Features, Segment, SCTP: Header, Services, Features, Packet Format, Socket: TCP and UDP Socket.	06	CO4
Unit-VI	**APPLICATION LAYER**	**No. of Hours**	**COs**
	Application layer protocol: HTTP, WWW, DNS, SMTP, FTP, TFTP, POP3, IMAP, MIME, SNMP.	06	CO6

Text Books:

1. Andrew S. Tanenbaum, David J. Wethrall, “Computer Network”, Pearson Education, ISBN: 978-0-13-212695-3.
2. Behrouz A. Forouzan, “TCP/IP Protocol Suite”, McGraw Hill Education, 4th Edition, ISBN: 978-0-07-070652-1.

Reference Books:

1. Behrouz A. Forouzan, “Data Communication and Networking”, McGraw Hill Education, 5th Edition, ISBN: 978-1-25-906475-3.
2. Mayank Dave, “Computer Network”, Cengage Learning, ISBN: 978-81-315-0986-9.
3. Kurose Ross, “Computer Networking: A Top-Down Approach Featuring the Internet”, Pearson Education, ISBN: 978-81-7758-878-1.

IT303: Internet of Things

Teaching Scheme	**Examination Scheme**
Lectures: 3 Hrs./Week	**Continuous Assessment: 20 Marks**
	In-Sem Exam: 30 Marks
	End-Sem Exam: 50 Marks
Credits: 3	**Total: 100 Marks**
Prerequisite Course: Digital Electronic & Computer Organization	

Course Objectives

1. To understand fundamentals of Internet of Things (IoT).
2. To understand the fundamental of IoT Network Architecture and Design.
3. To develop comprehensive approach towards building Middleware for IoT and Security Challenges.
4. To learn about the Fundamental IoT Mechanism and Key Technologies.
5. To understand fundamentals of cloud of things in IoT,
6. To learn real world application scenarios of IoT along with its societal and economic impact using case studies.

Course Outcomes (COs):

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

	Course Outcome (s)	**Bloom's Taxonomy**	
		Level	**Descriptor**
CO1	**Explain** the given societal challenge using IoT.	**2**	**Understand**
CO2	**Demonstrate** IoT systems based on IoT design methodologies.	**3**	**Apply**
CO3	**Choose** between available platform for stated IoT challenge	**2**	**Understand**
CO4	**Implement** Fundamental IoT Mechanism and Key Technologies for IoT specified Environment.	**3**	**Apply**
CO5	**Design** and Implement Cloud based IoT implementations for real-world applications.	**3**	**Apply**
CO6	**Analyze** real world application scenarios of IoT along with its societal and economic impact using case studies.	**4**	**Analyze**

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	0	2	2	0	2	3	0	3	2	1	3	0	3	0
CO2	2	3	2	2	0	0	0	0	2	2	2	2	2	2	0
CO3	2	2	2	2	2	2	2	1	2	2	2	2	2	2	0
CO4	3	2	2	2	0	0	0	0	2	2	2	2	2	2	0
CO5	2	2	2	2	2	2	2	1	2	1	2	2	2	2	2
CO6	2	2	2	2	2	2	2	1	2	1	2	2	2	2	2

Course Contents			
Unit-I	**INTRODUCTION TO IOT**	**No. of Hours**	**COs**
	IoT Definition, General Observations, Overview and Motivation, Examples of Application, Exemplary Devices: Raspberry Pi, Arduino, Beagle Bone Black, Types of Sensor, IPv6 Role, Areas Development and Standardization, Scope of the Present Investigation.	06	CO1
Unit-II	**NETWORKING**	**No. of Hours**	**COs**
	Comparing IoT Architectures, A simplified IoT Architecture, The Core of IoT functional Stack, IoT Data Management and Compute Stack, SMAC Stack, IoT Protocols.	06	CO2
Unit-III	**MIDDLEWARE FOR IoT**	**No. of Hours**	**COs**
	Platform middleware – Embedded IoT Devices - communication middleware – M2M – RFID – WSN - SCADA – software middleware – Frameworks – Data standards – 5G for IoT, IoT information Security, Privacy and Governance.	06	CO3
Unit-IV	**FUNDAMENTAL IoT MECHANISMS AND KEY TECHNOLOGIES**	**No. of Hours**	**COs**
	Identification of IoT Objects and Services, Structural Aspects of the IoT, Environment Characteristics, Traffic Characteristics, Scalability, Interoperability, Security and Privacy, Open Architecture, Key IoT Technologies, Device Intelligence, Communication Capabilities, Mobility Support, Device Power, Sensor Technology, RFID Technology, Satellite Technology.	06	CO4
Unit-V	**IoT PHYSICAL SERVERS AND CLOUD OFFERINGS**	**No. of Hours**	**COs**
	Introduction to Cloud Storage Models and communication API's, WAMP-AutoBahn for IoT, Python web application framework, Designing a RESTful web API, AMAZON web services for IoT, SkyNet IoT messaging platform.	06	CO5
Unit-VI	**CASE STUDIES**	**No. of Hours**	**COs**
	Case Studies: Smart Metering/Advanced Metering Infrastructure, e-Health/Body Area Networks, City Automation, Automotive Applications, Home Automation, Smart Cards Tracking (Following and Monitoring Mobile Objects).	06	CO6

Text Books:

1. Honbo Zhou, "The Internet of Things in the Cloud A Middleware Perspective", CRC Press, 2013.
2. AdrainMcEwen, Hakim Cassimally, "Designing the Internet of Things", Wiley, 2014.
3. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, "IoT Fundamentals: Networking Technologies, Protocols, Use cases for the Internet of things", Cisco Press – Paperback- 16 August 2017 978-1-58714-456- 1 599.

Reference Books:

1. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", Willy Publication- 2013 978-1-118-47347-4, 466.
2. Arshdeep Bahga, Vijay K. Madisetti, "Internet of Things A Hands-on Approach", VPT, 1st Edition, 2014.
3. Rolf H. Weber, Romana Weber, "Internet of Things Legal Perspectives", Springer 2010, ISBN 978-3-642-11709-1.

IT304: Theory of Computation

Teaching Scheme	Examination Scheme	
Lectures: 3 Hrs./Week	**Continuous Assessment:**	**20 Marks**
	In-Sem Exam:	**30 Marks**
	End-Sem Exam:	**50 Marks**
Credits: 3	**Total:**	**100 Marks**

Prerequisite Course: Engineering Mathematics IV

Course Objectives

1. To learn finite automata and finite state machine.
2. To study regular expression, pumping lemma and properties of regular languages.
3. To understand context free grammar and context free languages.
4. To learn pushdown automata, post machines and its construction.
5. To study turing machine and variants of turing machine.
6. To learn decidable languages and turing reducibility.

Course Outcomes (COs):

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

	Course Outcome (s)	Bloom's Taxonomy	
		Level	**Descriptor**
CO1	**Apply** the concepts of finite state machines to solve computing problems.	**3**	**Apply**
CO2	**Solve** the different regular expressions for the regular languages.	**3**	**Apply**
CO3	**Apply** well defined rules for verification and simplification of context free grammar.	**3**	**Apply**
CO4	**Apply** the basic concepts of Push Down Automata and Post Machine for construction of Machines for context free languages.	**3**	**Apply**
CO5	**Understand** the variants of Turing Machine for formal languages.	**2**	**Understand**
CO6	Express the **understand**ing of the decidability and its problems.	**2**	**Understand**

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	3	2	1	3	2	3	3	2	1	2
CO2	3	3	2	2	2	3	1	2	3	1	3	3	2	0	2
CO3	3	2	2	2	2	3	3	3	3	3	3	3	2	0	2
CO4	3	2	1	2	2	3	2	3	3	2	3	3	2	0	2
CO5	3	2	2	3	2	3	2	3	3	2	3	3	2	0	2
CO6	3	3	3	3	1	3	2	3	3	3	2	3	2	0	2

Course Contents			
Unit-I	**FINITE STATE MACHINE**	**No. of Hours**	**COs**
	Basic Machine and Finite State Machine. FSM without output: Definition and Construction-DFA, NFA, NFA with epsilon-Moves, Minimization Of FA, Equivalence of NFA and DFA, Conversion of NFA with epsilon moves to NFA, Conversion of NFA With epsilon moves to DFA. FSM with output: Definition and Construction of Moore and Mealy Machines, Inter-conversion between Moore and Mealy Machines.	06	CO1
Unit-II	**REGULAR EXPRESSIONS**	**No.of Hours**	**COs**
	Definition and Identities of Regular Expressions, Construction of Regular Expression of the given L, Construction of Language from the RE, Construction of FA from the given RE using direct method, Conversion of FA to RE using Arden's Theorem, Pumping Lemma for RL, Closure properties of RLs, Applications of Regular Expressions.	06	CO2
Unit-III	**CONTEXT FREE LANGUAGES**	**No. of Hours**	**COs**
	Introduction, Formal Definition of Grammar, Notations, Derivation Process: Leftmost Derivation, Rightmost Derivation, derivation trees, Context Free Languages, Ambiguous CFG, Removal of ambiguity, Simplification of CFG, Normal Forms, Chomsky Hierarchy, Regular grammar, equivalence of RG(LRG and RLG) and FA.	06	CO3
Unit-IV	**PUSHDOWN AUTOMATA (PDAs)**	**No. of Hours**	**COs**
	Push Down Automata: Introduction and Definition of PDA, Construction (Pictorial/ Transition diagram) of PDA, Instantaneous Description and ACCEPTANCE of CFL by empty stack and final state, Deterministic PDA Vs Nondeterministic PDA, Closure properties of CFLs, Introduction Post Machine- Definition.	06	CO4
Unit-V	**TURING MACHINES (TMs)**	**No. of Hours**	**COs**
	Formal definition of a Turing machine, Recursive Languages and Recursively Enumerable Languages, Design of Turing machines, Variants of Turing Machines: Multi-tape Turing machines, Universal Turing Machine, Nondeterministic Turing machines. Comparisons of all automata.	06	CO4
Unit-VI	**DECIDABILITY AND REDUCIBILITY**	**No. of Hours**	**COs**
	Decidability: Decidable problems concerning regular languages, Decidable problems concerning context-free languages, Un-decidability, Halting Problem of TM, A Turing-unrecognizable language. Reducibility: Un-decidable Problems from Language Theory, A Simple Un-decidable Problem PCP, Mapping Reducibility.	06	CO6

Text Books:

1. Michael Sipser, "Introduction to the Theory of Computation", CENGAGE Learning, 3rd Edition ISBBN-13:978-81-315-2529-6.
2. Vivek Kulkarni, "Theory of Computation", Oxford University Press, 3rd Edition, ISBN-13: 978-0-19-808458-7.

Reference Books:

1. Hopcroft Ulman, “Introduction to Automata Theory, Languages and Computations”, Pearson Education Asia, 2nd Edition, ISBN: 9788131720479.
2. Daniel I. A. Cohen, “Introduction to Computer Theory”, Wiley-India, 2nd Edition, ISBN: 978-81-265-1334-5.
3. K.L.P Mishra, N. Chandrasekaran, “Theory of Computer Science (Automata, Languages and
4. Computation)”, Prentice Hall India, 2nd Edition.
5. John C. Martin, “Introduction to Language and Theory of Computation”, TMH, 3rd Edition, ISBN: 978-0-07-066048-9.
6. Kavi Mahesh, “Theory of Computation: A Problem Solving Approach”, Wiley-India, 3rd Edition, ISBN:978-81-265-3311-4.
7. BasavarajS.Anami, Karibasappa K.G, “Formal Languages and Automata Theory”, Wiley India, ISBN: 9788126520107.

eLearning Resources:

1. NPTEL Course: Theory of Computation
   https://onlinecourses.nptel.ac.in/noc21_cs83/preview
2. eBook: Theory of Computation
   https://www.e-booksdirectory.com/listing.php?category=98

IT305A : Software Testing and Quality Assurance (Professional Elective-I)		
Teaching Scheme	**Examination Scheme**	
Lectures: 3 Hrs./Week	**Continuous Assessment:**	**20 Marks**
	In-Sem Exam:	**30 Marks**
	End-Sem Exam:	**50 Marks**
Credits: 3	**Total:**	**100 Marks**
Prerequisite Course: Seminar and Mini-project		

Course Objectives

1. To comprehend the software process models.
2. To understand the types of software requirements and SRS document.
3. To describe the testing strategies and methodologies in projects.
4. To understand different types of testing for web applications.
5. To understand the concepts of STLC to achieve quality.
6. To understand automation tools used in quality management.

Course Outcomes (COs):

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

Course Outcome (s)		Bloom's Taxonomy	
		Level	**Descriptor**
CO1	**Apply** basic concepts of Software Engineering and Process Models	**3**	**Apply**
CO2	**Understand** the Software Requirements and SRS Documents	**2**	**Understand**
CO3	**Describe** the testing concepts and Quality Assurance	**2**	**Understand**
CO4	**Analyze** different test methodologies and approaches for web applications.	**4**	**Analyze**
CO5	**Apply** Software Testing Life Cycle for testing an application	**3**	**Apply**
CO6	**Select** proper tool to perform Software Testing.	**5**	**Evaluate**

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

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

Course Contents			
Unit-I	**INTRODUCTION TO SOFTWARE ENGINEERING**	**No. of Hours**	**COs**
	Introduction to Software Engineering: The evolving role of software, Changing Nature of Software, Software myths. **A Generic view of process:** Software engineering- A layered technology, a process framework, Process patterns, process assessment. **Process models:** The waterfall model, Incremental process models, Evolutionary process models.	06	CO1
Unit-II	**REQUIREMENT ANALYSIS & SOFTWARE DEVELOPMENT LIFE CYCLE**	**No. of Hours**	**COs**
	Software Requirements: Functional and non-functional requirements, User requirements, System requirements, Interface specification, the software requirements document. **SDLC Phases:** Requirements Phase, Analysis Phase, Design phase, Coding Phase, Testing phase, Delivery and Maintenance Phase, **SDLC Models:** Waterfall Model, V Model, Agile Model, Prototype Model, Spiral Model	06	CO2
Unit-III	**SOFTWARE TESTING**	**No. of Hours**	**COs**
	Testing as a process, Basic definitions, Software testing principles, The tester's role in a software development organization, Differences between Manual and Automation. Quality Assurance, Quality Control, Differences between QA & QC & Testing	06	CO3
Unit-IV	**SOFTWARE TESTING METHODOLOGIES AND TEST APPROACHES**	**No. of Hours**	**COs**
	White Box Testing, Black Box Testing, Grey Box Testing. **Static Techniques:** Informal Reviews, Walkthroughs, Technical Reviews, Inspection **Dynamic Techniques: Functional Testing -** Unit Testing, Integration Testing, System Testing, User Acceptance Testing, Sanity/Smoke Testing, Regression Test, Retest. **Non Functional Testing -** Performance Testing. Scalability Testing, Compatibility Testing, Security Testing, Session Testing, Recovery Testing, Installation Testing, Adhoc Testing, Risk Based Testing, I18N Testing, L1ON Testing.	06	CO4
Unit-V	**SOFTWARE TESTING LIFE CYCLE**	**No. of Hours**	**COs**
	Requirements Analysis/Design, Test Planning, Test Cases Design, Test Environment setup, Test Execution and Test Closure	06	CO5
Unit-VI	**SOFTWARE TEST AUTOMATION**	**No. of Hours**	**COs**
	What is Test Automation, Terms used in automation, Skills needed for automation, What to automate, scope of automation, Introducing Selenium, Selenium Tool Suite, Selenium-IDE, Selenium RC, Selenium Webdriver, Selenium Grid.	06	CO6

Text Books:

1. Srinivasan Desikan, Gopalaswamy Ramesh, “Software Testing: Principles and Practices” Pearson.
2. Daniel Galin, “Software Quality Assurance: From Theory to Implementation”, Pearson Addison Wesley.
3. M G Limaye, “Software Testing Principles, Techniques and Tools”, Tata McGraw Hill, ISBN: 9780070139909 0070139903.

Reference Books:

1. Roger S. Pressman, “Software Engineering”, Mc Graw Hill.
2. Aditya P. Mathur, “Foundations of Software Testing”, Pearson.
3. Paul Ammann, Jeff Offutt, “Introduction to Software Testing”, Cambridge University Press.
4. Stephen Kan, “Metrics and Models in Software Quality”, Addison Wesley, 2nd Edition.

eLearning Resources

1. https://nptel.ac.in/courses/106/105/106105150/
2. https://onlinecourses.nptel.ac.in/noc19_cs71/preview

IT305B: Foundation of Data Science (Professional Elective-I)

Teaching Scheme	Examination Scheme	
Lectures: 3 Hrs./Week	**Continuous Assessment:**	**20 Marks**
	In-Sem Exam:	**30 Marks**
	End-Sem Exam:	**50 Marks**
Credits: 3	**Total:**	**100 Marks**

Prerequisite Course: Engineering Mathematics, Database Management Systems

Course Objectives

1. To introduce the data mining basics.
2. To introduce the origins of big data.
3. To introduce the fundamentals of big data.
4. To introduce the classification techniques of data.
5. To introduce the clustering techniques of data.
6. To introduce the data analytics with case study.

Course Outcomes (COs):

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

	Course Outcome (s)	Bloom's Taxonomy	
		Level	**Descriptor**
CO1	**Understand** concept of data mining.	**2**	**Understand**
CO2	**Understand** the sources of big data.	**2**	**Understand**
CO3	**Analyze** the fundamentals of big data.	**4**	**Analyze**
CO4	**Analyze** various classifications techniques of data.	**4**	**Analyze**
CO5	**Apply** various clustering techniques of data.	**3**	**Apply**
CO6	**Apply** the data analytics case study.	**3**	**Apply**

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

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

Course Contents			
Unit-I	**INTRODUCTION TO DATA MINING**	**No. of Hours**	**COs**
	Need of Data Mining, procedure of Data Mining, various kinds of data for mining- Database Data, Data Warehouses, Transactional Data, Other Kinds of Data, Limitations of Data mining - Mining Methodology, User Interaction, Efficiency and Scalability, Diversity of Database Types, Data Mining and Society.	06	CO1
Unit-II	**ORIGINS TO GENERATE BIG DATA**	**No.of Hours**	**COs**
	Sensors/meters and activity records from electronic devices- case study, Social interactions- case study, Business transactions- case study, Electronic Files- case study, Broadcastings- case study.	06	CO2
Unit-III	**FUNDAMENTALS OF BIG DATA**	**No. of Hours**	**COs**
	Aspects of Big data – structured data, Unstructured data, Natural Language, Machine generated data, graph-based data, big data architecture, audio, image and video data, streaming data, Data science process- necessity to prepare data, retrieving data, preparation of data, data explosion, data modeling and model building, presentation and automation.	06	CO3
Unit-IV	**BASICS OF DATA CLASSIFICATION**	**No. of Hours**	**COs**
	Concept of Data classification, Introduction of Decision tree, Bayes Classification, Rule based classification, Model Evaluation and Selection, Bayesian Belief Networks, Support Vector Machines, Genetic Algorithms, Rough Set Approach, Fuzzy Set Approaches, Classification accuracy improvement techniques.	06	CO4
Unit-V	**BASICS OF CLUSTERING**	**No. of Hours**	**COs**
	Introduction of Clustering, need to use Clustering, K-means Preliminaries, The K-means Algorithm, How to Evaluate Clustering, Beyond K-means: What Really Makes a Cluster, Beyond K-means: Other Notions of Distance, Beyond K-means: Grouping Data by Similarity, Data and Pre-Processing, Big Data and Nonparametric Bayes.	06	CO5
Unit-VI	**DATA ANALYTICS LIFECYCLES**	**No. of Hours**	**COs**
	Data Analytics Lifecycles overview, Discovery, data preparation, Model planning, Model building, Communication results, Operationalize, Case Study: Global Innovation Network and Analysis (GINA).	06	CO6

Text Books:

1. Jiawei Han, MichelineKamber, Jian Pei,"Data Mining- Concepts and Techniques", 3rd Edition, ISBN 978-0-12-381479-1.
2. DT Editorial Services, "Big Data, Black Book: Covers Hadoop 2, MapReduce, Hive, YARN, Pig, R and Data Visualization", Dreamtech Publication, ISBN- 9789351199311.
3. Li Chen, Zhixun Su, Bo Jiang, "Mathematical Problems in Data Science", Springer, ISBN :978-3-319- 25127-1.

Reference Books:

1. Michael Minelli, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
2. AmbigaDhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends

for Today's Business", Wiley CIO Series.
3. Arvind Sathi, "Big Data Analytics: Disruptive Technologies for Changing the Game", IBM Corporation, ISBN:978-1-58347-380-1.
4. EMC Education Services, "Data Science and Big Data Analytics- Discovering, analyzing Visualizing and Presenting Data", Wiley, 1st Edition, ISBN-13978-1118876138.

IT305C: Data Mining Techniques (Professional Elective-I)		
Teaching Scheme	**Examination Scheme**	
Lectures: 3 Hrs./Week	**Continuous Assessment:**	**20 Marks**
	In-Sem Exam:	**30 Marks**
	End-Sem Exam:	**50 Marks**
Credits: 3	**Total:**	**100 Marks**
Prerequisite Course: Engineering Mathematics, Database Management Systems		

Course Objectives

1. To understand the fundamentals of Data Mining.
2. To identify the appropriateness and need of mining the data.
3. To learn the pre-processing, mining and post processing of the data.
4. To understand various methods, techniques and algorithms in data mining.
5. To study concepts of pattern based data mining for decision making.
6. To understand Data Mining needs and Application.

Course Outcomes (COs):

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

	Course Outcome (s)	Bloom's Taxonomy	
		Level	**Descriptor**
CO1	**Apply** basic, intermediate and advanced techniques to mine the data.	**3**	**Apply**
CO2	**Analyze** the output generated by the pre-processing of data.	**4**	**Analyze**
CO3	**Explore** the hidden patterns in the data	**4**	**Analyze**
CO4	**Demonstrate** the algorithms used for text mining	**3**	**Apply**
CO5	**Implement** mining techniques for realistic data.	**3**	**Apply**
CO6	**Understand** the various kinds of tools.	**2**	**Understand**

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

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

Course Contents			
Unit-I	**INTRODUCTION**	**No. of Hours**	**COs**
	Data Mining, Data Mining Task Primitives, Data: Data, Information and Knowledge; Attribute; Types: Nominal, Binary, Ordinal and Numeric attributes, Discrete versus Continuous Attributes; Introduction to Data Pre-processing, Data Cleaning: Missing values, Noisy data; Data integration: Correlation analysis; transformation: Min-max normalization, z-score normalization and decimal; scaling; data reduction: Data Cube Aggregation, Attribute Subset Selection, sampling; and Data, Discretization: Binning, Histogram Analysis.	06	CO1
Unit-II	**ASSOCIATION RULES MINING**	**No. of Hours**	**COs**
	Market basket Analysis, Frequent item set, Closed item set, Association Rules, a-priori Algorithm, Generating Association Rules from Frequent Item sets, Improving the Efficiency of a-priori, Mining Frequent Item sets without Candidate Generation: FP Growth Algorithm; Mining Various Kinds of Association Rules: Mining multilevel association rules, constraint based association rule mining, Meta rule-Guided Mining of Association Rules.	06	CO2
Unit-III	**CLASSIFICATION**	**No. of Hours**	**COs**
	Introduction to: Classification and Regression for Predictive Analysis, Decision Tree Induction, Rule-Based Classification: using IF-THEN Rules for Classification, Rule Induction Using a Sequential Covering Algorithm. Bayesian Belief Networks, Training Bayesian Belief Networks, Classification Using Frequent Patterns, Associative Classification, Lazy Learners-k-Nearest-Neighbour Classifiers, Case-Based Reasoning.	06	CO3
Unit-IV	**CLUSTERING**	**No. of Hours**	**COs**
	Cluster analysis, distance measures, partitioning methods – k-means, k-medoids, hierarchical methods – single-link, complete-link, centroid, average link, Agglomerative method.	06	CO4
Unit-V	**TEXT AND WEB MINING**	**No. of Hours**	**COs**
	Text mining: Text Data Analysis and Information Retrieval, Dimensionality Reduction for Text, Feature vector, Bag of words, Tf-idf, Text Mining Approaches. Web mining: Introduction, web content mining, web usage mining, web structure mining, web crawlers.	06	CO5
Unit-VI	**REINFORCEMENT LEARNING AND BIG DATA MINING**	**No. of Hours**	**COs**
	Reinforcement learning- Introduction to reinforcement and holistic learning, Multi-perspective decision making for Big data and multi-perspective learning for big data, Advanced techniques for big data mining.	06	CO6
Text Books:			
1. Han, Jiawei Kamber, Micheline Pei and Jian, “Data Mining: Concepts and Techniques”, Elsevier Publishers, ISBN: 9780123814791, 9780123814807. 2. Parag Kulkarni, “Reinforcement and Systemic Machine Learning for Decision Making”, Wiley-			

IEEE Press, ISBN: 978-0-470-91999-6.

Reference Books:

1. Matthew A. Russell, "Mining the Social Web: Data Mining Facebook, Twitter, LinkedIn, Google+, GitHub, and More", Shroff Publishers, 2nd Edition, ISBN: 9780596006068.
2. Saumen Charkrobarti, “Mining the Web Discovering Knowledge from Hypertext Data”, Morgan Kaufmann, ISBN-13978-1558607545.
3. M. Dunham, “Data mining: Introductory and Advanced topics”, Pearson Education, 2003.

IT306 : Software Modeling and Design Laboratory

Teaching Scheme	Examination Scheme	
Lectures: 2 Hrs./Week	**Term Work:**	**NA**
	Oral :	**NA**
	Practical:	**50 Marks**
Credits: 1	**Total:**	**50 Marks**

Prerequisite Course: Object Oriented Programming.

Course Objectives

1. To prepare software system to identify requirements and formulate problem statement.
2. To prepare Use Case & Domain Class Model.
3. To prepare Structural Model.
4. To prepare Interaction and Behavior Model.

Course Outcomes (COs):

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

	Course Outcome (s)	Bloom's Taxonomy	
		Level	**Descriptor**
CO1	**Analyze** software system to identify software requirements and formulate problem statement.	**4**	**Analyze**
CO2	**Design** Use Case, Domain Class Model.	**3**	**Apply**
CO3	**Design** Structural Model	**3**	**Apply**
CO4	**Design** Interaction and behavior Model.	**3**	**Apply**

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

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

Guidelines: This Software Modeling and Design Laboratory course has Software Engineering, Modeling and Design as a core subject. The problem statements should be framed based on assignments mentioned in the syllabus. The teacher will frame the problem statements with due consideration that students have three hours to complete it. The practical examination will comprise of implementation and related theory. All assignments are to be performed in suitable open source UML tool. Use of open source platform and tools is encouraged.

