

SANJIVANI RURAL EDUCATION SOCIETY'S
SANJIVANI COLLEGE OF ENGINEERING
KOPARGAON
(An Autonomous Institute Affiliated to SPPU Pune)



DEPARTMENT OF INFORMATION TECHNOLOGY

COURSE CURRICULUM - 2019 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 **2019** w.e.f. A.Y **2020-2021** 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 Thought 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

SEMESTER-I

Course		Course Title	Teaching Scheme			Credits	Evaluation Scheme - Marks						
Cat.	Code		Hours/ Week				Theory			OR	PR	TW	Total
			L	T	P		ISE	ESE	CA				
PRJ	IT201	First Year Internship	-	-	-	2	-	-	-	50	-	-	50
BSC	BS202	Vector Calculus And Differential Equation	4	-	-	4	30	50	20	-	-	-	100
PC	IT203	Digital Electronics & Computer Organization	4	-	-	4	30	50	20	-	-	-	100
PC	IT204	Fundamentals of Data Structures	3	-	-	3	30	50	20	-	-	-	100
PC	IT205	Object Oriented Programming	3	-	-	3	30	50	20	-	-	-	100
HSMC	HS206	Universal Human Values And Ethics	3	-	-	3	30	50	20	-	-	-	100
PC	IT207	Digital Electronics Laboratory	-	-	2	1	-	-	-	25	25	25	75
PC	IT208	Fundamental of Data Structure Laboratory	-	-	2	1	-	-	-	25	25	25	75
PC	IT209	Object Oriented Programming Laboratory	-	-	2	1	-	-	-	25	25	25	75
MC	MC210	Mandatory Course-III	2	-	-	NON Credit	-	-	-	-	-	-	-
Total			19	-	6	22	150	250	100	125	75	75	775

MC210	Mandatory Course-III	Constitution of India – Basic features and fundamental principles
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SEMESTER-II

Course		Course Title	Teaching Scheme			Credits	Evaluation Scheme - Marks						
Cat.	Code		Hours/ Week				Theory			OR	PR	TW	Total
			L	T	P		ISE	ESE	CA				
PC	IT211	Discrete Mathematics	3	1	-	4	30	50	20	-	-	-	100
PC	IT212	Database Management System	3	-	-	3	30	50	20	-	-	-	100
PC	IT213	Microprocessor & Microcontroller	4	-	-	4	30	50	20	-	-	-	100
PC	IT214	Data Structures & Files	4	-	-	4	30	50	20	-	-	-	100
PC	IT215	Database Management System Laboratory	-	-	2	1	-	-	-	50	-	25	75
PC	IT216	Microprocessor & Microcontroller Laboratory	-	-	2	1	-	-	-	-	50	25	75
PC	IT217	Data Structures & Files Laboratory	-	-	2	1	-	-	-	-	50	25	75
PRJ	IT218	Seminar	2	-	-	2	-	-	-	50	-	-	50
PRJ	IT219	Mini Project	-	-	4	2	-	-	-	-	-	50	50
MC	MC220	Mandatory Course-IV	2	-	-	NON Credit	-	-	-	-	-	-	-
Total			18	1	10	22	120	200	80	100	100	125	725

MC220	Mandatory Course-IV	Innovation - Project based – Sc., Tech, Social, Design & Innovation
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Total Credits: 44

Total Marks: 1500

S.Y. B. Tech
Information Technology
Semester I

IT 201 : First Year Internship	
Teaching Scheme	Examination Scheme
Lectures: NA	Oral Exam: 50 Marks
Credits: 2	Total : 50 Marks

GUIDELINES FOR INTERNSHIP

There are three different options available for the students to earn internship credit.

1. **Online Course:** Students shall register for an online course on Programming in C of 8 weeks duration offered via SWAYAM/NPTEL. Credits shall be awarded only on successful completion of the course under the authorized mentor and passing the examination of the said course.
2. **RedHat Certification:** Students shall register for level 1 RedHat certification course in RedHat Academy Centre of the department. Students shall attend all the classes of the course as the schedule given by the RedHat Academy. Credits shall be awarded to the students on passing the examination conducted by RedHat.

3. **Internship at Centre for IoT Consultancy:** Students shall register for internship of 4 week duration at the Centre for IoT Consultancy in the department of Information Technology. Students will have to attend the training programme as per the schedule given by the Centre for IoT Consultancy.

The contents for the IoT training are as follows: Introduction to Internet of Things, study and identification of different Sensors, study and identification of different electronics components including breadboard. Introduction to Arduino device, writing programs using Arduino IDE, interfacing of input and output devices with Arduino, WiFi module, Use of IoT mobile Apps.

Students shall be given hands on practice during training and shall have to design and develop following projects.

1. Automatic street/corridor/passage/stair case light controller.
2. Room temperature indicator with relay switch.
3. Object detector using ultrasonic sensor.
4. Door lock using RFID.
5. Water tank level indicator with relay.
6. Heartbeat indicator.

Students shall be awarded internship credits only on successful implementation and submission of any 4 projects mentioned above at the Centre for IoT Consultancy.

BS 202 : VECTOR CALCULUS AND DIFFERENTIAL EQUATION			
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 describe and recall basics of calculus. 2. To understand the concept and problem solutions of a curriculum. 3. To apply core concept for any applied problems in engineering. 4. To analyze the problem of which kind and use particular method for finding solution in engineering field. 5. To justify the statements for using specific method to applications problems in engineering field. 6. To organize the suitable problems in engineering field and present thoughts related to the problems.			
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 calculus	1	Remember
CO2	Understand the concept and use in solving engineering problems.	2	Understand
CO3	Apply core concept for any applied problems in engineering.	3	Apply
CO4	Analyse the problem of which kind and use particular method for finding solution in engineering field.	4	Analyse
CO5	Justify the statements for using specific method to applications problems in engineering field.	5	Evaluate
CO6	Organize the suitable problems in engineering field and present thoughts related to the problems.	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	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 ϕ , Directional derivative, Divergence and Curl of vector point function, Solenoidal and irrotational vector field and scalar potential, vector identities.	08	CO1 CO3 CO5
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	CO3 CO4 CO5
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	CO1 CO2 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	CO3 CO4 CO6
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	CO2 CO3 CO5
Unit-VI	APPLICATIOIS 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	CO1 CO3 CO5
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. Diproima, "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.			