Term work: Staff in-charge will suitably frame the above assignments and flexibility may be incorporated. Students will submit term work in the form of journal. Each assignment has to be well documented with problem definition, code documented with comments. Staff in-charge will assess the assignments continuously and grade or mark each assignment on completion date. All the assignments should be conducted in suitable open source UML tool.

Suggested List of Assignments

Sr. No.	Assignment	No. of Hours	COs
1.	Write Problem Statement for System / Project.	4 Hrs.	CO1
2.	Prepare Use Case Model.	2 Hrs.	CO1
3.	Prepare Activity Model.	4 Hrs.	CO2
4.	Prepare Analysis Model-Class Model.	2 Hrs.	CO2
5.	Prepare a Design Model from Analysis Model	4 Hrs.	CO3
6.	Prepare Sequence Model.	4 Hrs.	CO4
7.	Prepare a State Model.	2 Hrs.	CO4

Reference Books:

1. Tom Pender, "UML2 Bible", Wiley India Pvt. Limited 2011.
2. JIM Arlow, Ila Neustadt, "UML 2 and the Unified Process", 2nd Edition, Pearson.

IT307 : Computer Network Laboratory			
Teaching Scheme		**Examination Scheme**	
Lectures: 2 Hrs./Week		**Term Work:**	**NA**
		Oral :	**50 Marks**
		Practical:	**NA**
Credits: 1		**Total:**	**50 Marks**

Prerequisite Course: Digital Electronic & Computer Organization

Course Objectives

1. To design small size network and simulation using network simulator.
2. To implement routing algorithms.
3. To implement Network Address Translation.
4. To understand transport and application level protocols.

Course Outcomes (COs):

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

	Course Outcome (s)		Bloom's Taxonomy	
			Level	**Descriptor**
	CO1	**Design** small size network and simulation using network simulator.	**3**	**Apply**
	CO2	**Implementation** of routing algorithms.	**3**	**Apply**
	CO3	**Implementation of** Network Address Translation.	**3**	**Apply**
	CO4	**Demonstrate** transport and application level protocols.	**3**	**Apply**

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

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

Guidelines: This Computer Network Laboratory course has Computer Network as a core subject. The problem statements should be framed based on assignments mentioned in the syllabus. The teacher will frame the problem statements with due consideration that students have three hours to complete that. The practical examination will comprise of implementation and related theory. All assignments are to be performed in C Language, C++ or Java. Use of open source platform and tools is encouraged.

Term work: Staff in-charge will suitably frame the above assignments and flexibility may be incorporated. Students will submit term work in the form of journal. Each assignment has to be well documented with problem definition, code documented with comments. Staff in-charge will assess the assignments continuously and grade or mark each assignment on completion date.All the assignments should be conducted in C or C++ or Java Language.

Suggested List of Assignments

Sr. No.	Assignment	No. of Hours	COs
1.	Assignment on setting up a small IP network	2 Hrs.	CO1
2.	Assignment on network simulator.	2 Hrs.	CO1
3.	Assignment of implementation of various routing algorithms like Static and RIP.	2 Hrs.	CO2
4.	Assignment of implementation of various routing algorithms like EIGRP and OSPF.	2 Hrs.	CO2
5.	Assignment on configuration of Network Address Translation Static and Dynamic using suitable network simulator.	2 Hrs.	CO3
6.	Assignment on configuration of Network Address Translation- Port Address Translation using suitable network simulator.	2 Hrs.	CO3
7.	Assignment on socket programming on Linux – TCP and UDP server.	2 Hrs.	CO4
8.	Assignment on application protocol such as HTTP, FTP, SMTP, DNS.	2 Hrs.	CO4

Text Books:

1. Andrew S. Tanenbaum, David J. Wethrall, “Computer Network”, Pearson Education, ISBN: 978-0-13-212695-3.
2. Behrouz A. Forouzan, “TCP/IP Protocol Suite”, McGraw Hill Education, ISBN: 978-0-07-070652-1, 4th Edition.
3. William Stallings, Computer Security: Principles and Practices, Pearson 6th Edition, ISBN: 978-0-13-335469-0.
4. Nina Godbole, Sunit Belapure, “Cyber Security- Understanding Cyber Crimes, Computer Forensics and Legal Perspectives”, Wiley India Pvt. Ltd, ISBN- 978-81-265-2179-1.
5. Bernard Menezes, “Network Security and Cryptography”, Cengage Learning, ISBN-978-81-315-1349-1.

Reference Books:

1. Behrouz A. Forouzan, “Data Communication and Networking”, McGraw Hill Education, 5th Edition, ISBN: 978-1-25-906475-3.
2. Mayank Dave, “Computer Network”, Cengage Learning, ISBN: 978-81-315-0986-9.
3. Berouz Forouzan, “Cryptography and Network Security”, TMH, 2nd Edition, ISBN -978-00-707-0208-0.
4. Kurose Ross, “Computer Networking: A Top-Down Approach Featuring the Internet”, Pearson Education, ISBN: 978-81-7758-878-1.
5. Bruice Schneier, “Applied Cryptography- Protocols, Algorithms and Source code in C, Algorithms”, Wiley India Pvt Ltd, 2nd Edition, ISBN 978-81-265-1368-0.
6. Nina Godbole, “Information Systems Security”, Wiley India Pvt. Ltd, ISBN -978-81-265-1692-6.
7. CK Shyamala et al., “Cryptography and Security”, Wiley India Pvt. Ltd, ISBN-978-81-265-2285-9.

8. Dr. V. K. Pachghare, “Cryptography and Information Security”, PHI, 2nd Edition, ISBN- 978-81-203-5082-3.

IT308 : Internet of Things Laboratory

Teaching Scheme	Examination Scheme	
Lectures: 2 Hrs./Week	**Term Work:**	**50 Marks**
	Oral :	**NA**
	Practical:	**NA**
Credits: 1	**Total:**	**50 Marks**

Prerequisite Course: Computer Network Technology

Course Objectives

1. To learn IoT platforms and operating system such as Raspberry -Pi/Beagle Board/ Arduino.
2. To learn web interface for IoT.
3. To learn the knowledge for communication objects.
4. To learn cloud environment for IoT.

Course Outcomes (COs):

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

	Course Outcome (s)	Bloom's Taxonomy	
		Level	**Descriptor**
CO1	**Understand** IoT platforms and operating system such as Raspberry-Pi/Beagle Board/Arduino.	**2**	**Understand**
CO2	**Implement** the web interface for IoT and solve Real World Problems	**3**	**Apply**
CO3	**Demonstrate** communication within the objects using IoT platforms such as Raspberry-Pi/Beagle Board/Arduino.	**3**	**Apply**
CO4	**Implement** cloud environment for IoT applications.	**3**	**Apply**

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

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

Guidelines: This Internet of Things Laboratory course has Internet of Things as a core subject. The problem statements should be framed based on assignments mentioned in the syllabus. The teacher will frame the problem statements with due consideration that students have three hours to complete that. The practical examination will comprise of implementation and related theory. All assignments are to be performed in C Language, C++ or Java. Use of open source platform and tools is encouraged.

Term work: Staff in-charge will suitably frame the above assignments and flexibility may be incorporated. Students will submit term work in the form of journal. Each assignment has to be well documented with problem definition, code documented with comments. Staff in-charge will assess the assignments continuously and grade or mark each assignment on completion date. All the assignments should be conducted in C or C++ or Java Language.

Suggested List of Assignments

Sr. No.	Assignment	No. of Hours	COs
1.	Assignment based on Study of Raspberry-Pi/Beagle Board/Arduino	2 Hrs.	CO1
2.	Assignment based on Study of different operating systems for Raspberry-Pi/Beagle board/Arduino. Understanding the process of OS installation on Raspberry-Pi/Beagle board/Arduino.	2 Hrs.	CO1
3.	Assignment based on Open source prototype platform- Raspberry-Pi/Beagle board/Arduino. Simple program digital read/write using LED.	2 Hrs.	CO2
4.	Assignment based on Designing a web interface to control connected LEDs remotely using Raspberry-Pi/Beagle board/Arduino.	2 Hrs.	CO2
5.	Write an application to detect obstacle using Proximity sensor and notify the user using LED or Buzzer.	2 Hrs.	CO3
6.	Assignment based on RFID/NFC using Arduino.	2 Hrs.	CO3
7.	Assignment based on Cloud Server.	2 Hrs.	CO4
8.	Assignment based on Mini Project.	2 Hrs.	CO4

Text Books:

1. Vijay Madisetti, “Internet of Things: A Hands-On Approach Arshdeep Bahga”, VPT – Paperback2015 978- 0996025515 628/- 2.
2. David Hanes, Gonzalo Salgueiro, “IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things”, Patrick Grossetete Cisco Press – Paperback – 16 Aug 2017 978-1- 58714-456- 1 599.
3. Daniel Minoli, “Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications”, Willy Publications - 2013 978-1-118- 47347-4, 466.

Reference Books:

1. Olivier Hersent, “The Internet of Things Key applications and protocols”, Willy Publications 2nd Edition 978-1-119- 99435-0.
2. Hakima Chaouchi, “The Internet of Things Connecting Objects to the Web”, Willy Publications, 978-1-84821- 140-7.
3. Agus Kurniawan, “The Internet of Things Donald Norris TAB 4 Smart Internet of Things Projects”, PACKT.
4. Cuno Pfister, “Getting Started with the Internet of Things”, SPD O’REILL Y IOT.
5. Dr. V. K. Pachghare, “Cryptography and Information security”, PHI, 2nd Edition, ISBN- 978-81-203-5082-3.

IT309 : Mini-Project Based on Skill Based Credit Course			
Teaching Scheme		**Examination Scheme**	
		Continuous Assessment	**50 Marks**
Practical: 2 Hrs./Week		**In-Sem Exam**	**NA**
		End-Sem Exam	**NA**
Credits: 1		**Total:**	**50 Marks**

Prerequisite Course: Object Oriented Programming, Database Management Systems

Course Objectives

1. To understand software requirement and design using industry standard tools.
2. To understand the agile methodology for development, testing of software products.
3. To understand sprint retrospective technology.

Course Outcomes (COs):

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

	Course Outcome (s)	Bloom's Taxonomy	
		Level	**Descriptor**
CO1	**Demonstrate** knowledge of software requirements and design using jira and Github.	**3**	**Apply**
CO2	**Apply** the knowledge of agile methodology for implementation, testing of software products.	**3**	**Apply**
CO3	**Use** sprint retrospective for deployment and planning.	**3**	**Apply**

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

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

Guidelines: This Mini-Project Based on Skill Based Credit Course do not have any particular subject as its core subject. The problem statements should be framed based on assignments mentioned in the syllabus. The teacher will frame the problem statements with due consideration that students have three hours to complete that. The practical examination will comprise of implementation and related theory. All assignments are to be performed in HTML, CSS, Javascript, PHP and MySQL. Use of open source platform and tools is encouraged.

Term work: Staff in-charge will suitably frame the above assignments and flexibility may be incorporated. Students will submit term work in the form of journal. Each assignment has to be well documented with problem definition, code documented with comments. Staff in-charge will assess the assignments continuously and grade or mark each assignment on completion date.All the assignments should be conducted in HTML, CSS, Javascript, PHP and MySQL.

Suggested List of Assignments

Sr. No.	Assignment	No. of Hours	COs
1.	Introduction (software development process, mvp, etc), handing out projects, squad formations, roles & responsibilities, how to make design document, plan for app development, Jira introduction, Q&A, highlight what students can adopt, define future course of action, Presentations on design documents by groups.	4 Hrs.	CO1
2.	Development process best practices (by instructor) , (Agile, Jira continuation, Git, unit testing, automation test tools, coding best practices) (Local development, sprint planning for 1 group), Sprint demo local deployment by groups.	5 Hrs.	CO2
3.	Sprint planning & sprint retrospective any 1 group at random, building a pipeline 30 mins, (by instructor). Sprint demo: Cloud deployment by groups, sprint planning & sprint retrospective any 1 group at random, how do you iterate, change management. Final sprint demo cloud deployment by groups, sprint retrospective any 1 group at random, closing comments by instructor.	4 Hrs.	CO3

Reference Books:

1. Mumshad Mannambeth, “Docker for the Absolute Beginner - Hands-On”, Packt Publishing, ISBN: 9781788991315. https://learning.oreilly.com/videos/docker-for-the/9781788991315/

eLearning Resources:

1. “Docker Engine installation overview”, https://docs.docker.com/engine/install/
2. “Gitlab”, https://docs.gitlab.com/ee/gitlab-basics/
3. “Jira for Agile team management” https://www.youtube.com/watch?v=TsG3OWTDAFY
4. “Selenium”, https://www.youtube.com/watch?v=oo8hakhidQM (Selenium installation on your machine and basic test automation)
   https://www.youtube.com/watch?v=_lBaedX4UAE (Selenium docker setup)
   https://www.youtube.com/watch?v=esb1v_d5-™ (Selenium running tests via containers)
5. “AWS ECS deployment”
   https://docs.aws.amazon.com/AmazonECS/latest/userguide/ECS_CLI_installation.html (installation)
   https://docs.aws.amazon.com/AmazonECS/latest/userguide/ecs-cli-tutorial-fargate.html
   https://reflectoring.io/aws-deploy-docker-image-via-web-console/

MC 310 : Behavioural and Interpersonal skills (non-verbal skills / behaviours, nonaggression)(Mandatory Course – V)		
Teaching Scheme	**Examination Scheme**	
Lectures: 1 Hrs./Week	**Term Work:**	**NA**
	Oral :	**NA**
	Practical:	**NA**
Credits: Non Credit	**Total:**	**NA**

Course Contents

Each individual has behaviour patterns that are shaped by the context of his or her past. Most often, adapting the behaviour to the changing context of the reality a person lives in becomes difficult which may lead to the reduction in personal effectiveness and natural self-expression. The main focus of this course is to equip the students with useful approaches to help in the deeper understanding of self and help individuals empower themselves to be the source of their own growth and development. The course will help students to learn effective communication skills, Group and team building skills and will help them learn thegoal setting process and thus become more effective in achieving their goals. The broader objective of this course is to make the students aware about the different facets of self and to help them learn skills to strengthen their inner capacities. So that they are able to understand themselves, think and act effectively, to be able to communicate in an effective manner and to learn to lead and to form an effective team. The specific objectives, however, are as following.

- To help the students to understand their real self by recognizing different aspects of their self-concept that will lead to an increased self-confidence.
- To train the students for communicating effectively in both formal as well as in informal settings.
- To help the students to understand the importance of non-verbal aspects of effective communication.
- To help the students to understand Emotion and emotional intelligence, Managing ones' own emotional reservoirs, effective dealing with emotions at work
- To facilitate the students in understanding the formation and function of group and team and to help them to learn the skills of a successful leader.
- To help the students in understanding and practicing the goal setting process by recognizing the importance of each step involved in goal setting. The activities involved are designed to facilitate their career goal decision making.

The activities to achieve the above objectives can be suggested as follows.

- Motivational lectures
- Group Discussions/activities
- Case Study
- Games/Stimulation Exercises
- Role-Playing
- Mindfulness training.

T.Y. B. Tech Information Technology Semester VI

IT311: Cryptography and Cyber Security		
Teaching Scheme	**Examination Scheme**	
Lectures: 3 Hrs./Week	**Continuous Assessment:**	**20 Marks**
	In-Sem Exam:	**30 Marks**
	End-Sem Exam:	**50 Marks**
Credits: 3	**Total:**	**100 Marks**
Prerequisite Course: Basic of Mathematics**,** Computer Fundamentals & Programming,		

Course Objectives

1. To understand security attack, security services and security mechanism
2. To use the different cryptographic algorithms for implementing security.
3. To use the different Message digest algorithms to secure a message over insecure channel.
4. To understand various protocols for network security to protect against the threats in the networks.
5. To apply and exhibit knowledge to secure personal data, and secure computer networks in an organization.
6. To apply security measures in an organization.

Course Outcomes (COs):

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

Course Outcome (s)		Bloom's Taxonomy	
		Level	**Descriptor**
CO1	**Understand** security attack, security services and security mechanism.	**2**	**Understand**
CO2	**Use** different cryptographic algorithms for implementing security.	**3**	**Apply**
CO3	**Use** the different Message digest algorithms to secure a message over insecure channel.	**3**	**Apply**
CO4	**Understand** various protocols for network security to protect against the threats in the networks.	**2**	**Understand**
CO5	**Apply** and exhibit knowledge to secure personal data, and secure computer networks in an organization	**3**	**Apply**
CO6	**Apply** security measures in an organization.	**3**	**Apply**

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

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

Course Contents			
Unit-I	**SECURITY FUNDAMENTALS**	**No. of Hours**	**COs**
	Introduction, Threats and Attacks, Security Services, Security Mechanisms, Cipher Techniques: Substitution and Transposition, One Time Pad, Block Ciphers, Stream Ciphers.	06	CO1
Unit-II	**CRYPTOGRAPHY**	**No. of Hours**	**COs**
	Symmetric Key Algorithms: Data Encryption standards, Advanced Encryption Standard, Linear Cryptanalysis and Differential Cryptanalysis, Public Key Algorithms: RSA, Key Generation and Usage, Diffie-Hellman Key Exchange Algorithm.	06	CO2
Unit-III	**MESSAGE DIGEST AND KEY MANAGEMENT**	**No. of Hours**	**COs**
	Hash Algorithms: SHA-1, MD5, Key Management: Introduction, Key Management: Generations, Distribution, Updation, Digital Certificate, Digital Signature, Kerberos 5.0.	06	CO3
Unit-IV	**NETWORK SECURITY**	**No. of Hours**	**COs**
	IPSEC- Introduction, AH and ESP, Tunnel Mode, Transport Mode, Security Associations, SSL- Introduction, Handshake Protocol, Record Layer Protocol. IKE- Internet Key Exchange Protocol.	06	CO4
Unit-V	**INTRODUCTION TO CYBER SECURITY**	**No. of Hours**	**COs**
	Introduction, Definition and origin, Cybercrime and Information Security, Classification of Cybercrimes, The legal Perspectives- Indian Perspective, Global Perspective, Categories of Cybercrime, Types of Attacks, a Social Engineering, Cyberstalking.	06	CO5
Unit-VI	**TOOLS AND METHODS USED IN CYBERCRIME**	**No. of Hours**	**COs**
	Introduction, Phishing, Password Cracking, Key-loggers and Spywares, Types of Virus, Worms, Dos and DDoS ,SQL injection, Cyber laws- Indian context, The Indian IT Act-Challenges, Amendments, Challenges to Indian Law and cybercrime Scenario in India, Indian IT Act and Digital Signatures.	06	CO6

Text Books:

1. William Stallings, "Cryptography and Network Security Principles and Practice", Pearson Education/PHI, 2006, ISBN: 978-1-292-15858-7.
2. Atul Kahate, "Cryptography and Network Security", McGraw Hill, ISBN: 9780070494831.
3. Nina Godbole, Sunit Belapure, “Cyber Security- Understanding Cyber Crimes, Computer Forensics and Legal Perspectives”, Wiely India Pvt. Ltd, ISBN- 978-81-265-2179-1.

Reference Books:

1. Nina Godbole, “Information Systems Security”, Wiley India Pvt. Ltd, ISBN -978-81-265-1692-6.
2. William Stallings, “Computer Security : Principles and Practices”, Pearson Ed. ISBN :978-81-317-3351-6.
3. Mark Merkow, “Information Security-Principles and Practices”, Pearson Ed. 978-81-317-1288-7.
4. CK Shyamala, et al., “Cryptography and Security”, Wiley India Pvt. Ltd, ISBN 978-81-265-2285-9.
5. Berouz Forouzan, “Cryptography and Network Security”, 2nd Edition, TMH, ISBN :9780070702080.

eLearning Resources

1. Cyber Security: https://onlinecourses.swayam2.ac.in/cec23_cs03/preview
2. Fundamentals of Cryptography:

https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_012666884706803712703_shared/overview

3. Cryptography with Python: https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013094409461669888178 3_shared/overview

IT312: Artificial Intelligence

Teaching Scheme	Examination Scheme	
Lectures: 3 Hrs./Week	**Continuous Assessment:**	**20 Marks**
	In-Sem Exam:	**30 Marks**
	End-Sem Exam:	**50 Marks**
Credits: 3	**Total:**	**100 Marks**

Prerequisite Course: Data Structures and Files

Course Objectives

1. To understand the basic principles of Artificial Intelligence
2. To provide an understanding of uninformed search strategies.
3. To provide an understanding of informed search strategies.
4. To study the concepts of Knowledge based system.
5. To learn and understand use of fuzzy logic and neural networks.
6. To learn and understand various application domain of Artificial Intelligence.

Course Outcomes (COs):

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

Course Outcome (s)		Bloom's Taxonomy	
		Level	**Descriptor**
CO1	**Understand** the basics of the theory and practice of Artificial Intelligence as a discipline and about intelligent agents capable of problem formulation.	**2**	**Understand**
CO2	**Analyze** of different uninformed search algorithms on well formulates problems along with stating valid conclusions that the evaluation supports.	**4**	**Analyze**
CO3	**Design and Analysis** of informed search algorithms on well formulated problems.	**4**	**Analyze**
CO4	**Formulate and solve** given problem using Propositional and First order logic.	**3**	**Apply**
CO5	**Apply** planning and neural network learning for solving AI problems	**3**	**Apply**
CO6	**Apply** reasoning for non-monotonic AI problems.	**3**	**Apply**

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

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

Course Contents

Unit-I	**FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE**	**No. of Hours**	**COs**
	Introduction, A.I. Representation, Non-AI &AI Techniques, Representation of Knowledge, Knowledge Base Systems, State Space Search, Production Systems, Problem Characteristics, types of production systems, Intelligent Agents and Environments, concept of rationality, the nature of environments, structure of agents, problem solving agents, problem formulation	06	CO1
Unit-II	**UNINFORMED SEARCH STRATEGIES**	**No. of Hours**	**COs**
	Formulation of real world problems, Breadth First Search, Depth First Search, Depth Limited Search, Iterative Deepening Depth First Search, Bidirectional Search, Comparison of Uninformed search Strategies, Searching with partial information, Sensor-less problems, Contingency problems.	06	CO2
Unit-III	**INFORMED SEARCH STRATEGIES**	**No. of Hours**	**COs**
	Generate& test, Hill Climbing, Best First Search, A* and AO* Algorithm, Constraint satisfaction, Game playing: Minimax Search, Alpha-Beta Cutoffs, Waiting for Quiescence.	06	CO3
Unit-IV	**KNOWLEDGE REPRESENTATION**	**No. of Hours**	**COs**
	Knowledge based agents, Wumpus world. Propositional Logic: Representation, Inference, Reasoning Patterns, Resolution, Forward and Backward Chaining. First order Logic: Representation, Inference, Reasoning Patterns, Resolution, Forwardand Backward Chaining. Basics of PROLOG: Representation, Structure, Backtracking. Expert System: Case study of Expert System in PROLOG	06	CO4
Unit-V	**INTRODUCTION TO PLANNING AND ANN**	**No. of Hours**	**COs**
	Blocks world, STRIPS, Implementation using goal stack, Introduction to Neural networks:- basic, comparison of human brain and machine, biological neuron, general neuron model, activation functions, Perceptron learning rule, applications and advantages of neural networks. Brief introduction to single layer and multiplayer networks.	06	CO5
Unit-VI	**UNCERTAINTY**	**No. of Hours**	**COs**
	Non Monotonic Reasoning, Logics for Non Monotonic Reasoning, Justification based Truth Maintenance Systems, Semantic Nets, Statistical Reasoning, Fuzzy logic: fuzzy set definition and types, membership function, designing a fuzzy set for a given application. Probability and Bayes' theorem, Bayesian Networks.	06	CO6

Text Books:

1. Elaine Rich and Kevin Knight, "Artificial Intelligence" Tata McGraw Hill.
2. Stuart Russell & Peter Norvig, "Artificial Intelligence: A Modern Approach", Pearson Education, 2nd Edition.

Reference Books:

1. Ivan Bratko, "Prolog Programming For Artificial Intelligence", 2nd Edition, Addison Wesley, 1440.
2. Eugene, Charniak, Drew Mcdermott, "Introduction to Artificial Intelligence", Addison Wesley.
3. Patterson, “Introduction to AI and Expert Systems”, PHI.
4. Nilsson, “Principles of Artificial Intelligence”, Morgan Kaufmann.
5. Carl Townsend, “Introduction to turbo Prolog”, Paperback, 1483.
6. Jacek M. Zurada, “Introduction to Artificial Neural Systems”, Jaico Publication.

eLearning Resources

Online Courses:

1. An Introduction to Artificial Intelligence by Prof. Mausam, IIT Delhi, NPTEL Course.
2. AI for Everyone by Andrew Ng, Coursera Course.

eResources:

1. http://www.eecs.qmul.ac.uk/~mmh/AINotes/AINotes4.pdf
2. https://www.slideshare.net/JismyKJose/conceptual-dependency-70129647
3. https://web.archive.org/web/20150813153834/http://www.cs.berkeley.edu/~zadeh/papers/Fuzzy%20Sets-Information%20and%20Control-1965.pdf
4. https://www.youtube.com/watch?v=aircAruvnKk
5. https://www.youtube.com/watch?v=IHZwWFHWa-w

IT313: System Programming and Operating System

Teaching Scheme	Examination Scheme	
Lectures: 4 Hrs./Week	**Continuous Assessment:**	**20 Marks**
	In-Sem Exam:	**30 Marks**
	End-Sem Exam:	**50 Marks**
Credits: 4	**Total:**	**100 Marks**

Prerequisite Course: Computer Fundamentals & Programming.

Course Objectives

1. To understand the basics of System Software.
2. To provide an understanding of basics of Compiler design.
3. To study the concepts of process management.
4. To study the concepts of process synchronization.
5. To learn and understand memory management techniques.
6. To learn and understand I/O management techniques.

Course Outcomes (COs):

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

	Course Outcome (s)	Bloom's Taxonomy	
		Level	**Descriptor**
CO1	**Understand** the basics of System Software.	**2**	**Understand**
CO2	**Understand** the phases of Compiler.	**2**	**Understand**
CO3	**Apply** processes management concepts.	**3**	**Apply**
CO4	**Use** synchronization concepts.	**3**	**Apply**
CO5	**Apply** the concepts of memory management techniques.	**3**	**Apply**
CO6	**Understand** the I/O management.	**2**	**Understand**

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

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

Course Contents			
Unit-I	**INTRODUCTION TO SYSTEM SOFTWARE**	**No. of Hours**	**COs**
	Introduction to components of System Software: Text editors, Loaders, Linkers, Assemblers, Macro processors, Compilers, Debuggers. Machine Structure. Assemblers: General design procedure, Design of two pass assembler, Single pass assembler. Macro Processor: Macro instructions, Features of macro facility, Design of two-pass, single pass and nested macro processor.	08	CO1
Unit-II	**INTRODUCTION TO COMPILERS**	**No.of Hours**	**COs**
	Phases of Compiler, Lexical analysis: Token, patterns and Lexemes & Lexical Errors, regular definitions for the language constructs & strings, sequences. Syntax Analysis: Grammars, Top-down v/s bottom up parsing. Semantic Analysis: SDT and dependency trees. Intermediate code generation –Three address code Intermediate Code forms.	08	CO2
Unit-III	**INTRODUCTION TO OS AND PROCESS MANAGEMENT**	**No. of Hours**	**COs**
	Introduction: Types of OS, System Components, OS services, System structure- Layered Approach. Process Management: Process Concept- Process states, Process control block, Threads. Process Scheduling: Types of process schedulers. Types of scheduling: Pre-emptive, Non pre-emptive. Scheduling algorithms: FCFS, SJF, RR, and Priority.	08	CO3
Unit-IV	**PROCESS SYNCRONIZATION**	**No. of Hours**	**COs**
	Mutual Exclusion**:** Concurrency, Mutual Exclusion: Hardware Support, Semaphores and Mutex, Monitors. Producer and Consumer problem, Inter-process communication. Deadlocks: Methods of handling deadlocks, Deadlock prevention, avoidance and detection, Recovery from deadlocks.	08	CO4
Unit-V	**MEMORY MANAGEMENT**	**No. of Hours**	**COs**
	Storage allocation methods, Contiguous and non-contiguous, Swapping, Paging, Segmentation, Segmentation with Paging. Virtual Memory, Demand paging. Page replacement scheme- FIFO, LRU, Optimal, Thrashing.	08	CO5
Unit-VI	**I/O Management**	**No. of Hours**	**COs**
	I/O Management: I/O Devices, Organization of I/O function, I/O Buffering, Hardware organization, device scheduling policies, device drivers Disk Scheduling- Disk Scheduling policies like FIFO, LIFO, STTF, SCAN, C-SCAN.	08	CO6

Text Books:

1. William Stallings, "Operating System: Internals and Design Principles", Prentice Hall, ISBN-10: 0-13-380591-3, ISBN-13: 978-0-13-380591-8, 8th Edition.
2. Silberscharz, A. and Galvin, P.B., "Operating System Concepts", 7th Edition, Addison-Wesley, ISBN 978-1-118-06333-0.
3. Dhamdhere D.M., "System Programming & Operating Systems", 2nd Edition, Tata McGraw-Hill, ISBN 0 - 07 - 463579 – 4.
4. Godbole, "Operating System", Tata-McGraw Hill.

Reference Books:

1. Beck, L.L., "System Software", 3rd Edition, Addison Wesley.
2. Bryant, R.E. and O' Hallaron, D.R., "Computer Systems: A Programmer's Perspective", Prentice-Hall of India.
3. Nutt, G., "Operating Systems", Addison-Wesley, 2004.
4. Joshi, R. C. and Tapaswi, S., "Operating Systems", Wiley Dreamtech.
5. Tanenbaum, A., "Modern Operating Systems", Prentice-Hall of India.

eLearning Resources

1. **Online Course:** Dr. S. Sasikala, "Operating Systems", Swayam, https://onlinecourses.swayam2.ac.in/cec21_cs20/preview
2. **eBook:** Operating System and Middleware: Supporting Controlled Interaction, https://gustavus.edu/mcs/max/os-book/osm-rev1.3.1.pdf

IT314A : Software Testing and Quality Assurance (Professional Elective-II)		
Teaching Scheme	**Examination Scheme**	
Lectures: 3 Hrs./Week	**Continuous Assessment:**	**20 Marks**
	In-Sem Exam:	**30 Marks**
	End-Sem Exam:	**50 Marks**
Credits: 3	**Total:**	**100 Marks**
Prerequisite Course: Seminar and Mini-project		

Course Objectives

7. To comprehend the software process models.
8. To understand the types of software requirements and SRS document.
9. To describe the testing strategies and methodologies in projects.
10. To understand different types of testing for web applications.
11. To understand the concepts of STLC to achieve quality.
12. To understand automation tools used in quality management.

Course Outcomes (COs):

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

Course Outcome (s)		Bloom's Taxonomy	
		Level	**Descriptor**
CO1	**Apply** basic concepts of Software Engineering and Process Models	**3**	**Apply**
CO2	**Understand** the Software Requirements and SRS Documents	**2**	**Understand**
CO3	**Describe** the testing concepts and Quality Assurance	**2**	**Understand**
CO4	**Analyze** different test methodologies and approaches for web applications.	**4**	**Analyze**
CO5	**Apply** Software Testing Life Cycle for testing an application	**3**	**Apply**
CO6	**Select** proper tool to perform Software Testing.	**5**	**Evaluate**

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

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

Course Contents			
Unit-I	**INTRODUCTION TO SOFTWARE ENGINEERING**	**No. of Hours**	**COs**
	Introduction to Software Engineering: The evolving role of software, Changing Nature of Software, Software myths. **A Generic view of process:** Software engineering- A layered technology, a process framework, Process patterns, process assessment. **Process models:** The waterfall model, Incremental process models, Evolutionary process models.	06	CO1
Unit-II	**REQUIREMENT ANALYSIS & SOFTWARE DEVELOPMENT LIFE CYCLE**	**No. of Hours**	**COs**
	Software Requirements: Functional and non-functional requirements, User requirements, System requirements, Interface specification, the software requirements document. **SDLC Phases:** Requirements Phase, Analysis Phase, Design phase, Coding Phase, Testing phase, Delivery and Maintenance Phase, **SDLC Models:** Waterfall Model, V Model, Agile Model, Prototype Model, Spiral Model	06	CO2
Unit-III	**SOFTWARE TESTING**	**No. of Hours**	**COs**
	Testing as a process, Basic definitions, Software testing principles, The tester's role in a software development organization, Differences between Manual and Automation. Quality Assurance, Quality Control, Differences between QA & QC & Testing	06	CO3
Unit-IV	**SOFTWARE TESTING METHODOLOGIES AND TEST APPROACHES**	**No. of Hours**	**COs**
	White Box Testing, Black Box Testing, Grey Box Testing. **Static Techniques:** Informal Reviews, Walkthroughs, Technical Reviews, Inspection **Dynamic Techniques: Functional Testing -** Unit Testing, Integration Testing, System Testing, User Acceptance Testing, Sanity/Smoke Testing, Regression Test, Retest. **Non Functional Testing -** Performance Testing. Scalability Testing, Compatibility Testing, Security Testing, Session Testing, Recovery Testing, Installation Testing, Adhoc Testing, Risk Based Testing, I18N Testing, L1ON Testing.	06	CO4
Unit-V	**SOFTWARE TESTING LIFE CYCLE**	**No. of Hours**	**COs**
	Requirements Analysis/Design, Test Planning, Test Cases Design, Test Environment setup, Test Execution and Test Closure	06	CO5
Unit-VI	**SOFTWARE TEST AUTOMATION**	**No. of Hours**	**COs**
	What is Test Automation, Terms used in automation, Skills needed for automation, What to automate, scope of automation, Introducing Selenium, Selenium Tool Suite, Selenium-IDE, Selenium RC, Selenium Webdriver, Selenium Grid.	06	CO6

Text Books:

4. Srinivasan Desikan, Gopalaswamy Ramesh, “Software Testing: Principles and Practices” Pearson.
5. Daniel Galin, “Software Quality Assurance: From Theory to Implementation”, Pearson Addison Wesley.
6. M G Limaye, “Software Testing Principles, Techniques and Tools”, Tata McGraw Hill, ISBN: 9780070139909 0070139903.

Reference Books:

5. Roger S. Pressman, “Software Engineering”, Mc Graw Hill.
6. Aditya P. Mathur, “Foundations of Software Testing”, Pearson.
7. Paul Ammann, Jeff Offutt, “Introduction to Software Testing”, Cambridge University Press.
8. Stephen Kan, “Metrics and Models in Software Quality”, Addison Wesley, 2nd Edition.

eLearning Resources

3. https://nptel.ac.in/courses/106/105/106105150/
4. https://onlinecourses.nptel.ac.in/noc19_cs71/preview

IT314B: Big Data Analytics (Professional Elective-II)

Teaching Scheme	Examination Scheme	
Lectures: 3 Hrs./Week	**Continuous Assessment:**	**20 Marks**
	In-Sem Exam:	**30 Marks**
	End-Sem Exam:	**50 Marks**
Credits: 3	**Total:**	**100 Marks**

Prerequisite Course: Engineering mathematics, Database Management Systems, Foundation of data science

Course Objectives

1. To introduce big data process in detail.
2. To introduce association rules for big data.
3. To introduce regression for big data.
4. To introduce classification for big data.
5. To introduce time series analysis for big data.
6. To introduce big data analytic tools for analytics.

Course Outcomes (COs):

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

	Course Outcome (s)	Bloom's Taxonomy	
		Level	**Descriptor**
CO1	**Understand** the process of big data.	**2**	**Understand**
CO2	**Understand** an association rules in big data.	**2**	**Evaluate**
CO3	**Apply** regression in big data.	**3**	**Apply**
CO4	**Apply** classification in big data.	**3**	**Apply**
CO5	**Understand** time series analysis in big data.	**2**	**Understand**
CO6	**Understand** various analytic tools and apply them for big data.	**3**	**Apply**

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

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

Course Contents			
Unit-I	**THE BIG DATA SCIENCE PROCESS**	**No. of Hours**	**COs**
	Overview of data science process, defining research goal, retrieving data, cleaning, integrating, and transforming data, exploratory data analysis, Build the model, presentation of data.	06	CO1
Unit-II	**ADVANCED ANALYTICAL THEORY AND METHODS: ASSOCIATION RULES**	**No. of Hours**	**COs**
	Overview, A priori Algorithm, Evaluation of Candidate Rules, Applications of Association Rules an Example: Transactions in a Grocery Store, The Groceries Dataset, Frequent item set Generation, Rule Generation and Visualization Validation and Testing Diagnostics.	06	CO2
Unit-III	**ADVANCED ANALYTICAL THEORY AND METHODS: REGRESSION**	**No. of Hours**	**COs**
	Linear Regression, Use Cases, Model Description, Diagnostics, Logistic Regression, Use Cases, Model Description Diagnostics, Reasons to Choose and Cautions, Additional Regression Models.	06	CO3
Unit-IV	**ADVANCED ANALYTICAL THEORY AND METHODS: CLASSIFICATION**	**No. of Hours**	**COs**
	Decision Trees, Overview of a Decision Tree, The General Algorithm, Decision Tree Algorithms, Evaluating a Decision Tree Decision Trees, Naive Bayes, Bayes' Theorem, Naive Bayes Classifier Smoothing Diagnostics Naive Bayes Diagnostics of Classifiers Additional Classification Methods.	06	CO4
Unit-V	**ADVANCED ANALYTICAL THEORY AND METHODS: TIME SERIES ANALYSIS**	**No. of Hours**	**COs**
	Overview of Time Series Analysis, Box-Jenkins Methodology, ARIMA Model, Autocorrelation Function (ACF), Autoregressive Model, Moving Average Models, ARMA and ARIMA Models, Building and Evaluating an ARIMA Model, Reasons to Choose and Cautions.	06	CO5
Unit-VI	**ADVANCED ANALYTICS-TECHNOLOGY AND TOOLS**	**No. of Hours**	**COs**
	Analytics for Unstructured Data, Use Case- MapReduce, Apache Hadoop, R- Introduction to R, R Graphical User Interfaces, Data Import and Export, Attribute and Data Types, Descriptive Statistics Exploratory Data Analysis, Visualization Before Analysis, Dirty Data, Visualizing a Single Variable, Examining Multiple Variables, Data Exploration Versus Presentation.	06	CO6

Text Books:

1. Davy Cielen, Mohammad Ali, "Introducing Data Science", Manning Publications.
2. "Data Science & Big Data Analytics - Discovering, Analyzing, Visualizing and Presenting Data EMC Education Services", Wiley Publication

Reference Books:

1. J. Hurwitz, et al., "Big Data for Dummies", Wiley, 2013.
2. Paul C. Zikopoulos, Chris Eaton, Dirk deRoos, Thomas Deutsch, George Lapis, "Understanding Big Data Analytics for Enterprise Class Hadoop and Streaming Data", McGraw-Hill, 2012.

3. James Manyika, Michael Chui, Brad Brown, Jacques Bughin, Richard Dobbs, Charles Roxburgh, Angela Hung Byers, "Big data: The next frontier for innovation, competition, and productivity", McKinsey Global Institute May 2011.

IT314C: Natural Language Processing (Professional Elective-II)

Teaching Scheme	Examination Scheme	
Lectures: 3 Hrs./Week	**Continuous Assessment:**	**20 Marks**
	In-Sem Exam:	**30 Marks**
	End-Sem Exam:	**50 Marks**
Credits: 3	**Total:**	**100 Marks**

Prerequisite Course: Basic understanding of probability theory, Basic knowledge of finite automata.

Course Objectives

1. To understand the core concepts of Natural language processing and levels of language analysis.
2. To understand the computational properties of natural languages and the commonly used algorithms for processing linguistic information.
3. Learning state of art NLP research areas such as parsing algorithms, ambiguity resolution and machine translation.
4. To study algorithmic examples in distributed, concurrent and parallel environments
5. To apply algorithmic strategies while solving problems
6. To develop time and space efficient algorithms

Course Outcomes (COs):

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

	Course Outcome (s)	Bloom's Taxonomy	
		Level	**Descriptor**
CO1	**Understand** automatic processing of human languages using computers.	**2**	**Understand**
CO2	**Understand** various applications of natural language processing. Automatic processing and information extraction of human language using computer.	**2**	**Understand**
CO3	**Analyze** Automatic processing and information extraction of human language using computer.	**4**	**Analyze**
CO4	**Understand** applications of Natural Language Processing such as Information extraction, semantic web search, machine translation, text summarization, spam detection	**2**	**Understand**
CO5	**Create** presentation for applying NLP for multi-core or distributed, concurrent/Parallel environments.	**6**	**Create**
CO6	**Implement** programs using NLP open source tools.	**3**	**Apply**

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

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

CO4	3	3	2	1	3	1	2	1	3	3	1	3	2	3	2
CO5	2	1	1	1	2	1	2	1	2	3	1	3	3	3	2
CO6	1	2	1	1	1	1	1	1	1	3	1	3	2	3	2

Course Contents			
Unit-I	**INTRODUCTION**	**No. of Hours**	**COs**
	Applications of Natural Language Understanding, Evaluating Language Understanding Systems, The Elements of Simple Noun Phrases, Verb Phrases and Simple Sentences, Noun Phrases, Adjective Phrases, Adverbial Phrases.	06	CO1
Unit-II	**GRAMMARS**	**No. of Hours**	**COs**
	Grammars and Sentence Structure, Top-Down Parser, Bottom-Up Chart Parser, Top-Down Chart Parsing, Finite State Models and Morphological Processing, Feature Systems and Augmented Grammars, Morphological Analysis and the Lexicon, Parsing with Features.	06	CO2
Unit-III	**PARSING**	**No. of Hours**	**COs**
	Auxiliary Verbs and Verb Phrases, Noun Phrases and Relative Clauses, Human Preferences in Parsing, Encoding Uncertainty: Shift-Reduce Parsers, A Deterministic Parser, Techniques for Efficient Encoding of Ambiguity, Partial Parsing**.**	06	CO3
Unit-IV	**AMBIGUITY RESOLUTION**	**No. of Hours**	**COs**
	Part-of-Speech Tagging, Obtaining Lexical Probabilities, Probabilistic Context-Free Grammars, Best-First Parsing, Semantics and Logical Form, Word Senses and Ambiguity, Encoding Ambiguity in Logical Form, Verbs and States in Logical Form.	06	CO4
Unit-V	**LINKING SYNTAX AND SEMANTICS**	**No. of Hours**	**COs**
	Semantic Interpretation and Compositionality, Prepositional Phrases and Verb Phrases, Lexicalized Semantic Interpretation and Semantic Roles, Handling Simple Questions, Semantic Interpretation Using Feature Unification, Semantic Filtering Using Selectional Restrictions, Semantic Networks, Statistical Word Sense Disambiguation	06	CO5
Unit-VI	**KNOWLEDGE REPRESENTATION AND RECENT TRENDS IN NLP**	**No. of Hours**	**COs**
	Handling Natural Language Quantification, Time and Aspectual Classes of Verbs, Automating Deduction in Logic-Based Representations, Procedural Semantics and Question Answering Machine Translation. MT evaluation tools such as Bleu,(word error rate) WER etc. Automatic text summarization, Sentiment Speech Recognition, Semantic web search, Automatic text Clustering.	06	CO6

Text Books:
1. Allen James, Natural Language Understanding, Pearson India, 2nd Edition, ISBN: 9788131708958, 8131708950. 2. James H. Martin, Daniel Jurafsky, "Speech and Language Processing", Pearson, 1st Edition, ISBN: 9789332518414, 8131716724.
Reference Books:
1. M. Christopher, H. Schutze, "Foundations of Statistical Natural Language Processing", MIT Press, 1st Edition, ISBN: 9780262133609. 2. C. Eugene, "Statistical Language Learning", MIT Press, 1st Edition, ISBN: 9780262032162. 3. S. Bird, E. Klein & E. Loper, "Natural Language Processing with Python", O' Reilly (Shroff Publishers), 1st Edition, ISBN:9788184047486.

HS315: Corporate Readiness	
Teaching Scheme	**Examination Scheme**
Lectures: 2 Hrs./Week	**CIA** **50 Marks**
Credits: 2	**Total:** **50 Marks**
Prerequisite Course: (Quantitative aptitude, Verbal and non verbal communication)	

Course Objectives

1. To develop clarity in the exploration process of student career and to match his skills and interests with a chosen career path.
2. To develop required aptitude skills.
3. To design the functional and chronological resume.
4. To demonstrate the importance of critical thinking ability and expression in group discussions.
5. To prepare students for the various professional interviews.
6. To develop different soft skills necessary to get success in their profession.

Course Outcomes (COs):

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

	Course Outcome (s)	Bloom's Taxonomy	
		Level	Descriptor
CO1	**Remember** placement processes of various organizations and modern job search approach.	1	Remember
CO2	**Understand** Industry Specific skill set with a view to design an Ideal Resume.	2	Understand
CO3	**Apply** the knowledge of GD & Presentation Skill during Industry Assessments for Placement/Internship/Industry Training/Higher Studies/Competitive Exams etc.	3	Understand
CO4	**Analyze and apply** the critical thinking ability as required during Aptitude/Technical Tests.	4	Analyze
CO5	**Evaluate** Technical/General Dataset to interpret insights in it.	5	Evaluate
CO6	**Create** an ideal personality that fits Industry requirement.	6	Create

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

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

Course Contents			
Unit-I	**PLACEMENT AWARENESS**	**No. of Hours**	**COs**
	Discussion over Different Companies for recruitment, their eligibility criteria and placement procedures. Revision and Assessment of Quantitative Aptitude.	06	CO1
Unit-II	**RESUME WRITING**	**No. of Hours**	**COs**
	Keywords, resume examples for industry, professional font, active language, important achievements, Proofread and edit. Innovative resume building- video resume.	05	CO2
Unit-III	**GROUP DISCUSSION AND PRESENTATION SKILLS**	**No. of Hours**	**COs**
	Why GDs are implemented commonly, Aspects which make up a Group Discussion, Tips on group discussion, do's and don'ts of GD and Presentation skills.	05	CO3
Unit-IV	**LOGICAL REASONING I**	**No. of Hours**	**COs**
	Coding and Decoding (Visual Reasoning and series), Statement & Conclusions (Syllogisms), Relationships (Analogy), Data arrangements, Crypt arithmetic.	05	CO4
Unit-V	**LOGICAL REASONING II**	**No. of Hours**	**COs**
	Data Interpretation, Data Sufficiency.	04	CO5
Unit-VI	**LOGICAL REASONING III**	**No. of Hours**	**COs**
	Blood relation and dices, Clocks and Calendar, Direction sense and cubes, Logical connectives, Puzzle.	05	CO6

Text Books:

1. R.S. Agarwal, "A Modern Approach to Verbal & Non-Verbal Reasoning".
2. B. S. Sijwali, "Reasoning verbal and non verbal".

Reference Books:

1. Shortcuts in Reasoning (Verbal, Non-Verbal, Analytical)
2. M. K. Panday, "Analytical Reasoning".
3. K. Gupta, "Logical and Analytical Reasoning".
4. Mishra & Kumar Dr. Lal, "Multi Dimensional Reasoning".

eLearning Resources:

EBooks:

1. https://themech.in/quantitative-aptitude-and-logical-reasoning-books/
2. https://www.thelocalhub.in/2021/01/reasoning-competitive-exams-pdf.html

E-learning Resources/MOOCs/ NPTEL Course Links:

1. https://www.practiceaptitudetests.com/non-verbal-reasoning-tests/
2. https://www.educationquizzes.com/11-plus/non-verbal-reasoning/
3. https://www.livecareer.com/resume/examples/web-development/e-learning-developer

PR316: Intellectual Property Rights and Entrepreneurship Development		
Teaching Scheme	**Examination Scheme**	
Lectures: 1 Hrs./Week	**Continuous Assessment:**	**10 Marks**
Practical: 2Hrs./Week	**In-Sem Exam:**	**15 Marks**
	End-Sem Exam:	**25 Marks**
Credits: 1	**Total:**	**50 Marks**
Prerequisite Course: Nil.		

Course Objectives

1. To introduce student with IPR.
2. To explain IPR procedure in India such as Patents, Designs and Trademarks.
3. To make aware economic importance of IPRs.
4. To develop ability to search and analyse the IPRs.
5. To instill a spirit of entrepreneurship among the student participants.
6. To give insights into the Management of Small Family Business.

Course Outcomes (COs):

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

Course Outcome (s)		Bloom's Taxonomy	
		Level	**Descriptor**
CO1	**Understand** patenting system.	**2**	**Understand**
CO2	**Understand** the procedure to file patent in India.	**2**	**Understand**
CO3	**Understand** financial importance of IPR.	**2**	**Understand**
CO4	**Search and analyze** the patents, designs and Trademarks.	**4**	**Analyze**
CO5	**Identify** the Skill sets required to be an entrepreneur.	**4**	**Analyze**
CO6	**Understand** the role of supporting agencies and Governmental initiatives to promote entrepreneurship.	**4**	**Analyze**

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

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

Course Contents			
Unit-I	**INTRODUCTION TO IPR**	**No. of Hours**	**COs**
	Concepts of IPR, The history behind development of IPR, Necessity of IPR and steps to create awareness of IPR, Concept of IP Management, Intellectual Property and Marketing, IP asset valuation. **Introduction to the leading International Instruments concerning Intellectual Property Rights:** the Berne Convention, Universal Copyright Convention, The Paris Convention, Patent Co-operation Treaty, TRIPS, The World Intellectual Property Organization (WIPO) and the UNESCO.	04	CO1
Unit-II	**PATENTS**	**No. of Hours**	**COs**
	Introduction to Patents, Procedure for obtaining a Patent. Licensing and Assignment of Patents: Software Licensing, General public Licensing, Compulsory Licensing. Infringement of Patents, Software patent and Indian scenario.	04	CO2
Unit-III	**DESIGNS**	**No. of Hours**	**COs**
	Registrable and non-Registrable Designs, Novelty & Originality, Procedure for Registration of Design. Copyright under Design: Assignment, Transmission, License. Procedure for Cancellation of Design, Infringement, Remedies.	04	CO3
Unit-IV	**TRADEMARKS AND COPY RIGHTS**	**No. of Hours**	**COs**
	Trademarks: Concept of trademarks, Importance of brands and the generation of "goodwill", Trademark registration procedure, Infringement of trademarks and Remedies available, Assignment and Licensing of Trademarks. **Copyright Right:** Concept of Copyright Right, Assignment of Copyrights, Registration procedure of Copyrights, Infringement (piracy) of Copyrights and Remedies, Copyrights over software and hardware.	04	CO4
Unit-V	**ENTREPRENEURSHIP: INTRODUCTION**	**No. of Hours**	**COs**
	Concept and Definitions: Entrepreneur & Entrepreneurship, Entrepreneurship and Economic Development, A Typology of Entrepreneurs. **Entrepreneurial Competencies:** The Entrepreneur's Role, Entrepreneurial Skills: creativity, problem solving, decision, making, communication, leadership quality; Self-Analysis, Culture & values, Risk-taking ability, Technology knowhow. **Factor Affecting Entrepreneurial Growth:** Economic & Non-Economic Factors, EDP Programmes. **Steps in Entrepreneurial Process:** Deciding Developing, Moving, Managing, Recognizing.	04	CO5
Unit-VI	**RESOURCES FOR ENTREPRENEURSHIP**	**No. of Hours**	**COs**
	Project Report Preparation: Specimen Format of Project Report; Project Planning and Scheduling using PERT / CPM; Methods of Project Appraisal – Feasibility Study both Economic and Market, Preparation projected financial statement.	04	CO6

	Role of Support Institutions and Management of Small Business: Director of Industries, DIC, SIDO, SIDBI, Small Industries Development Corporation (SIDC), SISI, NSIC, NISBUED, StateFinancial Corporation (SFC), EPC, ECGC. **Various Governmental Initiatives:** Make in India, Start Up India, Stand Up India, Digital India, Skill India **Case Studies of Successful Entrepreneurs.**		

Text Books:

1. Neeraj Pandey and Khushdeep Dharni, "Intellectual Property Rights", PHI, New Delhi.
2. The Indian Patent act 1970.
3. The copy right act 1957
4. Manual of patent office practice and procedure of Govt. of India.
5. Manual of Designs Practice and Procedure of Govt. India
6. Manual of Trademarks Practice and Procedure of Govt. India
7. Semiconductor Integrated Circuits Layout Design (SICLD) Act 2000 of Govt. India
8. R. Anita Rao & Bhanoji Rao, "Intellectual Property Rights- A Primer", Eastern Book Co.
9. Desai, Vasant, "The Dynamics of Entrepreneurial Development & Management", Himalaya Publishing House, Delhi.
10. Longenecker, Moore, Petty and Palich, "Managing Small Business", Cengage Learning, India Edition.
11. Morse and Mitchell, "Cases in Entrepreneurship", Sage South Asia Edition.
12. K Ramchandran, "Entrepreneurship – Indian Cases on Change Agents", Tata McGraw Hill.