IT203: 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			
<ol style="list-style-type: none"> 1. To learn basics of Digital Systems, VHDL and Processor Organization. 2. To understand memory and I/O organization. 3. To design and implement combinational and sequential logic circuits. 4. To analyze performance of Computer Systems, Cache. 5. To compare various parallel organizations. 6. To develop VHDL programs. 			
Course Outcomes (COs):			
After successful completion of the course, student will be able to			
Course Outcome (s)			Bloom's Taxonomy
			Level
			Descriptor
CO1	Learn basics of Digital Systems, VHDL and Processor Organization.		1 Remember
CO2	Understand memory and I/O organization.		2 Understand
CO3	Design and Implement combinational and sequential logic circuits.		3 Apply
CO4	Analyse performance of Computer Systems, Cache		4 Analyse
CO5	Compare various parallel organizations.		4 Analyse
CO6	Develop VHDL programs.		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	-	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	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	CO1 CO3
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	CO1 CO6
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	CO1 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	CO2
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	CO5
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", 6 th 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 Education ISBN: 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, Zvonko Vranesic, "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

IT204: 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			
<ol style="list-style-type: none"> To learn different searching & sorting techniques. To learn linear data structure and its application. To learn dynamic memory allocation concepts. To learn fundamentals of data structure and its applications. To learn algorithm design technique with time and space complexity To learn concept of linked organization for problem solving and programming 			
Course Outcomes (COs):			
After successful completion of the course, student will be able to			
Course Outcome (s)			Bloom's Taxonomy
			Level
			Descriptor
CO1	Describe appropriate searching and/or sorting techniques in the application development		2 Understand
CO2	Use appropriate linear data structure for solving problems and programming		3 Apply
CO3	Use dynamic memory allocation concepts in various application developments.		3 Apply
CO4	Apply appropriate constructs of C language, coding standards for application development		3 Apply
CO5	Examine basic analysis of algorithms with respect to time and space complexity		4 Analyse
CO6	Select appropriate data structures and algorithmic foundations for problem solving and programming		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	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	CO3
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	CO4 CO5
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	CO1 CO2 CO5
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	CO3 CO6
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	CO2 CO3 CO6
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	CO2 CO6
Text Books:			
<ol style="list-style-type: none"> 1. Ellis Horowitz, Sartaj Sahni, 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. Yashavant Kanetkar, "Understanding Pointers in C", BPB Publication.
7. Yashavant Kanetkar, "Let Us C", BPB Publication.

IT 205: 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			
<ol style="list-style-type: none"> To understand the basics of Object Oriented Programming with C++. To explain Object Oriented Programming principles and techniques. To design program using classes and objects of Object Oriented Programming. To build C++ classes using appropriate Overloading and Inheritance. To apply Memory allocation of Object Oriented Programming. To apply Templates of Object Oriented Programming 			
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 with C++.	2	Understand
CO2	Explain the principles and techniques of OOP	5	Evaluate
CO3	Write program using classes and objects of Object Oriented Programming	3	Apply
CO4	Build C++ classes using appropriate Overloading and Inheritance	6	Create
CO5	Apply memory allocation of OOP	3	Apply
CO6	Apply templates of OOP.	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
	Macros, Enumerations, Strings, Signatures of functions, passing variables to functions- Reference vs. pointers, Reference vs. value, Keyword const, Default arguments C++ Syntax and Semantics, the program development process, Numeric Types, expressions and Output in C++	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, structured exception handling, implementing data structures in C++, intro to the STL, Basic data structures such as linked lists, stacks, and queues are covered in terms of their usage and implementation using C++.	6	CO5
Unit-VI	TEMPLATE	No. Of Hours	COs
	Templates, C++ Standard library, design patterns, 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. Stroustrup, Bjarne, "The C++ Programming Language" 3 rd Edition Reading, MA: Addison-			

Wesley.

2. Daniel Du_y, “Introduction to C++ for Financial Engineers : An Object-oriented Approach”, 2006.
3. Steve Oualline, “Practical C++ Programming”, 1995.
4. Andrew Haigh, “Object Oriented Analysis & Design”, Tata McGraw Hill Edition.
5. Erich Gamma, Richard Helm, Ralph Johnson, John Vlissides, “Design Pattern-Elements of Reusable Object Oriented Programming”, Pearson.
6. Herbert Schildt, “Teach Yourself C++”, 1992.
7. Jesse Liberty, “Teach Yourself C++ in 24 hours”, 1999.
8. Schildt. H., “C++ from the Ground up”, 2nd Edition, Osborne McGraw-Hill, 1998.
9. Shtern. V, “Core C++ A Software Engineering Approach”, Prentice Hall Publisher, 2000.
10. Mary Delemater, Joel Murach, “Murach’s C++ Programming”, Pub 2018 ISBN: 9781-943872-27-5.
11. Bjarne Stroustrup, “A Tour of C++ (C++ In-Depth)”, 1st Edition, ISBN-13: 978-0321958310.
12. Stanley Lippman, “C++ Primer”, 5th Edition ISBN-13: 978-0321714114.
13. Bjarne Stroustrup, “The C++ Programming Language”, 4th Edition ISBN-13: 978-0321563842.
14. Alice E. Fischer and David W. Eggert, “Applied C and C++ Programming”, University of New Haven, and Michael J. Fischer, Yale University, August 2018.
15. Dale. N and Weems. C., “Programming and Solving with C++”, 4th Edition Jones and Bartlett Publishers, 2004.

HS 206: 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				
<ol style="list-style-type: none"> 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 starting 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:			
<ol style="list-style-type: none"> 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:			
<ol style="list-style-type: none"> 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

IT207 : Digital Electronics Laboratory			
Teaching Scheme		Examination Scheme	
Lectures: 2 Hrs./Week		Term	25 Marks
		Work:	
		Oral :	25 Marks
		Practical:	25 Marks
Credits: 1		Total:	75 Marks
Prerequisite Course: Basic Electronics Engineering			
Course Objectives			
1. To apply knowledge and concepts of digital system design techniques as hands-on experiments. 2. To Use logic function representation for simplification with K-Maps and analyze as well as design Combinational logic circuits using SSI & MSI chips. 3. Analyze Sequential circuits like Flip-Flops & design the applications like Asynchronous and Synchronous Counters. 4. Design Sequential Logic circuits like MOD counters using synchronous/asynchronous counters. 5. Understand and implement the design Steps with different modelling styles for any digital circuits with VHDL Programming. 6. Construct digital logic circuits and analyze their behavior through simulation software like Digital Works 3.0.			
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 and concepts of digital system design techniques as hands-on experiments.	3	Apply
CO2	Design Combinational logic circuits using SSI & MSI chips using logic function representation for simplification with K-Maps.	6	Create
CO3	Analyze Sequential circuits like Flip-Flops & design the applications like Asynchronous and Synchronous Counters.	4	Analyse
CO4	Design Sequential Logic circuits like MOD counters using synchronous/asynchronous counters.	6	Create
CO5	Implement design steps with different modelling styles for any digital circuits using VHDL Programming.	3	Apply
CO6	Construct digital logic circuits and analyze their behavior through simulation software like Digital Works 3.0.	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	-	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	-
CO5	3	-	2	-	3	2	-	-	3	1	-	2	-	3	-
CO6	-	2	3	-	3	2	-	2	3	2	-	2	-	3	-

<p>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.</p>			
<p>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.</p>			
Suggested List of Assignments			
Group A	COMBINATIONAL LOGIC DESIGN	No. of Hours	COs
1	Assignment on Code Conversion using Gates.	2	CO1 CO2
2	Assignment on Adder.	2	CO1 CO2
3	Assignment on Multiplexer & Decoder.	2	CO1 CO2
Group B	SEQUENTIAL LOGIC DESIGN	No. of Hours	COs
4	Assignment on Up and Down Asynchronous/Synchronous Counters.	2	CO1 CO3
5	Assignment on Module 'n' Counter.	2	CO1 CO4
Group C	VHDL PROGRAMMING (Implement any two from this group)	No. of Hours	COs
7	Simulation using Behavioral Modeling.	2	CO1 CO5
8	Simulation using Data Flow & Structural Modeling.	2	CO1 CO5
9	Simulation of Counter/Shift Registers. (Use any modeling Style)	2	CO1 CO5
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	CO1 CO6
Text Books:			
1. R.P. Jain, "Modern Digital Electronics", 3 rd Edition, Tata McGraw-Hill, ISBN: 0-07-049492-4. 2. J. Bhaskar, "VHDL Primer", Pearson Education, 3 rd Edition, ISBN: 0071226249.			
Reference Books:			
1. Stephen Brown, Zvonko Vranesic, "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.			

IT208 : Fundamental of Data Structure Laboratory			
Teaching Scheme		Examination Scheme	
Lectures: 2 Hrs./Week		Term Work: 25 Marks	
		Oral :	25 Marks
		Practical:	25 Marks
Credits: 1		Total:	75 Marks
Prerequisite Course: Computer Fundamentals and Programming			
Course Objectives			
1. To learn multidimensional array and pointers in depth. 2. To learn algorithm development in data structure 3. To learn different searching techniques. 4. To learn different sorting techniques. 5. To learn linked organization. 6. To learn problem solving using stack and queue.			
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 application development.		3 Apply
CO2	Develop Program by applyconstructs of C language, coding standard for applicationdevelopment.		6 Create
CO3	Select appropriate algorithm design technique to solve searching problem.		5 Evaluate
CO4	Apply appropriate sorting and searching techniques in the application development.		3 Apply
CO5	Apply appropriate data structures for problem solving & programming using sequential and linked organization.		3 Apply
CO6	Analyze the proper algorithmic foundation for solving stack and queue problems.		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	2	-	-	-	-	-	1	-	2	2	3	-	-
CO2	1	2	3	2	1	1	-	-	2	-	1	1	3	1	-
CO3	2	2	1	3	2	-	-	-	1	1	2	1	3	1	-
CO4	3	3	2	1	2	1	-	-	1	-	1	1	3	-	-
CO5	3	3	2	1	2	1	-	-	1	-	1	1	3	-	-
CO6	2	3	2	1	1	1	-	-	1	-	2	2	3	1	-

<p>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</p>			
<p>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</p>			
Suggested List of Assignments			
Sr. No.	Assignment	No. of Hours	COs
1.	Assignment based on matrix operations using pointer.	2 Hrs.	CO1CO2
2.	Assignment based on string operations using pointer	2 Hrs.	CO1CO2
3.	Assignment based on array of structures using with and without pointers.	2 Hrs.	CO1 CO2
4.	Assignment based on Linear or Binary Search	2 Hrs.	CO3
5.	Assignment based on Bubble Sort or Selection Sort.	2 Hrs.	CO4
6.	Assignment based on Quick Sort or Insertion Sort.	2 Hrs.	CO4
7.	Assignment based on Implementation of Stack and Queue and Circular Queue using array.	4 Hrs.	CO5 CO6
8.	Assignment based on implementation Singly Linked list, DLL and Circular LL.	4 Hrs.	CO5 CO6
9.	Assignment based on applications of Stack & Queue	4 Hrs.	CO5 CO6
10.	Assignment based on Implementation of Stack and Queue using Linked List.	4 Hrs.	CO5 CO6
Text Books:			
<ol style="list-style-type: none"> 1. Ellis Horowitz, Sartaj Sahni, 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:			
<ol style="list-style-type: none"> 1. Y. Langsam, M. Augenstein, 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. Yashavant Kanetkar, "Understanding Pointers in C", BPB Publication. 5. Yashavant Kanetkar, "Let Us C", BPB Publication. 			