Reference Books:

1. Handbook of Indian Patent Law and Practice.
2. David H. Holt, "Entrepreneurship: New Venture Creation".
3. Satish Taneja, S. L. Gupta, "Entrepreneurship Development New Venture Creation".
4. K. Nagarajan, "Project Management".

IT317 : Cryptography and Cyber Security Laboratory

Teaching Scheme	Examination Scheme	
Lectures: 2 Hrs./Week	**Term Work:**	**NA**
	Oral :	**NA**
	Practical:	**50 Marks**
Credits: 1	**Total:**	**50 Marks**

Prerequisite Course: Basic of Mathematics, Computer Fundamentals & Programming.

Course Objectives

1. To use the different cryptographic algorithms for implementing security.
2. To use the different Message digest algorithms to secure a message over insecure channel.
3. To design and implement security solutions in an organization.

Course Outcomes (COs):

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

	Course Outcome (s)		Bloom's Taxonomy	
			Level	**Descriptor**
	CO1	**Use** the different cryptographic algorithms for implementing security.	**3**	**Apply**
	CO2	**Use** the different Message digest algorithms to secure a message over insecure channel.	**3**	**Apply**
	CO3	**Design** and implement security solutions in an organization.	**3**	**Apply**

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

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

Guidelines: This Cryptography and Cyber Security Laboratory course has Cryptography and Cyber Security as a core subject. The problem statements should be framed based on assignments mentioned in the syllabus. The teacher will frame the problem statements with due consideration that students have two hours to complete that. The practical examination will comprise of implementation of assignments and related theory. All assignments are to be performed in C, C++, Java or Python. Use of open-source platform and tools is encouraged.

Term work: Staff in-charge will suitably frame the assignments and flexibility may be incorporated. Students will submit term work in the form of journal. Each assignment has to be well documented with problem definition; code documented with comments. Staff in-charge will assess the assignments continuously and grade or mark each assignment on completion date.All the assignments should be conducted in C or C++ or Java or Python Language.

Suggested List of Assignments

Sr. No.	Assignment	No. of Hours	COs
1.	Write a program in C++ or JAVA or Python to implement RSA algorithm for key generation and cipher verification.	2 Hrs.	CO1
2.	Write a program in C++ or JAVA or Python to implement Diffie Hellman Key Exchange algorithm.	2 Hrs.	CO1
3.	Write a program in C++ or JAVA or Python to implement MD5 and SHA-1 algorithm using Libraries (API).	2 Hrs.	CO2
4.	Write a program in C++ or JAVA or Python to implement DES algorithm using Libraries (API).	2 Hrs.	CO2
5.	Write a program in C++ or JAVA or Python to implement AES algorithm using Libraries (API).	2 Hrs	CO2
6.	Configure and demonstrate use of IDS tool such as SNORT.	2 Hrs.	CO3
7.	Configure and demonstrate use of vulnerability assessment tool such as NESSUS.	2 Hrs.	CO3
8.	Implement web security with Open SSL tool kit.	2 Hrs.	CO3

Text Books:

1. William Stallings, "Cryptography and Network Security Principles and Practice", Pearson Education/PHI, 2006.
2. Atul Kahate, "Cryptography and Network Security", McGraw Hill.
3. Nina Godbole, Sunit Belapure, “Cyber Security- Understanding Cyber Crimes, Computer Forensics and Legal Perspectives”, Wiely India Pvt. Ltd., ISBN- 978-81-265-2179-1.

Reference Books:

1. Nina Godbole, “ Information Systems Security”, Wiley India Pvt. Ltd, ISBN -978-81-265-1692-6.
2. Willaim Stallings, “Computer Security : Principles and Practices”, Pearson Ed. ISBN :978-81-317-3351-6.
3. Mark Merkow, “ Information Security-Principles and Practices”, Pearson Ed. 978-81-317-1288-7.
4. CK Shyamala et el., “Cryptography and Security”, Wiley India Pvt. Ltd, ISBN 978-81-265-2285-9.
5. Berouz Forouzan, “Cryptography and Network Security”, 2 edition, TMH, ISBN :978007070208.

IT318 : Artificial Intelligence Laboratory			
Teaching Scheme		**Examination Scheme**	
Lectures: 2 Hrs./Week		**Term Work:**	**NA**
		Oral :	**50 Marks**
		Practical:	**NA**
Credits: 1		**Total:**	**50 Marks**

Prerequisite Course: Data Structures and Files Laboratory.

Course Objectives

1. To implement Artificial Intelligence and Non Artificial Intelligence Techniques.
2. To implement uninformed and informed search strategies.
3. To understand and implement Artificial Neural Network.
4. To learn and understand Uncertainty in AI with example.

Course Outcomes (COs):

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

	Course Outcome (s)	Bloom's Taxonomy	
		Level	**Descriptor**
CO1	**Apply** and implement Artificial and Non Artificial Intelligence techniques.	**3**	**Apply**
CO2	**Use** uninformed and informed search strategies for implementation of search algorithms.	**3**	**Apply**
CO3	**Apply** Artificial Neural Network for various learning algorithms.	**3**	**Apply**
CO4	**Apply** Fuzzy logic for the implementation of real life problems.	**3**	**Apply**

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

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

Guidelines: This Artificial Intelligence Laboratory course has Artificial Intelligence as a core subject. The problem statements should be framed based on assignments mentioned in the syllabus. The teacher will frame the problem statements with due consideration that students have three hours to complete that. The practical examination will comprise of implementation and related theory. All assignments are to be performed in C/C++ or Python Language. Use of open source platform and tools is encouraged.

Term work: Staff in-charge will suitably frame the above assignments and flexibility may be incorporated. Students will submit term work in the form of journal. Each assignment has to be well documented with problem definition, code documented with comments. Staff in-charge will assess the assignments continuously and grade or mark each assignment on completion date. All the assignments should be conducted in C/C++ or Python Language.

Suggested List of Assignments

Sr. No.	Assignment	No. of Hours	COs
1.	Introduction to Python and Artificial Intelligence	2 Hrs.	CO1
2.	Assignment Based on direct heuristic search techniques.	2 Hrs.	CO1
3.	Implement any one technique from the following a) Best First Search and A* Algorithm b) AO* Algorithm c) Hill Climbing	2 Hrs.	CO1
4.	Implement Perceptron Learning Algorithm.	2 Hrs.	CO2
5.	Implement image processing application in AI using Python libraries.	2 Hrs.	CO3
6.	Implement text processing application in AI using Python libraries.	2 Hrs.	CO3
7.	Implement an expert system in Python.	2 Hrs.	CO3
8.	Mini-project	4 Hrs.	CO4

Text Books:

1. Elaine Rich and Kevin Knight, "Artificial Intelligence", Tata McGraw Hill.
2. Stuart Russell & Peter Norvig, "Artificial Intelligence: A Modern Approach", Pearson Education, 2nd Edition.

Reference Books:

1. Ivan Bratko, “Prolog Programming For Artificial Intelligence", 2nd Edition, Addison Wesley.
2. Eugene, Charniak, Drew Mcdermott, "Introduction to Artificial Intelligence", Addison Wesley.

eLearninng Resources:

1. GeeksforGeeks: Artificial Intelligence https://www.geeksforgeeks.org/artificial-intelligence-an-introduction/

IT319 : System Programming and Operating system Laboratory

Teaching Scheme	Examination Scheme	
Lectures: 2 Hrs./Week	**Term Work:**	**NA**
	Oral :	**NA**
	Practical:	**50 Marks**
Credits: 1	**Total:**	**50 Marks**

Prerequisite Course: Computer Fundamentals& Programming, Data Structures.

Course Objectives

1. To implement basic language translator by using various needed data structures.
2. To make use of system calls and process scheduling algorithms.
3. To understand process synchronization.
4. To learn and understand I/O and memory management.

Course Outcomes (COs):

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

	Course Outcome (s)	Bloom's Taxonomy	
		Level	**Descriptor**
CO1	**Apply** the programming construct to Implement Assembler and lexical analyzer.	**3**	**Apply**
CO2	**Use** system calls and process scheduling algorithms.	**3**	**Apply**
CO3	**Apply** process synchronization techniques.	**3**	**Apply**
CO4	**Apply** the Memory management algorithms and Disk scheduling	**3**	**Apply**

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

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

Guidelines: This System Programming and Operating System Laboratory course has System Programming and Operating System as a core subject. The problem statements should be framed based on assignments mentioned in the syllabus. The teacher will frame the problem statements with due consideration that students have three hours to complete it. The practical examination will comprise of implementation and related theory. All assignments are to be performed in C Language, C++ or Java. Use of open source platform and tools is encouraged.

Term work: Staff in-charge will suitably frame the above assignments and flexibility may be incorporated. Students will submit term work in the form of journal. Each assignment has to be well documented with problem definition, code documented with comments. Staff in-charge will assess the assignments continuously and grade or mark each assignment on completion date. All the assignments should be conducted in C or C++ or Java Language.

Suggested List of Assignments

Sr. No.	Assignment	No. of Hours	COs
1.	Assignment Based on Implementation of Two Pass Assembler.	2 Hrs.	CO1
2.	Assignment Based on lexical analyzer.	2 Hrs.	CO1
3.	Assignment based on use of system calls.	2 Hrs.	CO2
4.	Assignment based on process scheduling algorithms.	2 Hrs.	CO2
5.	Assignment Based on Process Synchronization.	2 Hrs.	CO3
6.	Assignment based on deadlock handling algorithms.	2 Hrs.	CO3
7.	Assignment Based on Page Replacement Algorithm.	2 Hrs.	CO4
8.	Assignment Based on Disk Scheduling.	2 Hrs.	CO4

Text Books:

1. Paul Gries, Jennifer Campbell, Jason Montojo, "Practical Programming Second Edition", SPD, ISBN: 978-93-5110-469-8.
2. Silberscharz, A. and Galvin, P. B., "Operating System Concepts", 7th Edition, Addison-Wesley, ISBN: 978-1-118-06333-0.

Reference Books:

1. Y. Langsam, M. Augenstin, A. Tannenbaum, "Data Structures using C and C++", Prentice Hall of India.
2. Herbert Schildt, "Java2: The Complete Reference", Tata-McGraw Hill, 5th Edition, ISBN: 9780070495432, 0070495432.

IT320 : Creational Activity				
Teaching Scheme			**Examination Scheme**	
Lectures: 2 Hrs./Week			**Term Work:**	**50**
			Oral :	**NA**
			Practical:	**NA**
Credits: 1			**Total:**	**50**
	Prerequisite Course: Soft-skills and Technical Skills			
	Course Objectives			
	1. To showcase talent through participating in events at college, state and national level.. 2. To acquire organizing abilities by organizing professional bodies events.(IEEE/CSI/ISTE) 3. To help society through NSS activities, social awareness and/or welfare activities..			
	Course Outcomes (COs):			
	After successful completion of the course, student will be able to			
	Course Outcome (s)		**Bloom's Taxonomy**	
			Level	**Descriptor**
	CO1	**Showcase** their talent through participating in events at college, state and national level.	**3**	**Apply**
	CO2	**Demonstrate** their organizing abilities through professional bodies events.(IEEE/CSI/ISTE)	**3**	**Apply**
	CO3	**Demonstrate** their ability to help society through NSS activities, social awareness and/or welfare activities.	**3**	**Apply**

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

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

Guidelines

- Students are expected to participate in the events like at programming competition, quiz competition, paper presentation competition, mini-project competition, debate competition, sports, etc at college level/ state level/national level/international level.
- Students may also be part of organizing committees of events or executive members of professional organizations like IEEE/CSI/ISTE that organizes events.
- Students may also participate in social awareness activities and/or social welfare activities.
- Students will be evaluated based on the level of their participation /organization and evidences produced.
- Course in-charge shall prepare suitable rubrics for awarding Term Work marks on above

guidelines and inform the students at the start of the course.

- Term Work submission will consist of appropriate evidences of event/activity participation/organization as directed by the course in-charge.

MC321 : Suitable Technical / Non-Technical Activities finalized by Department (Mandatory Course – VI)		
Teaching Scheme	**Examination Scheme**	
Lectures: 1 Hrs./Week	**Term Work:**	**NA**
	Oral :	**NA**
	Practical:	**NA**
Credits: Non Credit	**Total:**	**NA**

Course Contents
Faculty in-charge will facilitate students to organize and conduct following extra-curricular activities: 1. Quizzes 2. Expert Lecture 3. Programming Event 4. Poster Presentation 5. Aptitude 6. Blind Coding 7. Surf & Presentation 8. Group Discussion 9. Bug Finding

SANJIVANI RURAL EDUCATION SOCIETY'S

SANJIVANI COLLEGE OF ENGINEERING KOPARGAON

(An Autonomous Institute Affiliated to SPPU Pune)

DEPARTMENT OF INFORMATION TECHNOLOGY

COURSE CURRICULUM - 2020 PATTERN

THIRD YEAR B. TECH. HONORS SPECIALIZATIONS

LIST OF ABBREVIATIONS			
Abbreviation	**Full Form**	**Abbreviation**	**Full Form**
ES	Engineering Science	HSMC	Humanity Science
PC	Professional Core	CA	Continuous Assessment
PE	Professional Elective	OR	End Semester Oral Examination
OE	Open Elective	PR	End Semester Practical Examination
ISE	In-Semester Evaluation	TW	Continuous Term work Evaluation
ESE	End-Semester Evaluation	BSC	Basic Science Course
PRJ	Project	MC	Mandatory Course
HSIT	Honors Specialization Course in Information Technology		

Aboutoffered Specializations

CYBER SECURITY

Short Description:

The Cyber security Specialization covers the fundamental concepts underlying the construction of secure systems, from the hardware to the software to the human-computer interface, with the use of cryptography to secure interactions. These concepts are illustrated with examples drawn from modern practice and augmented with hands-on exercises involving relevant tools and techniques. Successful participants will develop a way of thinking that is security-oriented, a better understanding of how to think about adversaries, and how to build systems that defend against them.

The student will learn about the different phases of penetration testing, how to gather data for your penetration test, and popular penetration testing tools. Furthermore, the student will learn the phases of incident response, important documentation to collect, and the components of an incident response policy and team. Finally, you will learn key steps in the forensic process and important data to collect. This honor course also gives a student the first look at scripting and the importance of a system analyst. This honor course is intended for anyone who wants to gain a basic understanding of Cyber security to acquire the skills to work in the Cyber security field as a Cyber security Analyst.

Expected Outcome:

The basic concept of Cyber Security, Web Security Tools Laboratory Network and system administration fundamentals Information assurance fundamentals such as confidentiality, integrity, and availability, etc. Understand various digital forensics techniques and their usage for the incident response. Applications and implementation strategies with Blockchain using smart contract understand the components of Risk, risk management framework.

INTERNET OF THINGS

Short Description:

Internet of Things(IoT) is a network of physical objects or people called "things" that are embedded with software, electronics, network, and sensors that allows these objects to collect and exchange data. The goal of IoT is to extend to internet connectivity from standard devices like computer, mobile, tablet to relatively dumb devices like a toaster.

IoT makes virtually everything "smart," by improving aspects of our life with the power of data collection, AI algorithm, and networks. The thing in IoT can also be a person with a diabetes monitor implant, an animal with tracking devices, etc.

Expected Outcome:

At the end of this major specialization the engineering graduate shall demonstrate their ability to make use the emerging technology of Internet of Things in the diversified areas like agriculture, smart cities, industries, etc. The graduates shall be able to develop IoT system to be embedded in the existing system where a smart solution to the given problem is to be provided.

COURSE STRUCTURE- 2020 PATTERN
THIRD YEAR B. TECH.INFORMATION TECHNOLOGY

SEMESTER- V

HONORS SPECIALIZATION IN CYBER SECURITY

Course		Course Title	Teaching Scheme Hours/ Week			Credits	Evaluation Scheme-Marks						
							Theory			OR	PR	TW	Total
Cat.	Code		L	T	P		ISE	ESE	CIA				
HSIT	IT8101	Foundation For Cyber Security	4	-	-	4	30	50	20	-	-	-	100
		Total	4	-	-	4	30	50	20	-	-	-	100

HONORS SPECIALIZATION IN INTERNET OF THINGS

Course		Course Title	Teaching Scheme Hours/ Week			Credits	Evaluation Scheme-Marks						
							Theory			OR	PR	TW	Total
Cat.	Code		L	T	P		ISE	ESE	CIA				
HSIT	IT8201	Foundations of Internet of Things	4	-	-	4	30	50	20	-	-	-	100
		Total	4	-	-	4	30	50	20	-	-	-	100

SEMESTER- VI

HONORS SPECIALIZATION IN CYBER SECURITY

Course		Course Title	Teaching Scheme Hours/ Week			Credits	Evaluation Scheme-Marks						
							Theory			OR	PR	TW	Total
Cat.	Code		L	T	P		ISE	ESE	CIA				
HSIT	IT8102	Web Security	4	-	-	4	30	50	20	-	-	-	100
HSIT	IT8103	Web Security Tools Laboratory	-	-	2	1	-	-	-	-	-	50	50
		Total	4	-	2	5	30	50	20	-	-	50	150

HONORS SPECIALIZATION IN INTERNET OF THINGS

Course		Course Title	Teaching Scheme Hours/ Week			Credits	Evaluation Scheme-Marks						
							Theory			OR	PR	TW	Total
Cat.	Code		L	T	P		ISE	ESE	CIA				
HSIT	IT8202	Big Data Analytics for IoT	4	-	-	4	30	50	20	-	-	-	100
HSIT	IT8203	Big Data Analytics for IoT Laboratory	-	-	2	1	-	-	-	-	-	50	50
		Total	4	-	2	5	30	50	20	-	-	50	150

IT8101: Foundation For Cyber Security (Honors Specialization Course in Cyber Security)	
Teaching Scheme	**Examination Scheme**
Lectures: 4 Hrs./Week	**Continuous Assessment: 20 Marks**
	In-Sem Exam: 30 Marks
	End-Sem Exam: 50 Marks
Credits: 4	**Total: 100 Marks**
Prerequisite Course:	

Course Objectives

1. To outline the key components and principles of security.
2. To explore the security attacks and management roles.
3. To apply the cyber security policies and procedures for organizations.
4. To practice the security tools and hardening techniques.
5. To employ the Penetration Testing and explore the Next Generation Security.

Course Outcomes (COs):

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

Course Outcome (s)		Bloom's Taxonomy	
		Level	**Descriptor**
CO1	**Select** & describe appropriate cryptographic algorithm and its application.	**4**	**Analyze**
CO2	**Apply** the cyber security policies and procedures for organizations	**3**	**Apply**
CO3	**Apply** the security tools and hardening techniques	**3**	**Apply**
CO4	**Examine** security attacks and management roles.	**4**	**Analyze**
CO5	**Select** Penetration Testing and explore the Next Generation Security.	**5**	**Apply**
CO6	**Compare** and identify the best technological solution for cyber security	**4**	**Analyze**

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

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

Course Contents			
Unit-I	**USABLE SECURITY**	**No. of Hours**	**COs**
	Fundamentals of Human-Computer Interaction: users, usability, tasks, and cognitive models, Design: design methodology, prototyping, cyber security case study, Evaluation: usability studies, A/B testing, quantitative and qualitative evaluation, cyber security case study, Strategies for Secure Interaction Design: authority, guidelines for interface design.	08	CO1
Unit-II	**SOFTWARE SECURITY**	**No.of Hours**	**COs**
	Introducing Computer Security What is software security? Low level security: Attacks and exploits, Defending against low-level exploits, Web security: Attacks and defences, Designing and Building Secure Software.	08	CO2
Unit-III	**CRYPTOGRAPHY**	**No. of Hours**	**COs**
	Introduction to Classical Cryptography, Computational Secrecy and Principles of Modern Cryptography, Private-Key Encryption, Message Authentication Codes.	08	CO3
Unit-IV	**HARDWARE SECURITY**	**No. of Hours**	**COs**
	Introduction Digital System Specification, Digital System Implementation, Function Simplification and Don't Care Conditions, Sequential System Specification, Sequential System Implementation, Vulnerabilities in Digital Logic Design.	08	CO4
Unit-V	**DESIGN INTELLECTUAL PROPERTY PROTECTION**	**No. of Hours**	**COs**
	Design Intellectual Property Protection Introduction to IP Protection, Watermarking Basic, Good Watermarks, Fingerprinting, Hardware Metering.	08	CO4
Unit-VI	**PHYSICAL ATTACKS AND MODULAREXPONENTIATION**	**No. of Hours**	**COs**
	Physical Attacks (PA) Basics, Physical Attacks and Counter measures, Building Secure Systems Modular Exponentiation (ME) Basics ,ME in Cryptography, ME Implementation and Vulnerability, Montgomery Reduction.	08	CO6

Text Books:

1. Lawrence C. Miller, “Cybersecurity for Dummies”, Palo Alto Networks, John Wiley & Sons. Inc.,2nd Edition, 2016.
2. William Stallings, “Effective Cybersecurity: A Guide to Using Best Practices and Standards”, Addison - Wesley Professional Publishers, 1st Edition, 2018.

Reference Books:

1. Raef Meeuwisse, “Cybersecurity for Beginners”, Cyber Simplicity Publications, 2nd Edition, 2017.
2. Mehdi Khosrow-Pour, DBA, Information Resources Management Association, USA, “Cybersecurity and threats: concepts, methodologies, tools, and applications”, IGI Global, Vol. 1, 2018.
3. Tanenbaum, A., “Modern Operating Systems”, Prentice-Hall of India.

IT8201: Foundations of Internet of Things
(Honors Specialization Course in Internet of Things)

Teaching Scheme	Examination Scheme	
Lectures: 4 Hrs./Week	**Continuous Assessment:**	**20 Marks**
	In-Sem Exam:	**30 Marks**
	End-Sem Exam:	**50 Marks**
Credits: 4	**Total:**	**100 Marks**
Prerequisite Course: Microprocessors and Microcontrollers		

Course Objectives

1. To understand use of sensors and signal conditioning in IoT.
2. To understand use of various actuators in IoT.
3. To understand use of exemplary devices in IoT.
4. To analyze security challenges in IoT.
5. To make use IoT in various application.
6. To create prototype of an IoT System.

Course Outcomes (COs):

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

	Course Outcome (s)	Bloom's Taxonomy	
		Level	**Descriptor**
CO1	**Demonstrate** use of sensors and signal conditioning used in IoT.	**3**	**Apply**
CO2	**Demonstrate** use of various actuators IoT.	**3**	**Apply**
CO3	**Demonstrate** use of exemplary devices in IoT.	**3**	**Apply**
CO4	**Analyze** security challenges in IoT.	**4**	**Analyze**
CO5	**Use** IoT in various applications.	**3**	**Apply**
CO6	**Create** prototype for an IoT System	**6**	**Create**

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

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

Course Contents			
Unit-I	**IOT SENSORS AND SIGNAL CONDITIONG**	**No. of Hours**	**COs**
	Overview of IoT. IoT Sensors and transducers: specifications, classifications, principle of operation and applications. Signal Conditioning: operations - amplification/attenuation, filtering, protection, conversion (DAC/ADC), linearization.	08	CO1
Unit-II	**ACTUATORS IN IOT**	**No.of Hours**	**COs**
	Role of actuators, types: electrical, electromechanical, electromagnetic, hydraulic, pneumatic, smart material actuators, micro and nano-actuators.	08	CO2
Unit-III	**IOT EXEMPLARY DEVICE – RASPBERRY PI**	**No. of Hours**	**COs**
	Raspberry Pi: features, Architecture, Raspbian, Raspberry pi GPIO: serial, SPI, Interfacing with Raspberry pi.	08	CO3
Unit-IV	**SECURITY AND SAFETY**	**No. of Hours**	**COs**
	Introduction, Systems Security, Network Security, Generic Application Security, Application Process Security and Safety, Reliable-and-Secure-by-Design IoT Applications, Run-Time Monitoring, Privacy and Dependability.	08	CO4
Unit-V	**IOT APPLICATIONS**	**No. of Hours**	**COs**
	IoT Applications — Value Creation for Industry, Value Creation and Challenges, The Smart FactoryInitiative, Cost-effective Process Integration of IoT Devices, IoT for Retailing Industry.	08	CO5
Unit-VI	**CASE STUDIES**	**No. of Hours**	**COs**
	Latest Case Studies at least one on Smart City, Agriculture and Farming, Healthcare, Automobile, Home Automation, Energy.	08	CO6

Text Books:

1. OvidiuVermesan, Peter Friess, "Internet of Things: Converging Technologies for SmartEnvironments and Integrated Ecosystems", River Publishers, 2013.
2. Adrian McEwen,HakimCassimally "Designing the Internet of Things", John Wiley & Sons, 2014.
3. Joe Biron and Jonathan Follett "Foundational Elements of an IoT Solution: The Edge, TheCloud, and Application Development", 1st Edition. Cisco Press, 2017.
4. R. Bishop, "The Mechatronics Handbook", CRC Press, 2002.

Reference Books:

1. Qusay F. Hassan, "Internet of Things A to Z: Technologies and Applications", John Wiley & Sons, 2018.
2. Alessandro Bassi, Martin Bauer, "Enabling Things to Talk: Designing IoT solutions with the IoT Architectural Reference Model", Springer, 2013.
3. Sean McManus, Mike Cook "Raspbery pi for Dummeis", Wiley, 2013.
4. Dimitrios Serpanos, Marilyn Wolf, "Internet-of-Things (IoT) Systems Architectures, Algorithms, Methodologies", Springer.

IT8102 : Web Security

Teaching Scheme	Examination Scheme	
Lectures: 3 Hrs./Week	Continuous Assessment:	20 Marks
	In-Sem Exam:	30 Marks
	End-Sem Exam:	50 Marks
Credits: 3	Total:	100 Marks

Course Objectives

1) To study and practice fundamental techniques in developing secure web based applications.
2) To identify the vulnerabilities of web based applications and to protect those applications from attacks.
3) To impart familiarity with the security techniques that provides web security.
4) To find vulnerabilities of web based applications and various attacks.
5) To identify wide range of web security vulnerabilities and issues.
6) To learn fundamentals and advanced concept of session management and SQL injection.