IT209 : Object Oriented Programming Laboratory			
Teaching Scheme		Examination Scheme	
Lectures: 2 Hrs./Week		Term Work: 25 Marks	
		Oral :	25 Marks
		Practical:	25 Marks
Credits: 1		Total:	75 Marks
Prerequisite Course: Computer Fundamentals and Programming			
Course Objectives			
1. To develop program to solve complex problems using syntax and semantics of C++ programming language. 2. To implement algorithms for solving problems using namespace, encapsulation concepts. 3. To develop a program using the friend function and data abstraction concept. 4. To discover, explore and apply polymorphism and inheritance concepts in OOP. 5. To develop programs that appropriately utilizes memory allocation concepts in OOP. 6. To learn the use of templates in object oriented programming.			
Course Outcomes (COs):			
After successful completion of the course, student will be able to			
Course Outcome (s)		Bloom's Taxonomy	
		Level	Descriptor
CO1	Develop program to solve complex problems using syntax and semantics of C++ programming language.	6	Create
CO2	Implement algorithms for solving problems using namespace, encapsulation concepts.	3	Apply
CO3	Develop a program using Friend function and data abstraction concept.	6	Create
CO4	Discover , explore and apply polymorphism and inheritance concepts in object-oriented programming.	3	Apply
CO5	Develop programs that appropriately utilize memory allocation concept in C++ programming language.	6	Create
CO6	Apply the knowledge of Templates while implementing solution for complex 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	3	--	1	1	3	1	1	2	1	--	2	3	3	--	--
CO2	2	3	2	1	--	--	1	1	1	2	2	1	3	--	--
CO3	3	--	--	2	1	--	1	1	1	2	2	1	3	--	--
CO4	2	3	--	2	1	--	1	1	1	2	2	1	3	--	--
CO5	2	--	1	--	--	--	1	1	1	--	2	3	3	--	--
CO6	2	--	--	--	2	--	1	1	1	--	2	3	3	--	--

<p>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.</p>			
<p>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.</p>			
<p>Suggested List of Assignments</p>			
Sr. No.	Assignments	No. of Hours	COs
1	Write a function in C++ to demonstrate call by reference, call by value and call by pointer concept.	2 Hrs.	CO1
2	Write a menu driven program with class, object and different types of constructors.	2 Hrs.	CO1 CO2
3	Write a program to demonstrate use of Friend function.	2 Hrs.	CO1 CO3
4	Write a program to demonstrate compile time polymorphism (Operator Overloading/ Function Overloading)	2 Hrs.	CO1 CO4
5	Write a program to demonstrate run time polymorphism (Virtual Function Concept)	2 Hrs.	CO1 CO4
6	Write a program to demonstrate Encapsulation and Inheritance Concept	2 Hrs.	CO2 CO4
7	Write a program to demonstrate Memory allocation in C++	2 Hrs.	CO1 CO5
8	Write a program to demonstrate use of Template in C++	2 Hrs.	CO1 CO6
<p>Text Books:</p>			
<ol style="list-style-type: none"> 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. 			
<p>Reference Books:</p>			
<ol style="list-style-type: none"> 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 210 : 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			
<ol style="list-style-type: none"> 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	The student will get acquainted with the historical background, salient features, preamble and union territories of Indian constitution.		
CO2	The student will get aware about the fundamental rights.		
CO3	The student will get aware about directive principle of state policy and fundamental duties.		
CO4	The student will understand the system of government through parliamentary and federal system.		
CO5	The student will understand structure, formation and legislative framework of central government.		
CO6	The student will understand structure, formation and legislative framework of state government.		

Course Contents			
Unit-I	INTRODUCTION TO CONSTITUTION OF INDIA	No.of Hours	COs
	Historical background, Salient features, Preamble of constitution, Union and its territory.		
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.		
Unit-III	DIRECTIVE PRINCIPLE OF STATE POLICY AND FUNDAMENTAL DUTIES	No.of Hours	COs
	<p>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.</p> <p>Fundamental duties: List of fundamental duties, Features of fundamental duties, Criticism of fundamental duties, Significance of fundamental duties, Swaran Singh Committee Recommendations.</p>		
Unit-IV	SYSTEM OF GOVERNMENT	No.of Hours	COs
	<p>Parliamentary system: Features of parliamentary government, Features of presidential government, merits and demerit of Parliamentary system.</p> <p>Federal system: Federal features of constitution, unitary features of constitution.</p> <p>Centre and state relation: Legislative relation, administrative relations and financial relation.</p> <p>Emergency provision: National emergency, Financial emergency and criticism of emergency provision.</p>		
Unit-V	CENTRAL GOVERNMENT	No.of Hours	COs
	<p>President: Election of president, powers and functions of president, and Veto power of president.</p> <p>Vice-president: Election of vice-president, powers and functions of vice-president.</p> <p>Prime minister: Appointment of PM, powers and functions of PM, relationship with president.</p> <p>Central council of ministers: Appointment of ministers, responsibility of ministers, features of cabinet committees, functions of cabinet committees.</p> <p>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.</p> <p>Supreme court (SC): Organization of supreme court, independence</p>		

	of supreme court, jurisdiction and powers of supreme court.		
Unit-VI	STATE GOVERNMENT	No.of Hours	COs
	<p>Governor: Appointment of governor, powers and functions of governor, constitutional position.</p> <p>Chief minister: Appointment of CM, powers and functions of CM, relationship with governor.</p> <p>State council of ministers: Appointment of ministers, responsibility of ministers, cabinet.</p> <p>High court (HC): Organization of HC, independence of HC, jurisdiction and powers of HC.</p> <p>Sub-ordinate court: Structure and jurisdiction, Lok Adalats, Family court, Gram Nyayalayas.</p>		
Text Books:			
<ol style="list-style-type: none"> 1. M Laxmikanth, Indian Polity for Civil Service Examination, Mc GrawHill Education, 5th Edition. 2. Durga Das Basu, LexisNexis, Introduction to the Constitution of India, 22nd Edition. 			

**S.Y. B. Tech
Information
Technology
Semester II**

IT211: 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				
<ol style="list-style-type: none"> 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 various basic terminology of set, proof techniques and determine logical possibilities in a given situation.		3	Apply
CO2	Develop an understanding of relations and functions and be able to determine their properties.		6	Create
CO3	Solve problems based on Group and Rings.		3	Apply
CO4	Relate , interpret and apply the concepts of Graph Theory in various areas of IT.		5	Evaluate
CO5	Understand the fundamental mathematical requirement of cryptographic algorithms.		2	Understand
CO6	Determine the relationships between decodability and the prefix-free property.		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	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:			
<ol style="list-style-type: none"> 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:			
<ol style="list-style-type: none"> 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. 			