Course Outcomes (COs):

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

Course Outcome (s)		Bloom's Taxonomy	
		Level	Descriptor
CO1	**Understand** security-related issues in Web-based systems and applications.	2	Understand
CO2	To **Understand** the fundamental mechanisms of securing a Web-based system.	2	Understand
CO3	To be able to **Implement** security mechanisms to secure a Web-based application.	3	Apply
CO4	To be able to **Evaluate** a Web-based system with respect to its security requirements	5	Evaluate
CO5	To **Analyze** the various categories of threats, vulnerabilities, countermeasures in the area of Web security.	4	Analyze
CO6	To **Describe** the inner-workings of today's real time Web application security.	2	Understand

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	2	3	1	1	2	2	-	2	1	1	1	2	-	3	1
CO2	2	3	1	1	2	2	-	2	1	1	1	2	-	3	1
CO3	2	3	1	1	2	2	-	2	1	1	1	2	-	3	1
CO4	2	3	1	1	2	2	-	2	1	1	1	2	-	3	1
CO5	2	3	1	1	2	2	-	2	1	1	1	2	-	3	1
CO6	2	3	1	1	2	2	-	2	1	1	1	2	-	3	1

(Specify Values As: 3: High Level, 2: Medium Level, 1: Low Level For Mapping of COs to POs)

Course Contents			
Unit-I	**INTRODUCTION**	**No. of Hours**	**COs**
	Introduction - Evolution of Web Applications – Web Application Security - Core Defence Mechanisms - Handling User Access - Handling User Input- Handling Attackers Security and its building blocks, Security related definition and its categories. XSS, XSS attacks, types of XSS, XSS mitigation and prevention.	06	CO1 CO2
Unit-II	**WEB APPLICATION TECHNOLOGIES**	**No. of Hours**	**COs**
	Web Functionality Encoding Schemes Mapping the Application, Sanitizing user input, validating input, client side encoding, blacklisting and white listing input, Rules for the browser, Default directives and wildcards, The nonce attribute and the script hash.	06	CO1 CO2
Unit-III	**CREDENTIALS MANAGEMENT**	**No.of Hours**	**COs**
	Authentication Fundamentals- Two Factor and Three Factor Authentication - Password Based, Built-in HTTP, Single Sign-on Custom Authentication- Secured Password Based Authentication: Attacks against Password, Importance of Password Complexity, Broken authentication and session management, Password: strength, transit and storage, login authentication, hashing, Password: recovery.	06	CO3 CO4
Unit-IV	**SESSION MANAGEMENT**	**No.of Hours**	**COs**
	What is session, Need for Session Management Weaknesses in Session Token Generation Weaknesses in Session Token Handling Securing Session Management, Anatomy of session attacks, session hijacking, session without cookies, session ids using hidden form fields and cookies, session hijacking using session fixation, session hijacking counter measures, session hijacking: sedejacking, XSS, malware.	06	CO3 CO4
Unit-V	**SQL INJECTION**	**No.of Hours**	**COs**
	SQLi working, Anatomy of a SQLi attack - unsanitized input and server errors, Anatomy of a SQLi attack - table names and column names, Anatomy of a SQLi attack - getting valid credentials for the site, Types of SQL injection, SQLi mitigation - parameterized queries and stored procedures, SQLi mitigation- Escaping user input, least privilege, whitelist validation.	06	CO4 CO5 CO6
Unit-VI	**WEB APPLICATION VULNERABILITY**	**No.of Hours**	**COs**
	Understanding Vulnerabilities in Traditional Client Server Application and Web Applications, Cross Domain Attack: XSRF (Cross-Site Request Forgery), XSRF with GET and POST parameters, XSRF mitigation - The referer, origin header and the challenge response, XSRF mitigation.	06	CO5 CO6

Text Books:

1. B. Sullivan, V. Liu, and M. Howard, "Web Application Security, A B Guide", New York: McGraw-Hill. (ISBN No.: 978-0-07-177616-5).
2. D. Stuttard and M. Pinto, "The Web Application Hackers Handbook: Finding and Exploiting Security Flaws", 2nd Edition, Indianapolis, IN: Wiley, John Sons, 2011 (ISBN No. : 978-1-118-02647-2).

Reference Books:

1. Hanqing and L. Zhao, "Web Security: A Whitehat Perspective", United Kingdom: Auerbach Publishers, (ISBN No.: 978-1-46-659261-2).
2. M. Shema and J. B. Alcover, "Hacking Web Apps: Detecting and Preventing Web Application Security Problems", Washington, DC, United States: Syngress Publishing, (ISBN No. 978-1-59-749951-4)
3. Hanqing Wu, Liz Zhao "Web Security: A WhiteHat Perspective" CRC press.

Online Course :

Udemy:

1. Web Security: Common Vulnerability and their Mitigation.
2. Web Application Security.

Coursera:

1. Security for the Web.

IT8103 Web Security Tools Laboratory

Teaching Scheme	Examination Scheme	
Lectures: 2 Hrs./Week	**Term Work:**	**50 Marks**
	Oral :	**NA**
	Practical:	**NA**
Credits: 01	**Total:**	**50 Marks**

Prerequisite Course:

- Basic Security Tools

Course Objectives

1. To install different software and set up Operating System for Web Security.
2. To analyze different Vulnerabilities in a web application and networks.
3. To implement SQL injection to find Vulnerabilities.
4. To understand the basics of Cross site Scripting.
5. To identify wide range of web security vulnerabilities and issues.
6. To learn fundamentals and advanced concepts of session management and SQL injections.

Course Outcomes (COs):

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

	Course Outcome (s)	Bloom's Taxonomy	
		Level	**Descriptor**
CO1	To **Understand** the fundamental mechanisms of securing a Web-based system.	**2**	**Understand**
CO2	**Analyze** different Vulnerabilities in a web application and networks.	**4**	**Analyze**
CO3	To be able to **Implement** security mechanisms to secure a Web-based application.	**3**	**Apply**
CO4	**Implement** SQL injection to find Vulnerabilities.	**3**	**Apply**
CO5	To **Analyze** the various categories of threats, vulnerabilities, countermeasures in the area of Web security.	**4**	**Analyze**
CO5	**Implement** Cross site Scripting.	**3**	**Apply**

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

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

(Specify Values As: 3: High Level, 2: Medium Level, 1: Low Level For Mapping of COs to POs)

Guidelines: This Web Security Tools Laboratory course has Web Security as a core subject. The problem statements should be framed based on mentioned assignments in the syllabus for conduction of practical examination. The teacher will frame the problem statements with due consideration that students have three hours to complete that the assignment. The practical examination will comprise implementation and related theory. All assignments are to be performed in C++ Language.

Term Work: Staff in-charge will suitably frame the above assignments and flexibility may be incorporated. Students will submit term work in the form of a journal. Each assignment has to be well documented with problem definition, code documented with comments. Staff in-charge will assess the assignments continuously and grade or mark each assignment on completion date. All the assignments should be conducted in C++ Language.

Suggested List of Assignments

Sr. No.	ASSIGNMENTS	No. of Hours	Cos
1	Assignment on Crawling a website	2 Hrs.	CO1
2	Assignment on Vulnerability scanning	2 Hrs.	CO2
3	Assignment on Cookie Stealing with cross site scripting	2 Hrs.	CO3
4	Assignment on XSS and SQL injections	2 Hrs.	CO2,CO4
5	Assignment on SQL injection	2 Hrs.	CO4
6	Assignment on Password security	2 Hrs.	CO5
7	Assignment on Browser security	2 Hrs.	CO5
8	Assignment on Cross site scripting	2 Hrs.	CO6

Text Books:

1. B. Sullivan, V. Liu, and M. Howard, Web Application Security, A B Guide. New York: McGraw-Hill, (ISBN No.: 978-0-07-177616-5).
2 D. Stuttard and M. Pinto, The Web Application Hackers Handbook: Finding and Exploiting Security Flaws, 2nd ed. Indianapolis, IN: Wiley, John Sons, 2011, (ISBN No. : 978-1-118-02647-2).

Reference Books:

1. Hanqing and L. Zhao, "Web Security: A Whitehat Perspective", United Kingdom: Auerbach Publishers, (ISBN No.: 978-1-46-659261-2).
2. M. Shema and J. B. Alcover, "Hacking Web Apps: Detecting and Preventing Web Application Security Problems", Washington, DC, United States: Syngress Publishing, (ISBN No. 978-1-59-749951-4).
3. Hanqing Wu, Liz Zhao "Web Security: A WhiteHat Perspective", CRC press.

Online Course :

Udemy:

1. Web Security: Common Vulnerability and their Mitigation.
2. Web Application Security.

Coursera:

1. Security for the Web.

SANJIVANI RURAL EDUCATION SOCIETY'S

SANJIVANI COLLEGE OF ENGINEERING KOPARGAON

(An Autonomous Institute Affiliated to SPPU Pune)

DEPARTMENT OF INFORMATION TECHNOLOGY

COURSE CURRICULUM - 2020 PATTERN

FINAL YEAR B. TECH.

(W. e. f. Academic Year 2023-2024)

At. Sahajanandnagar, Post. Shingnapur Tal. Kopargaon Dist. Ahmednagar,

Maharashtra State, India PIN 423603

Declaration page

PROFILE

Sanjivani College of Engineering (An Autonomous Institute), Kopargaon is one among the premier technical institutes in Maharashtra state in the un-aided sector established in 1983.Department of Information Technology is established in the year 2001 with an intake of 60 students. Department is acquainted with 8 well equipped laboratories with latest hardware and Software, 3 class rooms and one tutorial Hall equipped with modern teaching aids and computing facilities. UG Program in IT department is accredited by NBA New Delhi for Second time in Academic Year 2019-2020 for three Years.

There are 15 experienced & well qualified teaching staff members & 6 supporting staff members who carry out the regular academic activities as well as curricular & extracurricular activities as per the plans prepared in advance at the beginning of every semester.

In the academic year 2019-2020 strength of students in department is 275. Apart from regular academic activities students take part in curricular & co curricular activities conducted by department organization ITERA as well as other department's organization & professional bodies in the institute like CSI, ISTE, and IEEE etc. Apart from the central library the department has its own library with a very good collection of reference book, text books and CSI magazines, IEEE magazines.

Along with regular academics Department of IT has started value added courses like SAP Certification Training Programme in collaboration with Primus Techsystems Pvt. Ltd. Pune and REDHAT Academy Centre, MBPS Infotech Pune.

IT Department has started capsule courses to improve technical skill sets of students. Department is having very good placements in various renowned and multi-national companies like TCS, Infosys, Persistent, Cognizant Wipro and many more.

Also to form well balanced Industry Interaction connect and bridge the gap between Industry and institution Department of IT has organized different events like Sanjivani Though Leader, Sanjivani I-connect and Sanjivani My Story Board.

Various personal and professional skill development programs like Communication and Soft Skill programs, Aptitude Training, Technical Skill enhancement programs, Foreign Language Certification Courses, Personal and Spiritual Development Programs, Entrepreneurship Development Activities, and Preparation courses for competitive Examinations (Gate/GRE/CAT etc.) are made available in campus. Students are given opportunities to develop and nurture their leadership qualities through Student Associations, Student Council, Professional Body activities and working as volunteers in various events organized at Department/ College level.

VISION AND MISSION
Vision of Institute
To develop world class professionals through quality education.
Mission of Institute
To create Academic Excellence in the field of Engineering and Management through Education, Training and Research to improve quality of life of people.
Vision of Department
To develop world class IT professionals through quality education.
Mission of Department
To create Academic Excellence in the field of Information Technology through Education, Industry Interaction, Training and Innovation to improve quality of life of people. We are committed to develop industry competent technocrats with life-long learning capabilities and moral values.

PROGRAM EDUCATIONAL OBJECTIVES
PEO 1:
Graduates of IT program should possess knowledge of fundamental concepts in mathematics, science, engineering and technology as well as skills in the field of Information Technology for providing solution to complex engineering problem of any domain by analyzing, designing and implementing.
PEO 2:
Graduates of IT program should possess better communication, presentation, time management and teamwork skills leading to responsible and competent research, entrepreneurship and professionals, will be able to address challenges in the field of Information Technology at global level.
PEO 3:
Graduates of IT program should have commitment to societal contributions through communities and life-long learning.

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

PROGRAM SPECIFIC OUTCOMES
PSO1:
Attain the ability to provide software solutions by applying knowledge of Data Structures & Algorithms, Databases, Web Technology, System Software, Soft Computing and Cloud Computing.
PSO2:
Apply the knowledge of Computer Hardware & Networking, Cyber Security, Artificial Intelligence and Internet of Things to effectively integrate IT based solutions.
PSO3:
Apply the knowledge of best practices and standards of Software Engineering for Project Management.

DEPARTMENT OF INFORMATION TECHNOLOGY

COURSE STRUCTURE AND SYLLABUS - 2020 PATTERN

FINAL YEAR B. TECH.

LIST OF ABBREVIATIONS			
Abbreviation	**Full Form**	**Abbreviation**	**Full Form**
ES	Engineering Science	HSMC	Humanity Science
PC	Professional Core	CA	Continuous Assessment
PE	Professional Elective	OR	End Semester Oral Examination
OE	Open Elective	PR	End Semester Practical Examination
ISE	In-Semester Evaluation	TW	Continuous Term work Evaluation
ESE	End-Semester Evaluation	BSC	Basic Science Course
PRJ	Project	MC	Mandatory Course

COURSE STRUCTURE - 2020 PATTERN

SEMESTER - VII

Course		Course Title	Teaching Scheme Hours/ Week			Credits	Evaluation Scheme - Marks						
							Theory			OR	PR	TW	Total
Cat.	Code		L	T	P		CIA	ISE	ESE				
PC	IT401	Natural Language Processing	3	-	-	3	20	30	50	-	-	-	100
PC	IT402	Distributed Systems	4	-	-	4	20	30	50	-	-	-	100
PC	IT403	Machine Learning	3	-	-	3	20	30	50	-	-	-	100
PE	IT404	Professional Elective-III	3	-	-	3	20	30	50	-	-	-	100
PE	IT405	Professional Elective-IV	3	-	-	3	20	30	50	-	-	-	100
PC	IT406	Natural Language Processing & Machine Learning Laboratory	-	-	4	2	-	-	-	-	50	50	100
PC	IT407	Distributed Systems Laboratory	-	-	2	1	-	-	-	50	-	-	50
PRJ	IT408	Project Stage - I	-	-	6	3	-	-	-	50	-	100	150
MC	MC409	Mandatory Course – VII	1	-	-	Non Credit	-	-	-	-	-	-	Pass/ Fail
		Total	17	-	12	22	100	150	250	100	50	150	800

MC409	Mandatory Course – VII	Finance related course proposed by Financial Smart

IT404 Professional Elective- III		IT405 Professional Elective- IV	
Course Code	Course	Course Code	Course
IT404A	Software Architecture	IT405A	Cloud Computing
IT404B	Digital Twin	IT405B	Ubiquitous Computing
IT404C	Cognitive Intelligence	IT405C	Business Intelligence

HONORS SPECIALIZATION IN CYBER SECURITY

Course		Course Title	Teaching Scheme Hours/ Week			Credits	Evaluation Scheme-Marks						
							Theory			OR	PR	TW	Total
Cat.	Code		L	T	P		ISE	ESE	CIA				
HSIT	IT8104	Ethical Hacking & Digital Forensic Tools	3	-	-	3	30	50	20	-	-	-	100
HSIT	IT8105	Ethical Hacking & Digital Forensic Tools Lab	-	-	2	1	-	-	-	50	-	-	50
		Total	4	-	2	4	30	50	20	50	-	-	150

COURSE STRUCTURE - 2020 PATTERN

SEMESTER - VIII

Course		Course Title	Teaching Scheme Hours/ Week			Credits	Evaluation Scheme - Marks						
							Theory			OR	PR	TW	Total
Cat.	Code		L	T	P		CIA	ISE	ESE				
OE	IT410	Open Elective-I	3	-	-	3	-	50	50	-	-	-	100
OE	IT411	Open Elective-II	3	-	-	3	-	50	50	-	-	-	100
OE	IT412	Open Elective-III	2	-	-	2	-	50	50	-	-		100
PRJ	IT413	Professional Internship	-	-	12	6	-	-	-	50	-	100	150
PRJ	IT414	Project Stage - II	-	-	8	4	-	-	-	50	-	-	50
		Total	8		20	16	-	150	150	100	-	100	500

IT410 Open Elective- I		IT411 Open Elective- II		IT412 Open Elective- II	
Course Code	Course	Course Code	Course	Course Code	Course
IT410OE1	Product and Brand Management	IT411OE1	Design & Implementation of Human-Computer Interfaces	IT412OE1	Introduction to Haskell Programming
IT410OE2	Organizational Behaviour	IT411OE2	Ethical Hacking	IT412OE2	Computer Graphics
IT410OE3	E-Business	IT411OE3	Introduction to Industry 4.0 And Industrial Internet of Things	IT412OE3	Google Cloud Computing Foundations
IT410OE4	Management Information System				

HONORS SPECIALIZATION IN CYBER SECURITY

Course		Course Title	Teaching Scheme Hours/ Week			Credits	Evaluation Scheme-Marks						
							Theory			OR	PR	TW	Total
Cat.	Code		L	T	P		ISE	ESE	CIA				
HSIT	IT8106	Mobile Hacking	4	-	-	4	30	50	20	-	-	-	100
		Total	4	-	-	4	30	50	20	-	-	-	100

IT401 : Natural Language Processing

Teaching Scheme	Examination Scheme	
Lectures: 3 Hrs./Week	**Continuous Assessment:**	**20 Marks**
	In – Sem Exam:	**30 Marks**
	End-Sem Exam:	**50 Marks**
Credits: 3	**Total:**	**100 Marks**

Prerequisite Course: Discrete Mathematics, Theory of computation, Foundation of Data Science.

Course Objectives

1. To introduce the Natural language processing basics and basics of linguistics.
2. To introduce the statistics for NLP and language model.
3. To apply text dependency parsing and LLM on textual data.
4. To apply sentiment analysis and information retrieval.
5. To apply various NLP tools and techniques.
6. To apply linguistic features and its application using NLP.

Course Outcomes (COs):

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

Course Outcome (s)		Bloom's Taxonomy	
		Level	Descriptor
CO1	Understand concept and processing of Natural Language Processing.	2	Understand
CO2	Understand the statistics for NLP and Language modeling.	2	Understand
CO3	Apply Dependency Parsing and Large Language Model on text.	3	Apply
CO4	Apply the information retrieval and sentiment analysis on textual data.	3	Apply
CO5	Apply various NLP tools and techniques.	3	Apply
CO6	Apply Spacy language model for various text applications.	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	1	-	1	-	-	-	0	-	0	2	-	-
CO2	2	2	1	1	1	1	-	-	-	0	-	1	1	-	-
CO3	2	1	2	1	2	1	1	-	-	0	-	1	1	-	1
CO4	1	3	2	1	2	1	-	-	-	0	1	1	2	-	-
CO5	2	2	2	1	3	-	1	0	-	0	-	2	2	-	2
CO6	1	1	2	1	3	-	1	0	-	0	2	2	2	-	1

Course Contents			
Unit-I	**INTRODUCTION TO NATURAL LANGUAGE PROCESSING (NLP)**	**No. of Hours**	**COs**
	Introduction: Natural Language Processing(NLP), Ambiguity in NLP, Finite autometa for NLP, Stage of NLP, Challenges and issues in NLP. Basics of Text Processing: language stop words, Tokenization, Stemming, Lemmitization, Part of speech Tagging(PoS Tagging).	8	CO1
Unit-II	**LANGUAGE MODELING AND EMBEDDING**	**No. of Hours**	**COs**
	Probabilistic Language Modeling, Markov models, N-gram models: estimation parameters and smoothing. Word Embedding / Vector Semantics: Bag-of-words, TF-IDF, word2vec, doc2vec, Glove, Contextualized representations (BERT), Topic Modeling: Latent Semantic Analysis.	7	CO2
Unit-III	**DEPENDENCY PARSING AND LARGE LANGUAGE MODEL**	**No. Of Hours**	**COs**
	Dependency Parsing: Dependency Grammar and Dependency Structure, Transition-Based Dependency Parsing, Neural Dependency Parsing, Dependency parsing for sentence structure, Large Language Model: Foundation Models and ChatGPT, Introduction to GPT, GPT-3, GPT 4,ChatGPT, BioGPT and Prompt engineering.	8	CO3
Unit-IV	**INFORMATION RETRIEVAL AND SENTIMENT ANALYSIS**	**No. of Hours**	**COs**
	Named Entity Recognition: NER System Building Process, Evaluating NER, System Entity Extraction, Relation Extraction, Reference Resolution, Coreference resolution, Cross Lingual Information Retrieval, Custom NER tag design, Regular Expression(RegEx) for string pattern extraction from language corpus, uses re.find(), re.findall(), re.search(), re.match() for string pattern search.	7	CO4
Unit-V	**NLP TOOLS AND TECHNIQUES**	**No. of Hours**	**COs**
	Prominent NLP Libraries: Natural Language Tool Kit (NLTK), SpaCy, Gensim etc. Language model using Spacy library for English language, Spacy Language model for Indian Language. CoreNLP: Stanford CoreNLP and its features,	8	CO5
Unit-VI	**APPLICATIONS OF NLP**	**No. of Hours**	**COs**
	Text Classification, Text Summarization, Question answering model, Question Answering in Multilingual Setting; NLP in Information Retrieval, Cross-Lingual IR, Custom Tag Spacy model.	7	CO6

Text Books:

1. Jurafsky, David, and James H. Martin, “Speech and Language Processing: An Introduction to Natural Language Processing”, Computational Linguistics and Speech Recognition‖, ,PEARSON Publication.
2. Manning, Christopher D., and nrich Schütze , “Foundations of Statistical Natural Language Processing”, Cambridge, MA: MIT Press.
3. Allen James, Natural Language Understanding, Pearson India, 2nd Edition, ISBN: 9788131708958, 8131708950.
4. James H. Martin, Daniel Jurafsky, “Speech and Language Processing”, Pearson, 1st Edition, ISBN:

9789332518414, 8131716724.

Reference Books:

1. Steven Bird, Ewan Klein, Edward Loper, "Natural Language Processing with Python – Analyzing Text with the Natural Language Toolkit", O'Reilly Publication.
2. Dipanjan Sarkar , "Text Analytics with Python: A Practical Real-World Approach to Gaining Actionable Insights from your Data", Apress Publication ISBN: 9781484223871
3. Alexander Clark, Chris Fox, and Shalom Lappin, "The Handbook of Computational Linguistics and Natural Language Processing", Wiley Blackwell Publications.
4. Jacob Eisenstein, "An Introduction to Information Retrieval", Cambridge University Press.

eLearning Resources:

1. https://web.stanford.edu/~jurafsky/slp3/ed3book.pdf
2. https://www3.cs.stonybrook.edu/~cse521/L16NLP.pdf
3. https://nptel.ac.in/courses/106101007
4. https://nptel.ac.in/courses/106106211

Note: Number of hours allocated to units includes actual teaching hours, continuous internal assessment hours and experiential learning.

IT402 : Distributed Systems

Teaching Scheme	Examination Scheme	
Lectures: 3 Hrs./Week	**Continuous Assessment:**	**20 Marks**
	In – Sem Exam:	**30 Marks**
	End-Sem Exam:	**50 Marks**
Credits: 3	**Total:**	**100 Marks**
Prerequisite Course: System Programming & Operating System, Computer Network.		

Course Objectives

1. To learn the principles, architectures and programming models used in distributed systems.
2. To understand the fundamentals and knowledge of the Middleware of distributed systems.
3. To gain knowledge of distributed shared memory and resource management in distributed systems.
4. To gain knowledge of working components and fault tolerance of distributed systems.
5. To make students aware about distributed and multimedia file systems and web systems.
6. Create an awareness of Emerging trends in distributed computing.

Course Outcomes (COs):

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

Course Outcome (s)		Bloom's Taxonomy	
		Level	Descriptor
CO1	Understand the core concepts of distributed systems & Middleware.	2	Understand
CO2	Apply Inter-process communication methods and analyze different coordination algorithms.	3	Apply
CO3	Understand the Concepts of Distributed Shared Memory and Resource Management in Distributed System.	2	Understand
CO4	Comprehend the importance of replication to achieve fault tolerance in distributed systems.	2	Understand
CO5	Analyze the design and functioning of existing distributed file systems, distributed multimedia, and distributed web-based systems.	4	Analyse
CO6	Understand various Recent Trends & Tools in distributed systems.	2	Understand

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	2	2	2	2	2	-	-	0	-	1	2	3	-
CO2	3	2	2	2	1	1	2	-	-	1	-	1	2	3	-
CO3	3	2	2	2	1	1	2	-	-	1	-	1	2	3	-
CO4	3	1	2	2	1	1	2	-	-	1	-	1	2	3	-
CO5	3	1	1	1	2	1	2	0	-	0	-	1	2	3	-
CO6	1	1	1	1	1	2	2	0	-	0	-	1	2	3	-

Course Contents			
Unit-I	**INTRODUCTION TO DISTRIBUTED SYSTEMS**	**No. of Hours**	**COs**
	Defining Distributed Systems, Characteristics, Middleware and Distributed Systems.Design goals,Challenges of Distributed Systems, Examples of Distributed Systems. Types of Distributed Systems: High Performance Distributed Computing, Distributed Information Systems, Pervasive Systems. Architectural styles: Layered architectures, Object based architectures, Publish Subscribe architectures. Distributed Computing Models: Physical, Architecture and Fundamental models. Introduction to middleware, middleware Framework, Role of middleware, Examples of Middleware. Case Study of Middleware System that includes Design, Architecture and Application.	10	CO1
Unit-II	**COMMUNICATION AND CO-ORDINATION**	**No. of Hours**	**COs**
	IPC: Introduction, Layered protocols, RMI, CORBA, API for internet protocols, IPC through shared memory, external data representation and marshaling, Types of communication, inter process communication, multicast communication, message-oriented communication, MPI, network virtualization, overlay networks Coordination: Clock synchronization, logical clocks, mutual exclusion, election algorithms, Gossip based coordination. Case Study: IBM WebSphere Message Queuing.	10	CO2
Unit-III	**DISTRIBUTED SHARED MEMORY & RESOURCE MANAGEMENT IN DISTRIBUTED SYSTEM**	**No. Of Hours**	**COs**
	DSM:General architecture of DSM systems, Design and implementation issues of DSM, Granularity, Structure of shared memory space, Consistency models, Replacement strategy, Thrashing. Resource Management in Distributed System: Types of resources, issues of resource sharing, Task assignment, Types of distributed load balancing algorithms, load estimation policy, process transfer, location policy, state information exchange policy, priority assignment policy, process migration.	10	CO3
Unit-IV	**CONSISTENCY, REPLICATION AND FAULT TOLERANCE**	**No. of Hours**	**COs**
	Replication: Data-Centric Consistency Models,Client-Centric Consistency Models, Reasons for replication. Replica management: Finding the best server location, Content replication and placement, Content distribution, Managing replicated objects. Consistency protocols: Primary based protocols, replicated write protocols. Fault Tolerance: Introduction to fault tolerance, Reliable client server communication, Reliable group communication, distributed commit, Recovery – Check pointing, Message logging. Case Study: Caching and replication in web.	10	CO4
Unit-V	**DISTRIBUTED FILES, MULTIMEDIA AND WEB BASED**	**No. of Hours**	**COs**

	SYSTEM		
	Distributed Files: Introduction, File System Architecture, Sun Network File System and HDFS. Distributed Multimedia Systems: Characteristics of Multimedia Data, Quality of Service Management, Resource Management. Distributed Web Based Systems: Architecture of Traditional Web-Based Systems, Apache Web Server, Web Server Clusters, Communication by Hypertext Transfer Protocol, Synchronization, Web Proxy Caching. Case Study: The Global Name Service, The X.500 Directory Service, Bit Torrent.	10	CO5
Unit-VI	**DISTRIBUTED SYSTEM MONITORING TOOLS & RECENT TRENDS**	**No. of Hours**	**COs**
	Distributed Computing: Document classification,Frameworks – Kuberbets, GPU Applications,Parallel Computing for AI/ ML. Parallel Virtual Machine (PVM), Jini, Service Oriented Architecture, The Future of Recent Trends. Tools for Distributed System Monitoring: Prometheus, Zabbix, Nagios. Case Studies: Mach, Chorus.	10	CO6

Text Books:

1. George Coulouris, J Dollimore and Tim Kindberg, "Distributed Systems: Concepts and Design", Pearson Education, ISBN: 9789332575226, 5th Edition, 2017.
2. Distributed Systems, Maarten van Steen, Andrew S. T,ThirdeditionVersion.
3. Distributed Operating Systems: Concepts and Design by P. K. Sinha, PHI, ISBN: 978-0780311190

Reference Books:

1. Distributed Computing, Sunita Mahajan and Seema Shah, Oxford University
2. Distributed Computing, Fundamentals, Simulations and Advanced topics, 2nd Edition, HagitAttiya and Jennifer Welch, Wiley India
3. Tool for Distributed Systems Monitoring, Łukasz KUFEL, Foundation of Computing and Decision Sciences, Vol 41(4), 2016, e-ISSN 2300-3405, DOI:10.1515/fcdc-2016-0014

eLearning Resources:

1. https://onlinecourses.nptel.ac.in/noc21_cs87/preview
2. https://onlinecourses.nptel.ac.in/noc21_cs15/preview
3. http://home.mit.bme.hu/~meszaros/edu/oprendszerek/segedlet/elosztott/distributed-systemssurvey.pdf
4. http://home.mit.bme.hu/~meszaros/edu/oprendszerek/segedlet/elosztott/DisSysUbiCompReport.ht ml

Note: Number of hours allocated to units includes actual teaching hours, continuous internal assessment hours and experiential learning.