IT 212: 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: Discrete Mathematics, Data Structures	

Course Objectives				
<ol style="list-style-type: none"> 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	Create systematic database design schema		6	Create
CO3	Devise Query to database using relational algebra and SQL.		3	Apply
CO4	Learn and understand transaction management and analyze concurrency control protocols.		4	Analyze
CO5	Evaluate and optimize queries and compare recovery scheme		5	Evaluate
CO6	Learn and 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 AND E-R MODEL	No. of Hours	COs
	<p>Introduction Introduction to database systems application, purpose of database system. Introduction to Data models, Three-schema architecture of a database, Components of a DBMS.</p> <p>E-R model: modeling, entity, attributes, relationships, constraints, components of E-R model.</p> <p>Relational model: basic concepts, attributes and domains, concept of integrity and referential constraints, schema diagram.</p>	06	CO1
Unit-II	RELATIONAL ALGEBRA, SQL and QUERY PROCESSING	No. of Hours	COs
	<p>Relational Algebra: Basic Operations, Selection, projection, joining, outer join, union, difference, intersection, Cartesian product, division operations (examples of queries in relational algebraic using symbols).</p> <p>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.</p>	06	CO2
Unit-III	RELATIONAL DATABASE DESIGN	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
	<p>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.</p> <p>Concurrency Control: Time-stamps and locking protocols, validation-based protocols, multiple granularity protocols, deadlock handling.</p>	06	CO4
Unit-V	RECOVERY SYSTEM AND QUERY OPTIMIZATION	No. of Hours	COs
	<p>Recovery System: Shadow-Paging and Log-Based Recovery, Checkpoints.</p> <p>Query Processing: Overview, Measures of query cost, Evaluation of expression, Materialization and Pipelining algorithm.</p>	6	CO5
Unit-VI	EMERGING DATABASE TECHNOLOGIES	No. of Hours	COs

	<p>JSON: Overview, Data Types, Objects, Schema, JSON with Java/PHP/Ruby/Python.</p> <p>Introduction to No SQL Databases-SQLite Database, XML Databases, MongoDB.</p> <p>Hadoop: HDFS, Dealing with Massive Datasets-Map Reduce and Hadoop.</p> <p>Introduction to HBase: Overview, HBase Data Model, HBase Region, Hive.</p>	6	CO6
Text Books:			
<ol style="list-style-type: none"> 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”, Second Edition, McGraw Hill International Editions, ISBN 978-0072465631. 3. Kristina Chodorow and MongoDB, “The Definitive Guide”, O’Reilly Publications, ISBN:978-93-5110-269-4, 2nd Edition. 			
Reference Books:			
<ol style="list-style-type: none"> 1. Ramez Elmasri and Shamkant B. Navathe, “Fundamental Database Systems”, Third 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. 			

IT213: 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			
<ol style="list-style-type: none"> 1. To state architectural details of 8086, 80386 microprocessor and 8051 micro controller. 2. To describe advance features of 80386 microprocessor and 8051 micro controller. 3. To use Assembly Language Programming concepts. 4. To demonstrate interfacing of 8051 micro-controller with I/O devices through I/O ports. 5. To differentiate between microprocessor and micro-controller. 6. To design a minimum system using 8051 micro-controller for a typical application. 			
Course Outcomes (COs):			
After successful completion of the course, student will be able to			
Course Outcome (s)		Bloom's Taxonomy	
		Level	Descriptor
CO1	State architectural details of 8086, 80386 microprocessor and 8051 micro controller.	1	Remember
CO2	Describe advance features of 80386 microprocessor and 8051 micro controller.	2	Understand
CO3	Use Assembly Language Programming concepts.	3	Apply
CO4	Demonstrate interfacing of 8051 micro-controller with I/O devices through I/O ports.	3	Apply
CO5	Differentiate between microprocessor and micro-controller.	4	Analyze
CO6	Design a minimum system using 8051 micro-controller for a typical application.	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	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	CO3
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	CO1 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	CO2
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	CO2
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	CO1 CO2 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	CO4 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.

IT214: 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				
<ol style="list-style-type: none"> 1. To study data structures and their implementations using OOP (C++) and their applications. 2. To study dynamic memory allocation concepts. 3. To learn data structures such as trees and graphs. 4. To learn hash tables and its implementations. 5. To study advanced data structures such as advance trees such as AVL trees, splay trees, B and B+ trees. 6. To learn 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	Understand different algorithm design techniques.		2	Remember
CO2	Apply appropriate construct of data structure to implement trees and graph.		3	Apply
CO3	Use dynamic memory allocation concepts and file handling in various application developments.		3	Apply
CO4	Apply and Implement learned algorithm design techniques and data structures to solve problems.		3	Apply
CO5	Analyze algorithms to determine algorithm correctness and time efficiency.		4	Analyze
CO6	Select appropriate data structures for problem solving.		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	1	1	-	-	-	1	1	1	-	3	-	2
CO2	2	1	3	1	1	-	-	-	1	1	1	-	3	-	2
CO3	2	1	3	1	1	1	-	-	1	1	1	-	3	-	2
CO4	2	1	3	1	1	1	-	-	1	1	1	-	3	-	2
CO5	1	3	2	1	1	-	-	-	1	1	1	-	3	-	2
CO6	1	1	2	3	1	1	-	-	1	1	1	-	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	CO2 CO5
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 CO4 CO5
Unit-III	TABLES	No.of Hours	COs
	Symbol Table: Notion of Symbol Table, OBST, Huffman's algorithm, Heap data structure, Min and MaxHeap, Heap sort implementation, applications of heap: priority queue.	08	CO6
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 CO6
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	CO2 CO5 CO6
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	CO3
Text Books:			
<ol style="list-style-type: none"> 1. Thomas H. Cormen, Charles E. Leiserson and Ronald L. Rivest, "Introduction to Algorithms", Second Edition. 2. R.Gilberg, B. Forouzan, "Data Structure: A Pseudo code approach with C++", Cengage learning. 3. Sartaj Sahni, "Data Structures, Algorithms and Applications in C++",2nd Edition, Universities Press. 			
Reference Books:			
<ol style="list-style-type: none"> 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", Second 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.

IT215 : Database Management Systems Laboratory			
Teaching Scheme		Examination Scheme	
Lectures: 2 Hrs./Week		Term Work:	25 Marks
		Oral :	50 Marks
		Practical:	NA
Credits: 1		Total:	75 Marks
Prerequisite Course: Database Management Systems			
Course Objectives			
<ol style="list-style-type: none"> 1. To design and implement a database schema for a given problem-domain. 2. To implement DDL commands on database. 3. To implement DML commands on database. 4. To implement Nested subqueries and aggregate function to retrieve data. 5. To programme PL/SQL including stored procedures, stored functions, cursors and packages. 6. To learn NoSQL database 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 entity-relationship models and implement database and queries using DDL & DCL commands.		4
CO2	Understand and Implement DML commands.		3
CO3	Populate and query a database using aggregate functions and nested sub-query.		3
CO4	Develop application programs using triggers.		3
CO5	Develop application programs using stored procedure and cursor.		3
CO6	Populate and query a database using MongoDB commands.		3

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	-	-	-	-

<p>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.</p>			
<p>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</p>			
<p>Suggested List of Assignments</p>			
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	CO2
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	CO3
3	Design and implement a database and apply the aggregate functions like count, sum, avg etc. Use group by and having clauses.	2	CO3
4	Implement nested sub queries. Perform a test for set membership (in, not in), set comparison (<some, >=some, <all etc.).	2	CO4
5	Write and execute triggers on suitable database.	2	CO5
6	Write and execute PL/SQL stored procedure/function using cursors to perform a suitable task on the database.	2	CO5
7	Create a database with suitable example using MongoDB and implement CRUD operations. <ul style="list-style-type: none"> • Inserting and saving document • Removing document • Updating document (document replacement, using modifiers, upserts, updating multipledocuments, returning updated documents) 	2	CO6
8	Execute at least 10 queries on any suitable MongoDB database that demonstrates following querying techniques: <ul style="list-style-type: none"> • Find and findOne (specific values) • Query criteria (Query conditionals, OR queries, \$not, Conditional semantics) • Type-specific queries (Null, Regular expression, Querying arrays) 	2	CO6
9	Execute at least 10 queries on any suitable MongoDB database that demonstrates following: <ul style="list-style-type: none"> • \$ where queries • Cursors (Limits, skips, sorts, advanced query options) 	2	CO6
10	Implement Map reduce example with suitable example.	2	CO6
<p>Reference Books:</p>			
<ol style="list-style-type: none"> 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, 2ndEdition. 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. 			

IT216 : Microprocessor & Micro-controller Laboratory			
Teaching Scheme		Examination Scheme	
Lectures: 2 Hrs./Week		Term Work:	25 Marks
		Oral :	NA
		Practical:	50 Marks
Credits: 1		Total:	75 Marks
Prerequisite Course: Microprocessor & Micro-controller			
Course Objectives			
1. To learn programmer's model for 80386 microprocessor and 8051 micro-controller. 2. To explain interfacing of I/O devices with 8051. 3. To use different tools for development of ALP. 4. To use DOS interrupts for file operations. 5. To select programming features between macros and procedures. 6. To develop ALP for array addition, code conversion, block transfer, string operations and sorting operations.			
Course Outcomes (COs):			
After successful completion of the course, student will be able to			
Course Outcome (s)			Bloom's Taxonomy
			Level
			Descriptor
CO1	Learn programmer's model for 80386 microprocessor and 8051 micro-controller.		1 Remember
CO2	Explain interfacing of I/O devices with 8051.		2 Understand
CO3	Use different tools for development of ALP.		3 Apply
CO4	Use DOS interrupts for file operations.		3 Apply
CO5	Select programming features between macros and procedures.		5 Evaluate
CO6	Develop ALP for array addition, number conversion, block transfer, string manipulation operations and sorting operations.		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	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
CO5	1	2	1	3	1	1	-	-	1	-	-	-	-	3	2
CO6	2	1	3	1	1	3	-	-	3	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, CO3, CO5, CO6
2.	Assignment on number conversion using macros.	2 Hrs.	CO1, CO3, CO5, CO6
3.	Assignment on string manipulations using near and far procedure.	2 Hrs.	CO1, CO3, CO5, CO6
4.	Assignment on File operation using DOS interrupts.	2 Hrs.	CO1, CO3, CO4, CO6
Group B	MICRO-CONTROLLER PROGRAMMING	No. of Hours	COs
5.	Assignment on memory block transfer.	2 Hrs.	CO1, CO3, CO6
6.	Assignment on Timer programming: ISR based.	2 Hrs.	CO1, CO2, CO3
7.	Assignment on ADC and Sensor (Eg. Temperature) Interfacing.	2 Hrs.	CO1, CO2, CO3
8.	Assignment on LCD interfacing.	2 Hrs.	CO1, CO2, CO3

Reference Books:

1. Peter Abel, Niyaz Nizamuddin, "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.

IT217 : Data Structures & Files Laboratory			
Teaching Scheme		Examination Scheme	
Lectures: 2 Hrs./Week		Term Work:	25 Marks
		Oral :	NA
		Practical:	50 Marks
Credits: 1		Total:	75 Marks
Prerequisite Course: Fundamentals of Data Structures, C++ Programming.			
Course Objectives			
<ol style="list-style-type: none"> 1. To learn C++ constructs and coding standards. 2. To learn non-linear data structures such as trees and graphs. 3. To study advanced data structures such as tables. 4. To study advanced data structures such as hash tables. 5. To learn advanced Tree. 6. To learn 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 construct of C++ language, coding standard for application development.		3
CO2	Implement algorithms to create/represent and traverse non-linear data structures such as Trees and Graphs.		3
CO3	Apply the concept of heap for implementation of Priority queue.		3
CO4	Apply the concept of hashing in database creation and manipulation.		3
CO5	Implement algorithm to construct and traverse advanced tree.		3
CO6	Implement and Apply algorithms to create and manipulate database using different file organizations.		3

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	1	2	1	-	-	2	1	-	-	3	-	2
CO2	2	1	3	1	1	1	-	-	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
CO5	2	1	3	1	1	1	-	-	2	1	-	-	3	-	2
CO6	2	1	3	1	1	1	-	-	2	1	-	-	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 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.