IT403 : Machine Learning

Teaching Scheme	Examination Scheme	
Lectures: 3 Hrs./Week	**Continuous Assessment:**	**20 Marks**
	In – Sem Exam:	**30 Marks**
	End-Sem Exam:	**50 Marks**
Credits: 3	**Total:**	**100 Marks**
Prerequisite Course: Linear Algebra, Calculus and Probability.		

Course Objectives

1. To understand Machine Learning concepts.
2. To explore the different types of Classification algorithm.
3. To explore the Regression techquiues.
4. To acquire the knowledge of Clustering techquiues.
5. To acquire the knowledge of Association rules and Dimensionality Reduction.
6. To understand the Deep Learning concept.

Course Outcomes (COs):

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

Course Outcome (s)		Bloom's Taxonomy	
		Level	Descriptor
CO1	Recognize the characteristics of machine learning that makes it useful to real-world problems.	2	Understand
CO2	Apply different classification algorithms for various machine learning applications.	3	Apply
CO3	Apply the Regression methods.	3	Apply
CO4	Apply Clustering technique.	3	Apply
CO5	Apply the Association rule and Principle Componenet Analysis.	3	Apply
CO6	Understand the Deep learning.	2	Understand

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

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

Course Contents			
Unit-I	**INTRODUCTION TO MACHINE LEARNING**	**No. of Hours**	**COs**
	Introduction: Definition, Real life applications, Introduction to Data in Machine Learning. Types of Learning: Supervised Learning Unsupervised Learning, Semi-Supervised Learning, Reinforcement Learning. Features: Types of Data (Qualitative and Quantitative), Scales of Measurement (Nominal, Ordinal, Interval, Ratio), Concept of Feature, Feature construction, Feature Selection and Transformation, Curse of Dimensionality. Dataset Preparation: Training Vs. Testing Dataset, Dataset Validation Techniques – Hold-out, k-fold Cross validation, Leave-One-Out Cross-Validation (LOOCV).	8	CO1
Unit-II	**REGRESSION**	**No. of Hours**	**COs**
	Linear Regression, Logistic Regression, Ridge Regression, Lasso Regression, Polynomial Regression. Types of Regression, performance metrics Mean Squared Error (MSE), Root Mean Squared Error (RMSE), Mean Absolute Error (MAE), R^2 (R-Squared).	7	CO2
Unit-III	**CLASSIFICATION**	**No. Of Hours**	**COs**
	Sigmoid function,Classification Algorithm in Machine Learning: Decision Trees , Bagging and boosting,Adaboost and gradient boost,Random Forest,Naïve Bayes Classifier, Support Vector Machines. Performance Evaluation: Confusion Matrix, Accuracy, Precision, Recall, AUC-ROC Curves, F-Measure	8	CO3
Unit-IV	**CLUSTERING**	**No. of Hours**	**COs**
	Distance measures-Euclidean, Manhattan, Hamming, Minkowski Distance Metric, Different clustering methods (Distance, Density, Hierarchical), K-means clustering Algorithm-with example, k-medoid algorithm-with example, Performance Measures- Rand Index,K-Nearest Neighbour algorithm	7	CO4
Unit-V	**ASSOCIATION AND DIMENSIONALITY REDUCTION**	**No. of Hours**	**COs**
	Association Rules-Market Basket Analysis, The Apriori Algorithm, Performance Measures – Support, Confidence, Lift. Dimensionality Reduction: Principal Component Analysis, Partial Least Squares Subset Selection, Feature Reduction/Dimensionality reduction, Principal components analysis (Eigen values, Eigen vectors, Orthogonality)	8	CO5
Unit-VI	**DEEP LEARNING**	**No. of Hours**	**COs**
	Introduction to ANN, McCulloch Pitts Neuron, Perceptron and its Learning Algorithm, Sigmoid Neuron, Activation Functions: Tanh, ReLu. Multi-layer Perceptron Model – Introduction, learning parameters: Weight and Bias, Loss function: Mean Square Error, Back Propagation Learning.	7	CO6

	Convolutional Neural Network, Building blocks of CNN, Transfer Learning, R-CNN,Autoencoders, LSTM Networks, Recent Trends in Deep Learning Architectures.		

Text Books:

1. Ethem Alpaydin, "Introduction to Machine Learning", PHI 4th Edition-2020 ,The MIT Press, ISBN:9780262043793.
2. Deep Learning- Ian Goodfelllow, Yoshua Benjio, Aaron Courville, The MIT Press ISBN:9780262035613
3. Machine Learning, Tom M. Mitchell, McGraw Hill, 1997 ISBN: 0071154671, 9780071154673

Reference Books:

1. Peter Flach, "Machine Learning The Art and Science of Algorithms that Make Sense of Data", Cambridge University Press India.ISBN 13: 9781107422223
2.
3. Pattern Recognition and Machine Learning. Christopher Bishop. Springer. 2006, ISBN-13: 978-1493938438
4. Understanding Machine Learning. Shai Shalev-Shwartz and Shai Ben-David. CambridgeUniversity Press. 2017. ISBN:978-1-107-05713-5.
5. Kevin P Murphy: Machine Learning – A Probabilistic Perspective, MIT Press, August 2012. ISBN 978-0-262-01802-9

eLearning Resources:

1. http://imlab.postech.ac.kr/dkim/class/csed514_2019s/DeepLearningBook.pdf
2. https://kkpatel7.files.wordpress.com/2015/04/alppaydin_machinelearning_2010.pdf.
3. https://nptel.ac.in/courses/106106139.
4. https://nptel.ac.in/courses/106/106/106106202/ https://nptel.ac.in/courses/106/106/106106198/ https://nptel.ac.in/courses/106/105/106105152/ https://nptel.ac.in/courses/106/106/106106213/

Note: Number of hours allocated to units includes actual teaching hours, continuous internal assessment hours and experiential learning.

IT404A : Software Architecture (Professional Elective –III)

Teaching Scheme	Examination Scheme	
Lectures: 3 Hrs./Week	**Continuous Assessment:**	**20 Marks**
	In – Sem Exam:	**30 Marks**
	End-Sem Exam:	**50 Marks**
Credits: 3	**Total:**	**100 Marks**
Prerequisite Course: Software Engineering Modeling and Design		

Course Objectives

1. To understand the Software architecture for various software systems.
2. To recognize and derive Quality attributes for software architectures.
3. To understand the use of different architectural styles and frameworks.
4. To understand systems requirement with the help of different UML diagrams.
5. To understand documentation for architectural patterns.
6. To understand the role of architecture in Software Enterprise.

Course Outcomes (COs):

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

Course Outcome (s)		Bloom's Taxonomy	
		Level	Descriptor
CO1	Understand the Software architecture for various software systems.	2	Understand
CO2	Recognize and derive Quality attributes for software architectures.	3	Apply
CO3	Demonstrate the use of different architectural styles and frameworks.	3	Apply
CO4	Depict systems requirement with the help of different UML diagrams.	3	Apply
CO5	Demonstrate documentation for architectural patterns.	3	Apply
CO6	Understand the role of architecture in Software Enterprise.	2	Understand

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	2	-	1	2	-	1	-	0	1	1	2	3	-
CO2	1	1	2	-	1	2	-	1	-	0	1	1	2	3	-
CO3	1	1	2	-	1	2	-	1	-	0	1	1	2	3	-
CO4	1	1	2	-	1	2	-	1	-	0	1	1	2	3	-
CO5	1	1	2	-	1	2	-	1	-	0	1	1	2	3	-
CO6	1	1	2	-	1	2	-	1	-	0	1	1	2	3	-

Course Contents			
Unit-I	**INTRODUCTION**	**No. of Hours**	**COs**
	Introduction: Introduction – Software architecture and requirements – Architecture diagrams - UML Component Diagram – UML Package Diagram – UML Deployment Diagram – UML Activity Diagram – Architecture structure – ABC (Architecture Business Cycle).	8	CO1
Unit-II	**UNDERSTANDING QUALITY ATTRIBUTES AND ACHIEVING QUALITY**	**No. of Hours**	**COs**
	Introduction to Quality Attributes – Need of quality attributes – Understanding quality attributes – architecture and quality attributes – achieving quality attributes. Case study of quality attributes in software architecture templates – Deriving Quality Attributes for software architectures.	7	CO2
Unit-III	**ARCHITECTURAL VIEWS**	**No. Of Hours**	**COs**
	Introduction – Definitions – Structures and views - Representing viewsavailable notations – Standard views – 4+1 view of Rational Unified Process, Siemens 4 views, SEI's perspectives and views – Case studies Architecture in the agile projects – Architecture and requirements – Implementation and testing – Architecture reconstruction and conformance.	8	CO3
Unit-IV	**ARCHITECTURAL STYLES**	**No. of Hours**	**COs**
	Introduction – Data flow styles – Call-return styles – Shared Information styles - Event styles – Case studies for each style. Architectural styles – Pipes and filters – Data abstraction and object-oriented organization – Eventbased – implicit invocation – Layered systems – Repositories – Other familiar architectures – Heterogeneous Architectures.	7	CO4
Unit-V	**DOCUMENTING THE ARCHITECTURE**	**No. of Hours**	**COs**
	Guidelines and practices – Documenting the Views using UML – Pros and cons of using visual languages–Need for formal languages - Architectural Description Languages–ACME–Designing and documentation, Case studies.	8	CO5
Unit-VI	**ADVANCED TOPICS**	**No. of Hours**	**COs**
	Software Architecture in the future-The Architecture Business Cycle Revisited – Role of architecture in Software Engineering Enterprise Architectures – Zachman's Framework – Opportunities and Advances in Software Architectures.	7	CO6

Text Books:

1. Len Bass, Paul Clements, Rick Kazman, "Software Architecture in Practice", Second Edition, Pearson, ISBN 978-81-775-8996-2.
2. Erich Gamma, Design Patterns
3. Ramesh Gopalaswamy, “Managing and global Software Projects”, Tata Mc Graw Hill. Tenth Reprint 2011.(Revised)
4. Roger S.Pressman, “Software Engineering - A Practitioner’s Approach”, 7th Edition McGraw Hill, 2010.(Revised).

Reference Books:

1. Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, "Mastering Cloud Computing: Foundations and Applications Programming", McGraw Hill, ISBN: 978 1259029950, 1259029956.
2. Barrie Sosinsky, "Cloud Computing Bible", Wiley, ISBN: 978 8126529803.
3. Gautham Shroff, "Enterprise Cloud Computing", Cambridge, ISBN: 9781107648890.
4. Ronald L. Krutz and Russell D. Vines, "Cloud Security: A Comprehensive guide to Secure Cloud Computing", Wiley, ISBN: 9788126528097.
5. Scott Adkins, John Belamaric, Vincent Giersch, Denys Makogon, Jason E. Robinson, "OpenStack: Cloud Application Development", Wrox, ISBN :9781119194316.
6. KailashJayaswal, JagannathKallakurchi, Donald J. Houde, "Cloud Computing Black Book",Wiley Dreamtech,ISBN:9789351194187.

eLearning Resources:

Note: Number of hours allocated to units includes actual teaching hours, continuous internal assessment hours and experiential learning.

IT404B : Digital Twin (Professional Elective-III)

Teaching Scheme	Examination Scheme	
Lectures: 3 Hrs./Week	**Continuous Assessment:**	**20 Marks**
	In – Sem Exam:	**30 Marks**
	End-Sem Exam:	**50 Marks**
Credits: 3	**Total:**	**100 Marks**

Prerequisite Course: Basic knowledge of Data Science, Data Analytics, Engineering Physics.

Course Objectives

1. To understand digital twin approach.
2. To gain the knowledge of digital twin development plan.
3. To understand the role of digital twin in industry.
4. To gain knowledge of digital twin framework.
5. To gain azure digital twin installation.
6. To learn digital twin definition language.

Course Outcomes (COs):

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

	Course Outcome (s)	Bloom's Taxonomy	
		Level	Descriptor
CO1	To understand digital twin approach.	2	Understand
CO2	To understand the knowledge of digital twin development plan.	2	Understand
CO3	To understand the role of digital twin in industry.	2	Understand
CO4	To understand the digital twin framework.	2	Understand
CO5	To apply azure digital twin installation.	3	Apply
CO6	To apply digital twin definition language.	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

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

Course Contents			
Unit-I	**INTRODUCTION TO DIGITAL TWIN**	**No. of Hours**	**COs**
	Origin of the Digital Twin concept, what is a Digital Twin, Entity life cycle and Digital Twin development life cycle. Types of Digital Twins- Discrete versus composite, Product versus facility, Simulation versus operational, Analytics versus physics-based, Characteristics of a Digital Twin.	8	CO1
Unit-II	**DIGITAL TWIN MODEL DEVELOPMENT PLAN**	**No. of Hours**	**COs**
	Key criteria, Expected business outcomes- The manufacturing industry- Discrete manufacturing, Process manufacturing, Smart manufacturing, Supply chain management. Prerequisites for the Digital Twin, Technological needs.	7	CO2
Unit-III	**IDENTIFYING THE FIRST DIGITAL TWIN**	**No. Of Hours**	**COs**
	Evaluating Digital Twin candidates, Industrial conglomerates, Digital twin at digital competency, Digital twin at the LOB, Large enterprises in a single industry sector, public sector, Software and public cloud providers.	8	CO3
Unit-IV	**WORK WITH DIGITAL TWIN**	**No. of Hours**	**COs**
	Project Planning framework, Solution planning framework, Validating the problem statement and outcomes, Exploring the business process for Digital Twin development, Factoring in technology considerations.	7	CO4
Unit-V	**AZURE DIGITAL TWIN**	**No. of Hours**	**COs**
	Technical Requirements, Azure Digital Twin service, MS visual studio, The Window Azure, CLI with windows powershell, Node.JS, Azure digital twin explorer, Creating first Digital twin.	8	CO5
Unit-VI	**DIGITAL TWIN DEFINITION LANGUAGE**	**No. of Hours**	**COs**
	Digital Twin Definitation Language, DT Interface, interface content, schemas, primitive schemas, complex schemas, geospatial schema.	7	CO6

Text Books:

1. Shyam Varan Nath, Pieter van Schalkwyk, Dan Isaacs, “Building Industrial Digital Twins”, Packt Publishing, ISBN: 9781839219078.
2. Alexanders Meijers, “Hands on Azure Digital Twins”, ISBN-9781801071383, Packt Publishing, March 2022.
3. Gopal Chaudhary, Manju Khari, Mohamed Elhoseny, “Digital Twin Technology”, 1st Edition, ISBN 9781003132868, Published October 5, 2021 by CRC press.
4. F Tao, M Zhang, AYC Nee, “Digital twin driven smart manufacturing”, Academic Press, ISBN-978-0-12-817630-6.

Reference Books:

1. Christoph Herwig, Ralf Pörtner, Johannes Möller, “Digital Twins Tools and Concepts for Smart Biomanufacturing”, Springer, ISBN 978-3-030-71660-8
2. Arup, “Digital Twins towards a meaningful framework”, W1T 4BQ, www.arup.com

eLearning Resources:

1. Prof. M. S. Krishnan, University of Michigan, https://www.coursera.org/learn/digital-twins
2. Udemy https://www.udemy.com/course/digital-twin-a-comprehensive-overview/

Note: Number of hours allocated to units includes actual teaching hours, continuous internal assessment hours and experiential learning.

IT404C : Cognitive Intelligence (Professional Elective-III)

Teaching Scheme	Examination Scheme	
Lectures: 3 Hrs./Week	**Continuous Assessment:**	**20 Marks**
	In – Sem Exam:	**30 Marks**
	End-Sem Exam:	**50 Marks**
Credits: 3	**Total:**	**100 Marks**

Prerequisite Course: To explain cognitive computing and design principles.

Course Objectives

1. To distinguish between NLP and cognitive computing.
2. To apply advanced analytics to cognitive computing.
3. To discuss application of cognitive computing in business.
4. To illustrate various applications of cognitive computing.
5. To provide an understanding of the central challenges in realizing aspects of human cognition.

Course Outcomes (COs):

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

	Course Outcome (s)	Bloom's Taxonomy	
		Level	**Descriptor**
CO1	Explain cognitive computing and design principles.	2	Understand
CO2	Distinguish between NLP and cognitive computing.	2	Understand
CO3	Apply advanced analytics to cognitive computing.	3	Apply
CO4	Discuss application of cognitive computing in business.	2	Understand
CO5	Illustrate various applications of cognitive computing.	2	Understand
CO6	Understand the aspects of human cognition.	2	Understand

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	2	-	0	-	-	-	0	-	0	3	-	2
CO2	3	2	2	2	-	0	-	-	-	0	-	0	3	-	2
CO3	3	2	2	2	-	-	-	-	-	0	-	0	3	-	2
CO4	3	2	2	2	-	-	-	-	-	0	-	0	3	-	2
CO5	3	2	2	2	-	-	-	0	-	0	-	0	3	-	2
CO6	3	2	2	2	-	-	-	0	-	0	-	0	3	-	2

Course Contents			
Unit-I	**FOUNDATION & DESIGN PRINCIPLES**	**No. of Hours**	**COs**
	Foundation of Cognitive Computing: cognitive computing as a new generation, the uses of cognitive systems, system cognitive, gaining insights from data, Artificial Intelligence as the foundation of cognitive computing, understanding cognition. Design Principles for Cognitive Systems: Components of a cognitive system, building the corpus, bringing data into cognitive system, machine learning, hypotheses generation and scoring, presentation and visualization services.	8	CO1
Unit-II	**NLP IN COGNITIVE SYSTEM**	**No. of Hours**	**COs**
	Natural Language Processing in support of a Cognitive System: Role of NLP in a cognitive system, semantic web, Applying Natural language technologies to Business problems. Representing knowledge in Taxonomies and Ontologies: Representing knowledge, Defining Taxonomies and Ontologies, knowledge representation, models for knowledge representation, implementation considerations.	7	CO2
Unit-III	**BIG DATA VS COGNITIVE COMPUTING**	**No. Of Hours**	**COs**
	Relationship between Big Data and Cognitive Computing: Dealing with human-generated data, defining big data, architectural foundation, analytical data warehouses, Hadoop, data in motion and streaming data, integration of big data with traditional data. Applying Advanced Analytics to cognitive computing: Advanced analytics is on a path to cognitive computing, Key capabilities in advanced analytics, Using advanced analytics to create value, Impact of open source tools on advanced analytics.	8	CO3
Unit-IV	**COGNITIVE COMPUTING IN BUSINESS**	**No. of Hours**	**COs**
	The Business Implications of Cognitive Computing: Preparing for change, advantages of new disruptive models, knowledge meaning to business, difference with a cognitive systems approach, meshing data together differently, using business knowledge to plan for the future, answering business questions in new ways, building business specific solutions, making cognitive computing a reality, cognitive application changing the market- IBM Watson as a cognitive systems.	7	CO4
Unit-V	**APPLICATIONS**	**No. of Hours**	**COs**
	The process of building a cognitive application: Emerging cognitive platform, defining the objective, defining the domain, understanding the intended users and their attributes, questions and exploring insights, training and testing- Building a cognitive health care application- Smarter cities-Cognitive Computing in Government.	8	CO5
Unit-VI	**COGNITIVE MDELS**	**No. of Hours**	**COs**
	Understanding Cognition, IBM's Watson, Design for Human Cognition, Augmented Intelligence, Cognition Modeling Paradigms: Declarative/ logic-based computational cognitive modeling, connectionist models of cognition, Bayesian models of cognition, a dynamical systems approach	7	CO6

	to cognition.		

Text Books:

1. Judith H Hurwitz, Marcia Kaufman, Adrian Bowles, "Cognitive computing and Big Data Analytics" , Wiley, 2015.
2. Vijay Raghvan, Venu Govindaraju, C.R. Rao, "Cognitive Computing: Theory and Applications", Elsevier publications, North Holland Publication, 1st Edition, 2016.
3. Bernadette Sharp, Florence Sedes, Wieslaw Lubaszewski, "Cognitive Approach to Natural Language Processing Hardcover", 1st Edition May 2017.

Reference Books:

1. Arun Kumar Sangaiah, Arunkumar Thangavelu, et al., "Cognitive Computing for Big Data Systems Over IoT: Frameworks, Tools and Applications: Lecture Notes on Data Engineering and Communications Technologies", 1st Edition 2018.
2. Min Chen and Kai Hwang, "Big-Data Analytics for Cloud, IoT and Cognitive Computing", Wiley Publication, 1st Edition, 2017.
3. Mallick, Pradeep Kumar, Borah, Samarjeet, "Emerging Trends and Applications in Cognitive Computing", IGI Global Publishers, 2019.
4. Ron Sun, "The Cambridge Handbook of Computational Psychology", Cambridge University Press.
5. Hurwitz, Kaufman, and Bowles, "Cognitive Computing and Big Data Analytics", Wiley.

eLearning Resources:

Note: Number of hours allocated to units includes actual teaching hours, continuous internal assessment hours and experiential learning.

IT405A : Cloud Computing (Professional Elective-IV)

Teaching Scheme	Examination Scheme	
Lectures: 3 Hrs./Week	**Continuous Assessment:**	**20 Marks**
	In – Sem Exam:	**30 Marks**
	End-Sem Exam:	**50 Marks**
Credits: 3	**Total:**	**100 Marks**
Prerequisite Course: Digital Electronics & Computer Organization		

Course Objectives

1. To understand the fundamental of Cloud Computing.
2. To gain the knowledge of Cloud IaaS Service.
3. To gain the knowledge of Cloud PaaS Service.
4. To gain the knowledge of Cloud SLA Management.
5. To gain the knowledge of Cloud Security.
6. To introduce the challenges of Cloud which motivates the students towards research.

Course Outcomes (COs):

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

Course Outcome (s)		Bloom's Taxonomy	
		Level	Descriptor
CO1	Understand the need of cloud computing.	2	Understand
CO2	Understand the importance of IaaS service of Cloud computing.	2	Understand
CO3	Understand PaaS service of Cloud computing.	2	Understand
CO4	Understand the role of SLA in cloud computing.	2	Understand
CO5	Understand Cloud Security.	2	Understand
CO6	Understand the issues and challenges of cloud computing which will lead students towards research platform.	2	Understand

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	1	2	0	1	3	2	0	1	1	3	2	1
CO2	3	2	3	1	2	0	1	3	2	0	1	1	3	2	1
CO3	3	2	3	1	2	-	1	3	2	0	1	1	3	2	1
CO4	3	2	3	1	2	-	1	3	2	0	1	1	3	2	1
CO5	3	2	3	1	2	-	1	3	2	0	1	1	3	2	1
CO6	3	2	3	1	2	-	1	3	2	0	1	1	3	2	1

Course Contents			
Unit-I	**INTRODUCTION TO CLOUD COMPUTING**	**No. of Hours**	**COs**
	Cloud Computing in a Nutshell, Roots of Cloud Computing, Layers and Types of Clouds, Desired Features of a Cloud, Cloud Infrastructure Management, Infrastructure as a Service Providers, Platform as a Service Providers, Challenges and Risks.	8	CO1
Unit-II	**INFRASTRUCTURE AS A SERVICE (IAAS)**	**No. of Hours**	**COs**
	Introduction and Inspiration, Background and Related Work, Virtual Machines Provisioning and Manageability, Virtual Machine (VM) Migration Services, VM Provisioning and Migration in Action, Provisioning in the Cloud Context, Future Research Directions.	7	CO2
Unit-III	**PLATFORM AS A SERVICE (PAAS)**	**No. Of Hours**	**COs**
	Introduction, Technologies and Tools for Cloud Computing, Aneka Cloud Platform, Aneka Resource Provisioning Service, Hybrid Cloud Implementation, Visionary thoughts for Practitioners.	8	CO3
Unit-IV	**SLA MANAGEMENT IN CLOUD COMPUTING**	**No. of Hours**	**COs**
	Inspiration, Traditional Approaches to SLO Management, Types of SLA, Life Cycle of SLA, SLA Management in Cloud, Automated Policy-based Management.	7	CO4
Unit-V	**SECURITY IN CLOUD COMPUTING**	**No. of Hours**	**COs**
	Introduction Cloud in Information Technology, Cloud General Challenges Security Aspects, Data Security, Data Center Security, Access Control, Encryption and Decryption Virtualization Security, Network Security- Platform-Related Security, Security Issues in Cloud Service Models, Software-as-a-Service Security, Platform-as-a-Service Security Issues, Infrastructure-as-a-Service Security Issues Audit and Compliance, Disaster Recovery, Privacy and Integrity.	8	CO5
Unit-VI	**CHALLENGES AND ISSUES IN CLOUD COMPUTING**	**No. of Hours**	**COs**
	Cloud Computing Challenges: Security Policy Implementation, Virtualization Security Management, Virtual Threats, VM Security Recommendations, VM-Specific Security Techniques, Cloud Computing Scheduling Challenges, Cloud Computing SLA Challenges, Cloud Computing power management challenges.	7	CO6

Text Books:

1. Prof. K. Chandrashekharan, "Essentials of Cloud Computing", CRC Press, Taylor & Francis Group.
2. Rajkumar Buyya, James Broberg, AndrzejGoscinski, "Cloud Computing: Principles and Paradigms", Wiley India, ISBN: 9788126541256.
3. Jack J. Dongarra, Kai Hwang, Geoffrey C. Fox, "Distributed and Cloud Computing: From Parallel Processing to the Internet of Things", Elsevier, ISBN :9789381269237, 9381269238, 1st Edition.
4. Thomas Erl, ZaighamMahmood and Ricardo Puttini, "Cloud Computing: Concepts, Technology & Architecture", Pearson, ISBN :978 9332535923, 9332535922, 1 st Edition.

Reference Books:

eLearning Resources:

Note: Number of hours allocated to units includes actual teaching hours, continuous internal assessment hours and experiential learning.

IT405B : Ubiquitous Computing (Professional Elective –IV)

Teaching Scheme	Examination Scheme	
Lectures: 3 Hrs./Week	**Continuous Assessment:**	**20 Marks**
	In – Sem Exam:	**30 Marks**
	End-Sem Exam:	**50 Marks**
Credits: 3	**Total:**	**100 Marks**

Prerequisite Course: Basic knowledge of Data Science, Data Analytics, Engineering Physics.

Course Objectives

1. To describe ubiquitous computing, its properties applications and architectural design.
2. To explain various smart devices and services used in ubiquitous computing.
3. To teach the role of sensors and actuators in designing real time applications using Ubicomp.
4. To explore the concept of human computer interaction in the context of Ubicomp.
5. To explain Ubicomp privacy and challenges to privacy.
6. To describe Ubicomp network with design issues and Ubicomp management.

Course Outcomes (COs):

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

Course Outcome (s)		Bloom's Taxonomy	
		Level	Descriptor
CO1	Understand the basics of ubiquitous computing.	2	Understand
CO2	Understand the applications of ubiquitous computing.	2	Understand
CO3	Understand the smart devices and services ubiquitous computing.	2	Understand
CO4	Understand the Human-computer interaction.	2	Understand
CO5	Understand the context aware system.	2	Understand
CO6	Understand the intelligent system.	2	Understand

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	-	1	1	0	-	-	-	0	-	1	3	1	1
CO2	-	-	-	1	3	1	-	-	-	0	-	1	2	1	1
CO3	2	1	2	1	2	-	-	-	-	0	-	3	2	1	1
CO4	-	2	-		2	2	-	-	2	1		3	2	1	1
CO5	-	-	-	3	-	-	-	0	-	0	2	2	1	1	1
CO6	2	1	-	3	2	-	-	0	-	0	-	2	1	1	1

Course Contents			
Unit-I	**UBIQUITOUS COMPUTING: BASICS AND VISION**	**No. of Hours**	**COs**
	Living in a Digital World, Modelling the Key Ubiquitous Computing Properties, Architectural Design for UbiCom Systems: Smart DEI Model.	8	CO1
Unit-II	**UBIQUITOUS COMPUTING: APPLICATIONS AND RESEARCH**	**No. of Hours**	**COs**
	Early UbiCom Research Projects- Smart Devices: CCI, Smart Environments, Smart Devices: iHCI and HPI ,Applications in the Virtual, Human and Physical World, Human to Human Interaction (HHI) Applications, Human Physical World Computer Interaction (HPI) and (CPI).	7	CO2
Unit-III	**SMART DEVICES AND SERVICES**	**No. Of Hours**	**COs**
	Introduction, Service Architecture Models, Service Provision Life Cycle, Service Invocation, Virtual Machines and Operating Systems.	8	CO3
Unit-IV	**HUMAN–COMPUTER INTERACTION**	**No. of Hours**	**COs**
	Introduction, User Interfaces and Interaction for Four Widely Used Devices, Hidden UI Via Basic Smart Devices, Hidden UI Via Wearable and Implanted Devices, Human Centered Design (HCD), iHCI Design.	7	CO4
Unit-V	**CONTEXT-AWARE SYSTEMS**	**No. of Hours**	**COs**
	Introduction, Modelling Context Aware Systems, Mobility Awareness, Spatial Awareness, Temporal Awareness: Coordinating and Scheduling, ICT System Awareness.	8	CO5
Unit-VI	**INTELLIGENT SYSTEMS (IS)**	**No. of Hours**	**COs**
	Introduction, Basic Concepts, IS Architectures, Semantic KB IS, Classical Logic IS, Soft Computing IS Models,IS System Operations.	7	CO6

Text Books:

1. Stefan Poslad, "Ubiquitous Computing", Wiley, Student Edition, ISBN:9788126527335.
2. Frank Adelstein, Sandeep Gupta, Golden Richard III, Loren Schwiebert, “Fundamentals of Mobile and Pervasive Computing,” Tata McGraw Hills.

Reference Books:

1. Nina Godbole, “Information Systems Security”, Wiley India Pvt. Ltd, ISBN -978-81-265-1692-6.
2. Willaim Stallings, “Computer Security : Principles and Practices”, Pearson Ed. ISBN :978-81-317-3351-6.
3. Mark Merkow, “Information Security-Principles and Practices”, Pearson Ed. 978-81-317-1288-7.
4. CK Shyamala, et al., “Cryptography and Security”, Wiley India Pvt. Ltd, ISBN 978-81-265-2285-9.
5. Berouz Forouzan, “Cryptography and Network Security”, 2nd Edition, TMH, ISBN :9780070702080.

eLearning Resources:

1. Dr. Willian Cope, University of Illinois, Ubiquitous Learning and Instructional Technologies, - https://www.coursera.org/learn/ubiquitouslearning.

Note: Number of hours allocated to units includes actual teaching hours, continuous internal assessment hours and experiential learning.

IT405C : Business Intelligence (Professional Elective –IV)

Teaching Scheme	Examination Scheme	
Lectures: 3 Hrs./Week	**Continuous Assessment:**	**20 Marks**
	In – Sem Exam:	**30 Marks**
	End-Sem Exam:	**50 Marks**
Credits: 3	**Total:**	**100 Marks**
Prerequisite Course: Fundamentals of Database Management System and Data Mining.		

Course Objectives

1. To understand the need for data warehouse for large organizations.
2. To apply the data sources to populate data warehouse.
3. To study the Design of data warehouse models using appropriate schema.
4. To study the Design and Development of data warehouse for a domain using Data warehouse tools.
5. To understand process modelling and Analysis of Data to meet business objectives.
6. To apply data analysis techniques for building Decision support system.

Course Outcomes (COs):

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

Course Outcome (s)		Bloom's Taxonomy	
		Level	**Descriptor**
CO1	Understand the concept and process of Business Intelligence and Decision making.	2	Understand
CO2	Apply practice of the data science and how methodologies are applied to visualize information from raw data.	3	Apply
CO3	Understand and analyze BI concepts and techniques for Importance of data visualization.	2	Understand
CO4	Understand BI Techniques for various performance situations.	2	Understand
CO5	Understand the concept and process modelling and Analysis of Data.	2	Understand
CO6	Apply BI techniques involving predictive and statistical approach.	2	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

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

Course Contents			
Unit-I	**INTRODUCTION TO BUSINESS INTELLIGENCE**	**No. of Hours**	**COs**
	BI concept, BI architecture, BI in today's perspective, BI Process, Applications of BI like Financial analysis, statistical analysis, sales analysis. CRM, result pattern and ranking analysis, Balanced Scorecard, BI in Decision Modelling: Optimization, Decision making under uncertainty. Ethics and business intelligence.	8	CO1
Unit-II	**DATA SCIENCE**	**No. of Hours**	**COs**
	The concept, process and typical Tools in Data Science. Example of different Algorithms i.e Segmentation, Classification, Validation, Regressions, recommendations. Exercises using Excel and R to work on Histograms, Regression, Clustering and Text Analysis. Co-relation between Algorithm and Code in Data Science.	7	CO2
Unit-III	**DATA VISUALIZATION AND DASHBOARD DESIGN**	**No. Of Hours**	**COs**
	Responsibilities of BI analysts by focusing on creating data visualizations and dashboards. Importance of data visualization, types of basic and composite charts.	8	CO3
Unit-IV	**PERFORMANCE DASHBOARD**	**No. of Hours**	**COs**
	Measuring, Monitoring and management of Business, KPIs and dashboard, the types of dashboards, the common characteristics of Enterprise dashboard, design of enterprise dashboards, and the common pitfalls of dashboard design.	7	CO4
Unit-V	**MODELLING AND ANALYSIS**	**No. of Hours**	**COs**
	Exploring Excel Modeling capabilities to solve business problems, summarize and present selected data, introduction to business metrics and KPIs, creating cubes using Microsoft Excel.	8	CO5
Unit-VI	**POWER BI**	**No. of Hours**	**COs**
	Overview of Power BI, Sample Reports & Dashboards, Data set modes in the Power BI service, Data Sources, Power Query Editor, Data Shaping & Transformation, Detect Data Type, Replace Value, Transpose, Reverse Rows, First Row As Header, Split Column, Merge Column, Extract Date, Time, Duration.	7	CO6

Text Books:

1. Efraim Turban, Ramesh Sharda, Dursun Delen, "Decision Support and Business Intelligence Systems", 9th Edition, Pearson 201
2. "Business Intelligence – Grundlagen und praktische Anwendungen: Eine Einführung in die IT" by Hans-Georg Kemper and Henning Baars

Reference Books:

1. David Loshin Morgan, Kaufman, "Business Intelligence: The Savvy Manager"s Guide", Second Edition, 2012.
2. Larissa T. Moss, S. Atre, "Business Intelligence Roadmap: The Complete Project Lifecycle of Decision

Making", Addison Wesley, 2003
3. Carlo Vercellis, "Business Intelligence: Data Mining and Optimization for Decision Making", Wiley Publications, 2009.

eLearning Resources:

1. https://learn.microsoft.com/en-us/power-bi/
2. https://www.coursera.org/projects/power-bi-desktop

Note: Number of hours allocated to units includes actual teaching hours, continuous internal assessment hours and experiential learning.

IT8104 : Ethical Hacking & Digital Forensic Tools (Honors Specialization Course)		
Teaching Scheme	**Examination Scheme**	
Lectures: 3 Hrs./Week	**Continuous Assessment:**	**20 Marks**
	In – Sem Exam:	**30 Marks**
	End-Sem Exam:	**50 Marks**
Credits: 3	**Total:**	**100 Marks**
Prerequisite Course: Foundation for Cyber Security		

Course Objectives

1. To understand the basics of ethical hacking.
2. To analyze different Vulnerabilities in a web application and servers.
3. To explore the penetration testing skills
4. To implement Pentest tools.
5. To understand the basics of Incidence Response.
6. To understand various digital forensics techniques and its usage for the incident response.

Course Outcomes (COs):

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

Course Outcome (s)		Bloom's Taxonomy	
		Level	**Descriptor**
CO1	Understand the basics of ethical hacking.	2	Understand
CO2	Analyze different Vulnerabilities in a web application and servers.	4	Analyze
CO3	Explore the penetration testing skills.	2	Understand
CO4	Implement Pentest tools.	3	Apply
CO5	Understand the basics of Incidence Response.	2	Understand
CO6	Understand various digital forensics techniques and its usage for the incident response.	2	Understand

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	--	--	1	--	0	1	--	1	1	--	1	--	3	--
CO2	--	3	--	1	--	0	1	--	2	0	1	2	--	3	--
CO3	--	--	2	--	2	1	--	--	2	0	--	2	--	3	--
CO4	2	--	3	--	3	1	--	2	2	1	2	2	--	3	--
CO5	--	--	--	1	--	--	1	0	1	0	--	1	--	3	--
CO6	--	--	--	1	--	--	1	0	1	1	--	1	--	3	--

Course Contents			
Unit-I	**INTRODUCTION TO ETHICAL HACKING**	**No. of Hours**	**COs**
	Introduction to ethical hacking, Elements of information security, Essential Terminologies-Threat, Attack, Vulnerabilities, Target of Evaluation, Exploit. Phases involved in hacking, Foot printing, Reconnaissance, Scanning, Enumeration, System Hacking, Session Hijacking	8	CO1
Unit-II	**GAINING ACCESS**	**No. of Hours**	**COs**
	Dark web, Gathering information from networks, Wireless attacks, Post connection attacks, Attacks on user, Social Engineering, Social Media Security, External Network attack, Fake Game website attack, Hacker Methodology, Website Reconnaissance.	7	CO2
Unit-III	**PENETRATION TESTING**	**No. Of Hours**	**COs**
	Introduction to penetration Testing, Phases of Penetration Testing, Planning, Discovery, Attack, Discovery, Network pen testing, System pen testing, Post hacking session, website pen testing, Cross site scripting	8	CO3
Unit-IV	**SQL INJECTION**	**No. of Hours**	**COs**
	SQL 101, Vulnerability Test, Post Method SQLi, Get Method SQLi, Website pen testing tools- Sqlmap, Zap, Python for ethical Hacking setup, man in the middle, Packet Listener, Keylogger, Backdoor, Packaging & malicious files.	7	CO4
Unit-V	**INCIDENCE RESPONSE**	**No. of Hours**	**COs**
	Introduction, Investigation Preparation, Detection and analysis, Containment, Eradication & Recovery, Post Incident Activities.	8	CO5
Unit-VI	**DIGITAL FORENSICS**	**No. of Hours**	**COs**
	Digital Forensics, Types of investigations & tools, Trends, Challenges, Anti-forensics techniques, Data collection and examination, Analysis and reporting, Data acquisition	7	CO6

Text Books:

1. Patrick Engebretson,"The Basics of Hacking and Penetration Testing", Elsevier, 2013.
2. Thomas Mathew, EC-Council, "Ethical Hacking: Student Courseware" by International Council of Electronic Commerce Consultants, OSB publisher.
3. Jason Luttgens, Matthew Pepe, Kevin Mandia, "Incident Response & Computer Forensics", McGraw-Hill Osborne Media, 3rd edition, 2014.

Reference Books:

1. Keith J. Jones, Richard Bejtlich, Curtis W. Rose, "Real Digital Forensics: Computer Security and Incident Response", Paperback – Import, 2005.
2. John Sammons, "The Basics of Digital Forensics: The Primer for Getting Started in Digital Forensics", Paperback, February 24, 2012.
3. Michael T Simpson, Kent Backman, James Corley, "Hands on ethical hacking and network defense", Cengage Learning, 2 edition, 2010
4. Johnny Long, "NoTech Hacking : A Guide to Social Engineering, Dumpster Diving and Shoulder Surfing", Syngress publishers, 1st edition, 2008
5. https://www.edureka.co/blog/ethical-hacking-tutorial/

eLearning Resources:

1. https://www.udemy.com/course/the-complete-ethical-hacking-course/
2. https://www.udemy.com/course/fundamentals-of-computer-forensics/
3. https://www.coursera.org/learn/ibm-penetration-testing-incident-response-forensics#syllabus

Note: Number of hours allocated to units includes actual teaching hours, continuous internal assessment hours and experiential learning.

IT406 : Natural Language Processing & Machine Learning Laboratory

Teaching Scheme	Examination Scheme	
Lectures: 4 Hrs./Week	**Oral:**	**NA Marks**
	Practical:	**50 Marks**
	Term Work:	**NA Marks**
Credits: 1	**Total:**	**50 Marks**
Prerequisite Course: Python Programming Language		

Course Objectives

1. To perform data preprocessing and implement supervised, un-supervised Machine Learning algorithms in Python Programming Language.
2. To implement Clustering techniques, association rules and Deep Learning concept in Python Programming Language.
3. To understand and apply the fundamental concepts of natural language processing (NLP).
4. To apply different tools and techniques on textual data.

Course Outcomes (COs):

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

	Course Outcome (s)	Bloom's Taxonomy	
		Level	**Descriptor**
CO1	Perform data preprocessing, make use of Data sets and python library in implementing the Machine learning algorithms.	3	Apply
CO2	Implement Clustering techniques, association rules and Deep Learning concept in Python Programming Language.	3	Apply
CO3	Apply basic operations on textual data and text pre-processing.	3	Apply
CO4	To Apply different tools and techniques for text processing and information retrieval from textual data.	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	3	3	1	1	1	1	1	2	2	3	2	1
CO2	3	3	2	3	3	1	1	1	1	1	2	2	3	2	1
CO3	1	2	-	-	3	-	-	-	-	-	-	2	3	1	1
CO4	2	3	0	-	3	0	-	-	-	1	2	2	3	2	1

Course Contents

1. The faculty member should prepare the laboratory manual for all the experiments and it should be made available to students and laboratory instructor/Assistant.

2. All the assignments should be implemented using python programming language

3. Implement all assignments.

4. The instructor is expected to frame the assignments by understanding the prerequisites, technological aspects, utility and recent trends related to the topic.

5. The instructor may frame multiple sets of assignments and distribute them among batches of students.

6. All the assignments should be conducted on multicore hardware and 64-bit open-sources software.

Staff in-charge will suitably frame the assignments and flexibility may be incorporated. Students will submit term work in the form of journal. Each assignment has to be well documented with problem definition; code documented with comments.

Staff in-charge will assess the assignments continuously and grade or mark each assignment on completion date.All the assignments should be conducted in Python Language.

	List of Assignments	No. of Hours	COs
1.	Downloading the dataset and perform cleaning of data. Data Analysis & visualization-using NumPy, pandas matplotlib, SciPy.	2	CO1
2.	Write a program to implement a naïve Bayes classifier. The learned classifier should be tested on test instances and the accuracy of prediction for the test instances should be printed as output.	2	CO1
3.	Assignment based on simple linear regression on any dataset. Download the dataset https://www.kaggle.com/datasets/budincsevity/szeged-weather/download?datasetVersionNumber=1 a. Apply Linear Regression using suitable library function and predict apparent temperature given the humidity. b. Assess the performance of regression models using MSE, MAE and R-Square metrics. c. Visualize simple regression model.	2	CO1
4.	Assignment based on Random Forest Classifier using ensemble technique on any dataset. Download the car evaluation dataset. https://www.kaggle.com/datasets/elikplim/car-evaluation-data-set/download?datasetVersionNumber=1 Implement the Random Forest Classifier models to predict the safety of the car, one with 10 decision-trees and another one with 100 decision-trees. Print the accuracy for number of decision-trees in the model. demonstrate the feature selection process using the Random Forest model to find only the important features, rebuild the model using these features and print its effect on accuracy.	2	CO1
5.	Assignment based on K-means Clustering Algorithm on Mall Customer Segmentation. Download the Mall Customer Segmentation dataset. https://www.kaggle.com/datasets/krishnaraj30/mall-visiting-customer-data,	2	CO2

6.	Assignment based on Association rules and Apriori Algorithm Download Market Basket Analysis dataset from below link. https://www.kaggle.com/datasets/ahmtcnbs/datasets-for-appiori.	2	CO2
7.	Assignment based on Deep Learning Implement Convolutional Neural Network (CNN) for Image Classification. Download the Image dataset and Evaluate the model with Accuracy.	2	CO2
8.	Text Pre-processing using NLP operations: perform Tokenization, Lemmitization, Stemming, Stop word removal, Punctuation removal, using SpaCy or NLTK library, Input- use any sample text input file.	2	CO3
9.	Perform bag-of-words approach tf-idf on data. Create embedding using Word2Vec using Gensim or any other python library.	2	CO3
10.	Implement Named Entity Recognition(NER) on textual data using SpaCy library for "English" language.	2	CO3
11.	Implement Bi-gram, Tri-gram word sequence and its count in text inputs or twitter data using NLTK library.	2	CO4
12.	Implement regular expression function to find URL, IP address, Date, PAN number in textual data using python libraries.	2	CO4
13.	Implement and visualize Dependency Parsing of Textual Input using Stanford CoreNLP and Spacy library.	2	CO4
14.			

Text Books:

1. Andreas C. Müller, Sarah Guido, "Introduction to Machine Learning with Python",Released October 2016, O'Reilly Media, Inc. ISBN: 9781449369415.
2. Manaranjan Pradhan and U Dinesh Kumar, "Machine Learning using Python" Wiley ISBN-13. 978-8126579907.

Reference Books:

1. Ethem Alpaydin, Introduction to Machine Learning, PHI 4th Edition-2020 ,The MIT Press,ISBN:9780262043793.
2. Peter Flach, "Machine Learning The Art and Science of Algorithms that Make Sense of Data",
3. Cambridge University Press India.ISBN 13: 9781107422223.
4. Steven Bird, Ewan Klein, Edward Loper, "Natural Language Processing with Python – Analyzing Text with the Natural Language Toolkit", O'Reilly Publication.
5. Jacob Eisenstein, "Natural Language Processing", MIT Press.
6. Alexander Clark, Chris Fox, and Shalom Lappin, "The Handbook of Computational Linguistics and Natural Language Processing", Wiley Blackwell Publications.

eLearning Resources:

IT 407 : Distributed System Laboratory

Teaching Scheme	Examination Scheme	
Lectures: 2 Hrs./Week	**Oral:**	**50 Marks**
	Practical:	**NA Marks**
	Term Work:	**NA Marks**
Credits: 1	**Total:**	**50 Marks**

Prerequisite Course: System Programming & Operating Systems ,Computer Network

Course Objectives

1. The course aims to provide an understanding of the principles on which the distributed systems are based, their architecture, algorithms and how they meet the demands of Distributed applications.
2. The course covers the building blocks for a study related to the design and the implementation of distributed systems and applications.
4.

Course Outcomes (COs):

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

Course Outcome (s)		Bloom's Taxonomy	
		Level	**Descriptor**
CO1	Demonstrate knowledge of the core concepts and techniques in distributed systems.	3	Apply
CO2	Learn how to apply principles of state-of-the-Art Distributed systems in practical application.	2	Understand
CO3	Design, build and test application programs on distributed systems.	3	Apply
CO4			

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

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

Course Contents

The laboratory assignments are to be submitted by students in the form of journals. The Journal consists of prologue, Certificate, table of contents, and handwritten/ printed write-up of each assignment (Title, Objectives, Problem Statement, Outcomes, Software & Hardware requirements, Date of Completion, Assessment grade/marks and assessor's sign, Theory-Concept, algorithms, printouts of the code written using coding standards, sample test cases etc.).

Oral Examination will be based on the term work.

Candidate is expected to know the theory involved in the experiment.The Oral examination should be conducted if the journal of the candidate is completed in all respects and certified by concerned faculty and head of the department.

Examiners will assess the term work based on performance of students considering the parameters such as timely conduction of practical assignment, methodology adopted for implementation of practical assignment, timely submission of assignment in the form of handwritten/printed write-up along with results of implemented assignment, attendance etc.

Examiners will judge the understanding of the practical performed in the examination by asking some questions.

	List of Assignments	No. of Hours	COs
1.	Input- use any sample text input file.	2	CO1
2.	Develop any distributed application using CORBA to demonstrate object brokering. (Calculator or String operations).	2	CO2
3.	Develop a distributed system, to find sum of N elements in an array by distributing N/n elements to n number of processors MPI or OpenMP. Demonstrate by displaying the intermediate sums calculated at different processors.	2	CO2
4.	Implement Berkeley algorithm for clock synchronization.	2	CO2
5.	Implement Bully and Ring algorithm for leader election,	2	CO2
6.	To develop any distributed application using Messaging System in Publish-Subscribe paradigm.	4	CO3
7.	Create a simple web service and write any distributed application to consume the web service.	4	CO3
8.	Mini Project (In group): A Distributed Application for Interactive Multiplayer Games.	4	CO3
9.			
10.			
11.			
12.			
13.			
14.			

Text Books:

Reference Books:

1. Distributed Systems –Concept and Design, George Coulouris, Jean Dollimore, Tim Kindberg& Gordon Blair,Pearson,5th Edition,ISBN:978-13-214301-1.
2. Distributed Algorithms,Nancy Ann Lynch, Morgan Kaufmann Publishers, illustrated, reprint, ISBN: 9781558603486.
3. Java Network Programming & Distributed Computing by David Reilly, Michael Reilly.
4. John Cheng,MaxGrossman, and yMcKercher, Professional CUDA CProgramming, John Wiley & Sons,

Inc, ISBN: 978-1-118-73932-7.
eLearning Resources:

IT408 : Project Stage-I

Teaching Scheme	Examination Scheme	
Lectures: 6 Hrs./Week	**Oral:**	**50 Marks**
	Practical:	**NA Marks**
	Term Work:	**100 Marks**
Credits: 3	**Total:**	**50 Marks**

Prerequisite Course: Mini-Project, Seminar, Skill based Course, Software Engineering Modeling & Design.

Course Objectives

1. To identify problem and formulate a problem statement.
2. To analyze a problem using requirement analysis.
3. To design a software model for proposed system.

Course Outcomes (COs):

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

	Course Outcome (s)	Bloom's Taxonomy	
		Level	**Descriptor**
CO1	Analyze problem to get software requirement specifications.	4	Analyze
CO2	Design software model for proposed system.	3	Apply
CO3	Develop the software as per the SRS and associated Design.	6	Create
CO4			

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	3	3	3	3	0	-	-	3	3	3	2	1	2	3
CO2	1	3	3	3	3	-	-	-	3	3	3	2	1	2	3
CO3	1	3	3	3	3	-	-	-	3	3	3	2	1	2	3
CO4															

Course Contents
1.The Head of the department/Project coordinator shall constitute a review committee for project group; project guide would be one member of that committee by default. 2.There shall be two reviews in Project phase –I in semester-I by the review committee. 3.The Project Review committee will be responsible for evaluating the timely progress of the projects. 4.Student should identify Project of enough complexity, which has at least 4-5 major functionalities. 5.The project should be based on the latest research work published in standard research journals/conferences. 6.Student should identify stakeholders and write detail problem statement for system. 7.Review committee should finalize the scope of the project. 8.If change in project topic is unavoidable then the students should complete the process of Project approval by submitting synopsis along with the review of important papers. This new Project topic should be approved by review committee. 9.Every project group shall maintain a project log-book. 10.The students or project group shall make presentation on the progress made by them before the committee. 11.The record of the remarks/suggestions of the review committee should be properly maintained and should be made available at the time of examination. 12.Each student/group is required to give presentation as part of review for 10 to 15 minutes followed by a detailed discussion.