Suggested List of Assignments

Sr. No.	Assignments	No. of Hours	COs
1	Assignment based on implementation of tree.	2 Hrs.	CO1,CO2
2	Assignment based on traversal of tree.	2 Hrs.	CO1,CO2
3	Assignment based on minimum spanning tree.	2 Hrs.	CO1,CO2
4	Assignment based on shortest path in graph.	2 Hrs.	CO1,CO2
5	Assignment based on implementation of priority queue as application of heap.	2 Hrs.	CO1,CO3
6	Assignment based on Implement hash table.	2 Hrs.	CO1,CO4
7	Assignment based on implementation of advanced tree.	2 Hrs.	CO1,CO5
8	Assignment based on file organizations.	2 Hrs.	CO1,CO6

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. Sartaj Sahni, "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. Augenstein, 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.

IT218 : Seminar			
Teaching Scheme		Examination Scheme	
Lectures: 2 Hrs./Week		Term Work:	NA
		Oral :	NA
		Practical:	50 Marks
Credits: 2		Total:	75 Marks
Prerequisite Course: Basic Communication, Reading Skill and writing skill.			
Course Objectives			
<ol style="list-style-type: none"> 1. To explore the basic principles of communication (verbal and non-verbal) and active, 2. To explore the empathetic listening, speaking and writing techniques. 3. To build independent thinking on complex problem. 4. To expose the student to new technologies, researches, products, algorithms, services. 5. To study and summarize the literature survey. 			
Course Outcomes (COs):			
After successful completion of the course, student will be able to			
Course Outcome (s)			Bloom's Taxonomy
			Level
			Descriptor
CO1	Familiar with basic technical writing concepts and terms, such as audience analysis, jargon, format, visuals, and presentation.		2
CO2	Improve skills to read, understand, and interpret material on technology.		3
CO3	Improve communication and writing skills		4
CO4	Create and present the study using multimedia and presentation skill.		6
CO5	Write and analyze a technical report summarizing state-of-the-art on an identified topic.		4
CO6	Analyze and summarize the literature survey.		5

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

Course Content
<p>Context</p> <ul style="list-style-type: none"> • Each student will select a topic in the area of Information Technology and Computer Engineering 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 the seminar report prepared in Latex only. • Active participation at classmate seminars is essential. • Seminar Log book is recommended to use it. • Seminar should make the student attain skills like: <ol style="list-style-type: none"> a) Gathering of literature in specific area in a focused manner. b) Effectively summarizing the literature to find state-of-the-art in proposed area. c) Identifying scope for future work. d) Presenting (arguing) the case for the intended work to be done as project. e) Reporting literature review and proposed work in scientific way using good English.
<p>Guidelines for Assessment:</p> <p>Panel of staff members along with a guide would be assessing the seminar work based on parameters</p> <ul style="list-style-type: none"> • Topic • Contents • Presentation • Regularity • Punctuality • Timely Completion • Question and Answers, • Report, Paper presentation/Publication, Attendance and Active Participation. <p>Attendance for all seminars for all students is compulsory.</p> <p>Criteria for Evaluation</p> <ol style="list-style-type: none"> 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
<p>Guidelines for Seminar Presentation:</p> <p>Term Work:</p> <ul style="list-style-type: none"> • The term work will consist of a report and presentation prepared by the student on the seminar topic • A panel of examiner will evaluate the viability of project scope and seminar delivery. • 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.
<p>Reference Books:</p> <ol style="list-style-type: none"> 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. Vikas Shirodka, “Fundamental skills for building Professionals”, SPD,ISBN 978-93-5213-146-5.

IT219 : 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			
<ol style="list-style-type: none"> 1. To acquire the fundamental principles, concepts and constructs of computer programming. 2. To build the programming skills using PHP to solve real world problems. 3. To develop competency for the design, coding and debugging. 4. To acquire theoretical and analytical skills to develop web applications. 5. To understand the concepts, principles, strategies, and methodologies of Web applications. 6. To design and develop websites using PHP and MySQL. 			
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 in diversified problem domains.		3
CO2	Apply programming logic of PHP to solve real world problems.		3
CO3	Decide effectiveness of computer based solutions.		2
CO4	Have a sufficient theoretical knowledge and analytical skills to develop Web applications.		6
CO5	Apply the described concepts, principles and methods to develop web applications.		3
CO6	Design and develop website using PHP and MySQL.		6

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	1	2	2	-	-	3	3	2	3	2	-	3
CO2	2	1	3	1	1	3	1	-	3	3	2	3	2	-	3
CO3	2	1	1	1	3	2	1	-	3	3	2	3	2	-	3
CO4	2	1	3	1	1	1	1	-	3	3	2	3	2	-	3
CO5	2	1	3	1	1	1	1	-	3	3	2	3	2	-	3
CO6	2	1	3	1	1	3	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 have three hours to complete that. The practical examination will comprise of implementation and related theory. All assignments are to be performed in PHP and MySQL.

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 and MySQL.

Suggested List of Assignments

Sr. No.	Assignments	No. of Hours	COs
1	Assignment on PHP Basics, Data types, Variables and Constants.	4 Hrs.	CO1, CO5
2	Assignment on Operators in PHP, Control Structures, Looping Structures.	4 Hrs.	CO1, CO5
3	Assignment on Conditional Statements, Array.	4 Hrs.	CO1, CO5
4	Assignment on Function, User defined Functions, String Function.	4 Hrs.	CO2, CO3
5	Assignment on Form Elements, PHP POST & GET Form elements.	4 Hrs.	CO2, CO3
6	Assignment on Form Validating form data. Include and Require in form.	4 Hrs.	CO4
7	Assignment on State Management: Cookies, Session management.	4 Hrs.	CO2, CO3
8	Assignment on PHP Myadmin: Creating Database & Tables, Dropping Database & Tables, Adding Fields, Selecting Tables.	4 Hrs.	CO4, CO5
9	Mini Project using PHP and MySQL.	4 Hrs.	CO2, CO5, CO6

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. Vikram Waswani, "The Complete Reference MySQL", TATA McGraw Hill.
5. Luke Welling and Laura Thomson, "PHP and MySQL Web Development", Addison Wesley, 5th Edition, 2017.