	List of Assignments	No. of Hours	COs
1.	Review I: Literature review and problem identification 1.Literature Survey 2.The precise problem statement/title based on literature survey and feasibility study. 3.Purpose, objectives and scope of the project. 4.List of required tools or equipment for implementing the project, test Environment, cost and human efforts in hours. 5.System overview- proposed system and proposed outcomes. 6.Architecture and initial phase of design using suitable design tools.	24	CO1
2.	Review II: Requirement Analysis & System Design: 1. Requirement Analysis. 2. Detailed architecture (Algorithms/ Techniques/ Methodology). 3. System design(UML Diagrams).	24	CO2
3.	Review III: Implementation: 1. 80% Implementation.	24	CO3
4.			
5.			
6.			
7.			
8.			
9.			

10.			
11.			
12.			
13.			
14.			
Text Books:			
Reference Books:			
eLearning Resources:			

MC409 : Finance related course proposed by Financial Smart (Mandatory Course - VII)	
Teaching Scheme	**Examination Scheme**
Lectures: 1 Hrs./Week	**Oral: NA Marks**
	Practical: NA Marks
	Term Work: NA Marks
Credits: 0	**Total: 50 Marks**
Prerequisite Course:	

Course Objectives

Course Outcomes (COs):

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

Course Outcome (s)		Bloom's Taxonomy	
		Level	Descriptor
CO1			
CO2			
CO3			
CO4			

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1															
CO2															
CO3															
CO4															

Course Contents			
Finance related course proposed by Financial Smart			
	List of Assignments	**No. of Hours**	**COs**
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
13.			
14.			
Text Books:			
Reference Books:			
eLearning Resources:			

IT8105 : Ethical Hacking & Digital Forensic Tools Lab (Honors Specialization Course).	
Teaching Scheme	**Examination Scheme**
Lectures: 1 Hrs./Week	**Oral: NA Marks**
	Practical: NA Marks
	Term Work: NA Marks
Credits: 0	**Total: 50 Marks**
Prerequisite Course: Ethical Hacking & Digital Forensic Tools	

Course Objectives

1. To install different softwares and set up OS for ethical hacking practicals.
2. To analyze different Vulnerabilities in a web application and networks.
3. To implementsecurity and hacking tools with Python.
4. To implement SQL injection to find Vulnerabilities.

Course Outcomes (COs):

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

Course Outcome (s)		Bloom's Taxonomy	
		Level	**Descriptor**
CO1	Install different softwares and set up OS for ethical hacking practicals.	3	Apply
CO2	Analyze different Vulnerabilities in a web application and networks.	4	Analyze
CO3	Implementsecurity and hacking tools with Python.	3	Apply
CO4	Implement SQL injection to find Vulnerabilities.	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

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

Course Contents

Guidelines: This Object Oriented Programming Laboratory course has Object Oriented Programming as a core subject. The problem statements should be framed based on mentioned assignments in the syllabus for conduction of practical examination.

The teacher will frame the problem statements with due consideration that students have three hours to complete that. The practical examination will comprise of implementation and related theory. All assignments are to be performed in C++ Language.

Term Work: Staff in-charge will suitably frame the above assignments and flexibility may be incorporated. Students will submit term work in the form of journal. Each assignment has to be well documented with problem definition, code documented with comments.

Staff in-charge will assess the assignments continuously and grade or mark each assignment on completion date. All the assignments should be conducted in C++ Language.

	List of Assignments	No. of Hours	COs
1.	Assignment on installation of virtual box	2	CO1
2.	Assignment on installation of Kali Linux	2	CO1
3.	Assignment on Dark Web	2	CO2
4.	Assignment on Network pentesting	2	CO2
5.	Assignment on SQL injection	2	CO4
6.	Assignment on setup of python for ethical hacking	2	CO3
7.	Assignment on keylogger	2	CO6
8.	Assignment on Backdoor	2	CO6
9.	Case study on Incidence Response	2	CO5
10.			
11.			
12.			
13.			
14.			

Text Books:

1. Patrick Engebretson,"The Basics of Hacking and Penetration Testing", Elsevier, 2013.
2. Thomas Mathew, EC-Council, "Ethical Hacking: Student Courseware" by International Council of Electronic Commerce Consultants, OSB publisher
3. Jason Luttgens, Matthew Pepe, Kevin Mandia, "Incident Response & Computer Forensics", McGraw-Hill Osborne Media, 3rd edition, 2014.

Reference Books:

1. Michael T Simpson, Kent Backman, James Corley, "Hands on ethical hacking and network defense", Cengage Learning, 2 edition, 2010.
2. https://www.edureka.co/blog/ethical-hacking-tutorial/

eLearning Resources:

1. https://www.udemy.com/course/the-complete-ethical-hacking-course/
2. https://www.udemy.com/course/fundamentals-of-computer-forensics/
3. https://www.coursera.org/learn/ibm-penetration-testing-incident-response-forensics#syllabus

IT410OE1 : Product and Brand Management

Teaching Scheme	Examination Scheme	
Lectures: 3 Hrs./Week	**Continuous Assessment:**	**0 Marks**
	In – Sem Exam:	**50 Marks**
	End-Sem Exam:	**50 Marks**
Credits: 3	**Total:**	**100 Marks**
Prerequisite Course: Basic understanding of Fundamentals of Marketing will be beneficial.		

Course Objectives

1. To learn Marketing and Branding, Executives and Administrators.

Course Outcomes (COs):

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

Course Outcome (s)		Bloom's Taxonomy	
		Level	Descriptor
CO1			
CO2			
CO3			
CO4			
CO5			
CO6			

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

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

Course Contents			
Unit-I		**No. of Hours**	**COs**
Unit-II		**No. of Hours**	**COs**
Unit-III		**No. Of Hours**	**COs**
Unit-IV		**No. of Hours**	**COs**
Unit-V		**No. of Hours**	**COs**
Unit-VI		**No. of Hours**	**COs**
Text Books:			
Reference Books:			
eLearning Resources:			
1. https://onlinecourses.nptel.ac.in/noc22_mg82/preview			

Note: Number of hours allocated to units includes actual teaching hours, continuous internal assessment hours and experiential learning.

IT410OE2 : Organizational Behaviour

Teaching Scheme	Examination Scheme	
Lectures: 3 Hrs./Week	**Continuous Assessment:**	**0 Marks**
	In – Sem Exam:	**50 Marks**
	End-Sem Exam:	**50 Marks**
Credits: 3	**Total:**	**100 Marks**
Prerequisite Course: Basic knowledge of Organizational Behaviour.		

Course Objectives

1. To help students to be cognizant of their work place, so that they make conscious decisions in their future work life as well as long term career.

Course Outcomes (COs):

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

	Course Outcome (s)	Bloom's Taxonomy	
		Level	**Descriptor**
CO1			
CO2			
CO3			
CO4			
CO5			
CO6			

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

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

Course Contents			
Unit-I		**No. of Hours**	**COs**
Unit-II		**No. of Hours**	**COs**
Unit-III		**No. Of Hours**	**COs**
Unit-IV		**No. of Hours**	**COs**
Unit-V		**No. of Hours**	**COs**
Unit-VI		**No. of Hours**	**COs**

Text Books:

1. "Behaviour in Organizations", Jerald Greenberg and Robert A. Baron, PHI learning private Ltd, New Delhi (Ninth Edition).
2. Understanding Organizational Behaviour by Udai Pareek, Oxford University Press (Third Edition)
3. ORGB by Nelson, Quick and Khandelwal , Cengage Learning New Delhi (second edition).

Reference Books:

eLearning Resources:

1. https://onlinecourses.nptel.ac.in/noc20_mg51/preview

Note: Number of hours allocated to units includes actual teaching hours, continuous internal assessment hours and experiential learning.

IT410OE3 : E-Business

Teaching Scheme	Examination Scheme	
Lectures: 3 Hrs./Week	**Continuous Assessment:**	**0 Marks**
	In – Sem Exam:	**50 Marks**
	End-Sem Exam:	**50 Marks**
Credits: 3	**Total:**	**100 Marks**

Prerequisite Course: Basic knowledge of computer and internet.

Course Objectives

1. To help the students to develop skills to manage businesses in the digital world.

Course Outcomes (COs):

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

Course Outcome (s)		Bloom's Taxonomy	
		Level	**Descriptor**
CO1			
CO2			
CO3			
CO4			
CO5			
CO6			

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

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

Course Contents			
Unit-I		**No. of Hours**	**COs**
Unit-II		**No. of Hours**	**COs**
Unit-III		**No. Of Hours**	**COs**
Unit-IV		**No. of Hours**	**COs**
Unit-V		**No. of Hours**	**COs**
Unit-VI		**No. of Hours**	**COs**
Text Books:			
1. Management Information Systems: Managing the Digital Firm, Laudon and Laudon, Pearson 2. Scaling for E-Business, Menasce & Almeida, PHI			
Reference Books:			
eLearning Resources:			
1. https://onlinecourses.nptel.ac.in/noc19_mg54/preview			

Note: Number of hours allocated to units includes actual teaching hours, continuous internal assessment hours and experiential learning.

IT410OE4 : Management Information System

Teaching Scheme	Examination Scheme	
Lectures: 3 Hrs./Week	**Continuous Assessment:**	**0 Marks**
	In – Sem Exam:	**50 Marks**
	End-Sem Exam:	**50 Marks**
Credits: 3	**Total:**	**100 Marks**

Prerequisite Course: Basic understanding of Fundamentals of Management Information System.

Course Objectives

1. To understand existing and upcoming technologies, wide variety of their applications for business and e-Commerce, and issues involved in their management.

Course Outcomes (COs):

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

	Course Outcome (s)	Bloom's Taxonomy	
		Level	**Descriptor**
CO1			
CO2			
CO3			
CO4			
CO5			
CO6			

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

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

Course Contents			
Unit-I		**No. of Hours**	**COs**
	Course contents will be as per the corresponding NPTEL Course available on the NPTEL portal.		
Unit-II		**No. of Hours**	**COs**
Unit-III		**No. Of Hours**	**COs**
Unit-IV		**No. of Hours**	**COs**
Unit-V		**No. of Hours**	**COs**
Unit-VI		**No. of Hours**	**COs**
Text Books:			
1. Kenneth C. Laudon & Jane P. Laudon. "Management Information Systems". Pearson Publishing.			
Reference Books:			
eLearning Resources:			
1. https://onlinecourses.nptel.ac.in/noc20_mg60/preview			

Note: Number of hours allocated to units includes actual teaching hours, continuous internal assessment hours and experiential learning.

IT411OE1 : Design & Implementation of Human-Computer Interfaces

Teaching Scheme	Examination Scheme	
Lectures: 3 Hrs./Week	**Continuous Assessment:**	**0 Marks**
	In – Sem Exam:	**50 Marks**
	End-Sem Exam:	**50 Marks**
Credits: 3	**Total:**	**100 Marks**

Prerequisite Course: Knowledge of data structures, algorithms, and programming desirable.

Course Objectives

1. To introduced to the human-computer interfaces, concept of usability and its engineering.

Course Outcomes (COs):

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

	Course Outcome (s)	Bloom's Taxonomy	
		Level	Descriptor
CO1			
CO2			
CO3			
CO4			
CO5			
CO6			

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

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

Course Contents			
Unit-I		**No. of Hours**	**COs**
	Course contents will be as per the corresponding NPTEL Course available on the NPTEL portal.		
Unit-II		**No. of Hours**	**COs**
Unit-III		**No. Of Hours**	**COs**
Unit-IV		**No. of Hours**	**COs**
Unit-V		**No. of Hours**	**COs**
Unit-VI		**No. of Hours**	**COs**

Text Books:

1. Samit Bhattacharya. (2019). Human-Computer Interaction: User-Centric Computing for Design, McGraw Hill Education (1st ed).
2. Bruce R Maxim & Roger S Pressman (2019). Software Engineering: A Practitioner's Approach. (8th ed). McGraw Hill Education.

Reference Books:

eLearning Resources:

1. https://onlinecourses.nptel.ac.in/noc22_cs125/preview

Note: Number of hours allocated to units includes actual teaching hours, continuous internal assessment hours and experiential learning.

IT411OE2 : Ethical Hacking

Teaching Scheme	Examination Scheme	
Lectures: 3 Hrs./Week	**Continuous Assessment:**	**0 Marks**
	In – Sem Exam:	**50 Marks**
	End-Sem Exam:	**50 Marks**
Credits: 3	**Total:**	**100 Marks**

Prerequisite Course: Basic concepts in programming and networking.

Course Objectives

1. To understand the basic topics like networking, network security and cryptography, and vulnerabilities and ways to secure them.

Course Outcomes (COs):

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

	Course Outcome (s)	Bloom's Taxonomy	
		Level	**Descriptor**
CO1			
CO2			
CO3			
CO4			
CO5			
CO6			

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

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

Course Contents			
Unit-I		**No. of Hours**	**COs**
	Course contents will be as per the corresponding NPTEL Course available on the NPTEL portal.		
Unit-II		**No. of Hours**	**COs**
Unit-III		**No. Of Hours**	**COs**
Unit-IV		**No. of Hours**	**COs**
Unit-V		**No. of Hours**	**COs**
Unit-VI		**No. of Hours**	**COs**
Text Books:			
1. Data and Computer Communications -- W. Stallings. 2. Data Communication and Networking -- B. A. Forouzan			
Reference Books:			
eLearning Resources:			
1. https://onlinecourses.nptel.ac.in/noc22_cs13/preview			

Note: Number of hours allocated to units includes actual teaching hours, continuous internal assessment hours and experiential learning.

IT411OE3 : Introduction to Industry 4.0 And Industrial Internet of Things

Teaching Scheme	Examination Scheme	
Lectures: 3 Hrs./Week	**Continuous Assessment:**	**0 Marks**
	In – Sem Exam:	**50 Marks**
	End-Sem Exam:	**50 Marks**
Credits: 3	**Total:**	**100 Marks**

Prerequisite Course: Basic knowledge of computer and internet.

Course Objectives

1. To undrestand the Industry 4.0 concerns the transformation of industrial processes through the integration of modern technologies such as sensors, communication, and computational processing.

Course Outcomes (COs):

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

Course Outcome (s)		Bloom's Taxonomy	
		Level	Descriptor
CO1			
CO2			
CO3			
CO4			
CO5			
CO6			

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

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

Course Contents			
Unit-I		**No. of Hours**	**COs**
	Course contents will be as per the corresponding NPTEL Course available on the NPTEL portal.		
Unit-II		**No. of Hours**	**COs**
Unit-III		**No. Of Hours**	**COs**
Unit-IV		**No. of Hours**	**COs**
Unit-V		**No. of Hours**	**COs**
Unit-VI		**No. of Hours**	**COs**

Text Books:

1. Industry 4.0: The Industrial Internet of Things, by Alasdair Gilchrist (Apress)
2. Industrial Internet of Things: Cybermanufacturing Systems by Sabina Jeschke, Christian Brecher, Houbing Song, Danda B. Rawat

Reference Books:

eLearning Resources:

1. https://onlinecourses.nptel.ac.in/noc20_cs69/preview

Note: Number of hours allocated to units includes actual teaching hours, continuous internal assessment hours and experiential learning.

IT411OE4 : Deep Learning - IIT Ropar

Teaching Scheme	Examination Scheme	
Lectures: 3 Hrs./Week	**Continuous Assessment:**	**0 Marks**
	In – Sem Exam:	**50 Marks**
	End-Sem Exam:	**50 Marks**
Credits: 3	**Total:**	**100 Marks**

Prerequisite Course: Basic knowledge of Machine Learning.

Course Objectives

1. To understand Deep Learning.

Course Outcomes (COs):

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

Course Outcome (s)		Bloom's Taxonomy	
		Level	Descriptor
CO1			
CO2			
CO3			
CO4			
CO5			
CO6			

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

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

Course Contents			
Unit-I		**No. of Hours**	**COs**
	Course contents will be as per the corresponding NPTEL Course available on the NPTEL portal.		
Unit-II		**No. of Hours**	**COs**
Unit-III		**No. Of Hours**	**COs**
Unit-IV		**No. of Hours**	**COs**
Unit-V		**No. of Hours**	**COs**
Unit-VI		**No. of Hours**	**COs**
Text Books:			
Reference Books:			
eLearning Resources:			
1. https://onlinecourses.nptel.ac.in/noc24_cs59/preview			

Note: Number of hours allocated to units includes actual teaching hours, continuous internal assessment hours and experiential learning.

IT412OE1 : Introduction to Haskell Programming

Teaching Scheme	Examination Scheme	
Lectures: 2 Hrs./Week	**Continuous Assessment:**	**0 Marks**
	In – Sem Exam:	**50 Marks**
	End-Sem Exam:	**50 Marks**
Credits: 2	**Total:**	**100 Marks**
Prerequisite Course: Basic concepts in programming.		

Course Objectives

1. To understand Haskell programming.

Course Outcomes (COs):

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

Course Outcome (s)		Bloom's Taxonomy	
		Level	**Descriptor**
CO1			
CO2			
CO3			
CO4			
CO5			
CO6			

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

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

Course Contents			
Unit-I		**No. of Hours**	**COs**
	Course contents will be as per the corresponding NPTEL Course available on the NPTEL portal.		
Unit-II		**No. of Hours**	**COs**
Unit-III		**No. Of Hours**	**COs**
Unit-IV		**No. of Hours**	**COs**
Unit-V		**No. of Hours**	**COs**
Unit-VI		**No. of Hours**	**COs**
Text Books:			
Reference Books:			
eLearning Resources:			
1. https://onlinecourses.nptel.ac.in/noc19_cs80/preview			

Note: Number of hours allocated to units includes actual teaching hours, continuous internal assessment hours and experiential learning.

IT412OE2 : Computer Graphics

Teaching Scheme	Examination Scheme	
Lectures: 2 Hrs./Week	**Continuous Assessment:**	**0 Marks**
	In – Sem Exam:	**50 Marks**
	End-Sem Exam:	**50 Marks**
Credits: 2	**Total:**	**100 Marks**

Prerequisite Course: Knowledge of data structures and algorithm is preferable.

Course Objectives

1. To understand the present day graphics hardware (I/O devices, GPU) and the widely popular openGL graphics library.

Course Outcomes (COs):

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

	Course Outcome (s)	Bloom's Taxonomy	
		Level	**Descriptor**
CO1			
CO2			
CO3			
CO4			
CO5			
CO6			

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

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

Course Contents			
Unit-I		**No. of Hours**	**COs**
	Course contents will be as per the corresponding NPTEL Course available on the NPTEL portal.		
Unit-II		**No. of Hours**	**COs**
Unit-III		**No. Of Hours**	**COs**
Unit-IV		**No. of Hours**	**COs**
Unit-V		**No. of Hours**	**COs**
Unit-VI		**No. of Hours**	**COs**

Text Books:

1. Samit Bhattacharya. (2015). Computer Graphics. Oxford University Press.
2. Hearn, D. & Baker, M. P. (2003). Computer Graphics with OpenGL, (3rd ed), Pearson.

Reference Books:

eLearning Resources:

1. https://onlinecourses.nptel.ac.in/noc20_cs90/preview

Note: Number of hours allocated to units includes actual teaching hours, continuous internal assessment hours and experiential learning.

IT412OE3 : Google Cloud Computing Foundations

Teaching Scheme	Examination Scheme	
Lectures: 2 Hrs./Week	**Continuous Assessment:**	**0 Marks**
	In – Sem Exam:	**50 Marks**
	End-Sem Exam:	**50 Marks**
Credits: 2	**Total:**	**100 Marks**

Prerequisite Course: Have basic IT knowledge and be interested in learning more about Cloud and ML.

Course Objectives

1. To understand Google Cloud Computing Foundations.

Course Outcomes (COs):

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

Course Outcome (s)		Bloom's Taxonomy	
		Level	**Descriptor**
CO1			
CO2			
CO3			
CO4			
CO5			
CO6			

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

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

Course Contents			
Unit-I		**No. of Hours**	**COs**
	Course contents will be as per the corresponding NPTEL Course available on the NPTEL portal.		
Unit-II		**No. of Hours**	**COs**
Unit-III		**No. Of Hours**	**COs**
Unit-IV		**No. of Hours**	**COs**
Unit-V		**No. of Hours**	**COs**
Unit-VI		**No. of Hours**	**COs**
Text Books:			
Reference Books:			
eLearning Resources:			
1. https://onlinecourses.nptel.ac.in/noc24_cs09/preview			

Note: Number of hours allocated to units includes actual teaching hours, continuous internal assessment hours and experiential learning.

IT412OE4 : Cloud Computing and Distributed Systems

Teaching Scheme	Examination Scheme	
Lectures: 3 Hrs./Week	**Continuous Assessment:**	**0 Marks**
	In – Sem Exam:	**50 Marks**
	End-Sem Exam:	**50 Marks**
Credits: 3	**Total:**	**100 Marks**

Prerequisite Course: Have basic IT knowledge and be interested in learning more about Cloud and ML.

Course Objectives

1. To understand Cloud Computing and Distributed Systems.

Course Outcomes (COs):

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

	Course Outcome (s)	Bloom's Taxonomy	
		Level	**Descriptor**
CO1			
CO2			
CO3			
CO4			
CO5			
CO6			

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

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

Course Contents			
Unit-I		**No. of Hours**	**COs**
	Course contents will be as per the corresponding NPTEL Course available on the NPTEL portal.		
Unit-II		**No. of Hours**	**COs**
Unit-III		**No. Of Hours**	**COs**
Unit-IV		**No. of Hours**	**COs**
Unit-V		**No. of Hours**	**COs**
Unit-VI		**No. of Hours**	**COs**
Text Books:			
Reference Books:			
eLearning Resources:			

Note: Number of hours allocated to units includes actual teaching hours, continuous internal assessment hours and experiential learning.

IT8106 : Mobile Hacking

Teaching Scheme	Examination Scheme	
Lectures: 3 Hrs./Week	Continuous Assessment:	0 Marks
	In – Sem Exam:	50 Marks
	End-Sem Exam:	50 Marks
Credits: 3	Total:	100 Marks
Prerequisite Course:		

Course Objectives

1. To understand Mobile Hacking

Course Outcomes (COs):

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

Course Outcome (s)		Bloom's Taxonomy	
		Level	Descriptor
CO1			
CO2			
CO3			
CO4			
CO5			
CO6			

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

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

Course Contents			
Unit-I		**No. of Hours**	**COs**
	Course contents will be as per the corresponding NPTEL Course available on the NPTEL portal.		
Unit-II		**No. of Hours**	**COs**
Unit-III		**No. Of Hours**	**COs**
Unit-IV		**No. of Hours**	**COs**
Unit-V		**No. of Hours**	**COs**
Unit-VI		**No. of Hours**	**COs**
Text Books:			
Reference Books:			
eLearning Resources:			

Note: Number of hours allocated to units includes actual teaching hours, continuous internal assessment hours and experiential learning.

IT414 : Professional Internship

Teaching Scheme	Examination Scheme	
Lectures: 12 Hrs./Week	**Oral:**	**50 Marks**
	Practical:	**Marks**
	Term Work:	**100 Marks**
Credits: 6	**Total:**	**50 Marks**

Prerequisite Course: Soft-skills and Technical Skills.

Course Objectives

1. To get opportunity to observe current technological developments relevant to the program.
2. To get opportunity to learn, understand and sharpen the real time technical skills.
3.
4. To get exposure of the industrial environment
5.

Course Outcomes (COs):

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

	Course Outcome (s)	Bloom's Taxonomy	
		Level	**Descriptor**
CO1	Understand the current technological developments relevant to the program.	2	Understand
CO2	Apply technical skills to propose solution to real-time problems.	3	Apply
CO3	Acquire professional competency in Information Technology.	3	Apply
CO4			

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

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

Course Contents			
Minimum of Eight weeks to 6 months in an Industry in the area of Information Technology. The Professional internship should give exposure to the practical aspects of the discipline. In addition, the student may also work on a specified task or project, which may be assigned to him/her. The outcome of the internship should be presented in the form of a report.			
SOP for Internship: (Students should bring documents at the time of submission or when return to the Institute) 1. Experience certificate /relieving /offer letter of placement. 2. Monthly report (Attendance). 3. Geotag/GPS Map Camera Photos (Evidences). 4. Presentation on Internship. 5. Skills/knowledge acquired. 6. Report of Internship. 7. Placed or not placed details.			
	List of Assignments	**No. of Hours**	**COs**
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
13.			
14.			
Text Books:			
Reference Books:			
eLearning Resources:			

IT415 : Project Stage - II

Teaching Scheme	Examination Scheme	
Lectures: 8 Hrs./Week	**Oral:**	**50 Marks**
	Practical:	**Marks**
	Term Work:	**- Marks**
Credits: 4	**Total:**	**50 Marks**

Prerequisite Course: Project Stage - I.

Course Objectives

1. To implement software applications from design models.
2. To test software applications using extensive test cases.
3. To produce robust software applications that provide solution to problems in the society.
4.

Course Outcomes (COs):

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

Course Outcome (s)		Bloom's Taxonomy	
		Level	**Descriptor**
CO1	Implement software application from a design model.	3	Apply
CO2	Test a software application using extensive test cases.	5	Evaluate
CO3	Produce a robust software application that solves a problem.	6	Create
CO4			

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

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

Course Contents
Review 4: Implementation: Deliverables: 1. 100% Implementation Review 5: Complete project & Testing: Deliverables: 1. Testing. 2. Performance Analysis. 3. Deliverable project.
Project report contains the details as Follows: Contents List of Abbreviations List of Figures List of Graphs List of Tables 1. Introduction and aims/motivation and objectives 2. Literature Survey 3. Problem Statement/definition 4. Project Requirement specification 5. Systems Proposed Architecture 6. High level design of the project(using suitable tools) 7. System implementation. 8. Results and Testing 9. Performance Analysis 10. Conclusions 11. Bibliography in IEEE format Appendices A. Plagiarism Report of Paper and Project report from any open source tool B. Base Paper(s) C. Tools used D. Papers Published/Certificates • Use appropriate plagiarism tools, reference managers, Latex Lyx/latest Word for efficient and effective project writing. Term Work: • The term work will consist of a report and presentation prepared by the student on the project allotted to them.

	List of Assignments	No. of Hours	COs
1.			
2.			
3.			

4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
13.			
14.			
Text Books:			
Reference Books:			
eLearning Resources:			