MC210 : 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				
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				

Course Contents			
Unit-I		No.of Hours	COs
	<p>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.</p> <p>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.</p> <p>Two types of activities may be undertaken under this</p> <p>(a) Exposure to social problems (which are amenable to technological solutions)</p> <p>(b) Design & Innovation (to address above problems)</p> <p>After this students be encouraged to undertake technology projects of social relevance.</p>		
Text Books:			

SANJIVANI RURAL EDUCATION SOCIETY'S
SANJIVANI COLLEGE OF ENGINEERING
KOPARGAON

(An Autonomous Institute Affiliated to SPPU Pune)



DEPARTMENT OF INFORMATION TECHNOLOGY
COURSE CURRICULUM - 2019 PATTERN
THIRD YEAR B. TECH.

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

DECLARATION

We, the Board of Studies **INFORMATION TECHNOLOGY**, hereby declare that, We have designed the Curriculum of **T.Y. B.Tech. Information Technology** of Pattern **2019** 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

Kopergaon-423603



Dean Academics
Dean Academics
Sanjivani College of Engineering
Kopergaon-423603



Director
Director
Sanjivani College of Engineering
Kopergaon

PROFILE

Sanjivani College of Engineering (An Autonomous Institute), Kopergaon 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- 2019 PATTERN
THIRD YEAR B. TECH. INFORMATION TECHNOLOGY

SEMESTER- V

Course		Course Title	Teaching Scheme			Credits	Evaluation Scheme - Marks						
Cat.	Code		Hours/ Week				Theory			OR	PR	TW	Total
			L	T	P		ISE	ESE	CIA				
PRJ	IT301	Professional Internship-II	-	-	-	2	-	-	-	50	-	-	50
PC	IT302	System Programming and Operating System	4	-	-	4	30	50	20	-	-	-	100
PC	IT303	Computer Network	3	-	-	3	30	50	20	-	-	-	100
PC	IT304	Internet of Things	3	-	-	3	30	50	20	-	-	-	100
PC	IT305	Theory of Computation	3	-	-	3	30	50	20	-	-	-	100
PEC	IT306	Professional Elective-I	3	-	-	3	30	50	20	-	-	-	100
PC	IT307	System Programming and Operating system	-	-	2	1	-	-	-	-	50	-	50
PC	IT308	Computer Network Laboratory	-	-	2	1	-	-	-	50	-	-	50
PC	IT309	Internet of Things Laboratory	-	-	2	1	-	-	-	-	-	50	50
PRJ	IT310	Skill Based Credit Course	1	-	-	1	-	-	50	-	-	-	50
MC	MC311	Mandatory Course-V	1	-	-	Non Credit	-	-	-	-	-	-	-
Total			18	-	6	22	150	250	150	100	50	50	750

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)

Professional Elective- I	
Course Code	Course
IT306A	Cloud Computing
IT306B	Foundation of Data Science
IT306C	Data Mining Techniques
IT306D	Compiler Design

SEMESTER- VI

Course		Course Title	Teaching Scheme			Credits	Evaluation Scheme-Marks						
Cat.	Code		Hours/ Week				Theory			OR	PR	TW	Total
			L	T	P		ISE	ESE	CIA				
PC	IT312	Cryptography and Cyber Security	3	-	-	3	30	50	20	-	-	-	100
PC	IT313	Artificial Intelligence	3	-	-	3	30	50	20	-	-	-	100
PE	IT314	Professional Elective-II	3	-	-	3	30	50	20	-	-	-	100
OE	IT315	Open Elective-I	4	-	-	4	30	50	20	-	-	-	100
PRJ	PR316	IPR & EDP	2	-	-	1	15	25	10	-	-	-	50
PRJ	PR317	IPR & EDP Lab	-	-	2	1	-	-	-	-	-	50	50
HSMC	HS318	Corporate Readiness	1	-	2	2	-	-	-	-	-	50	50
PC	IT319	Cyber Security Laboratory	-	-	2	1	-	-	-	-	50	-	50
PC	IT320	Artificial Intelligence Laboratory	-	-	2	1	-	-	-	50	-	-	50
MC	MC321	Mandatory Course-VI	1	-	-	Non Credit	-	-	-	-	-	-	-
Total			17	-	08	20	135	225	90	50	50	100	650

Professional Elective- II		Open Elective-I	
Course Code	Course	Course Code	Course
IT314A	Software Testing and Quality Assurance	IT315 OE1	Object Oriented Programming with JAVA/ C++
IT314B	Big Data Analytics	Equivalent courses for IT315: 1. NPTEL Course: "Object Oriented Programming with C++". 2. NPTEL Course: "The Joy of Computing using Python". 3. NPTEL Course: "Programming in Java". 4. NPTEL Course: "Blockchain and it's Applications".	
IT314C	Natural Language Processing		
IT314D	Optimization Techniques		

Mandatory Course-VI	
MC320	Suitable Technical / Non-Technical Activities finalized by Department

**T.Y. B. Tech
Information
Technology
Semester V**

IT 301 : Professional Internship-II	
Teaching Scheme	Examination Scheme
Lectures: NA	Oral Exam: 50 Marks
Credits: 2	Total : 50 Marks

Course Objectives			
<ol style="list-style-type: none"> 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. To get exposure of the industrial environment. 			
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
CO2	Apply technical skills to propose solution to real-time problems.		3
CO3	Acquire professional competency in Information Technology.		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	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

Course Contents	
Guidelines for Internship	
Minimum of six weeks in an Industry in the area of Information Technology. The summer 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.	
1	Two guides shall supervise the internship project work, one from the department and another one from industry.
2	Industry shall submit the month-wise satisfactory attendance of the students to the institute/department
3	Student must regularly use daily diary which is to cultivate the habit of documenting.
4	The presentation is way to evaluate student performance, so student must be ready as they are evaluated by institute guide, internal and external examiner.
5	Student must submit a comprehensive report to the department before presentation.
Steps to apply for internship	
1	Students shall ask for permission letter from IT Department office/office of Training & Placement cell of the college in consultation of guide (Institute) to allot various slots of 4 to 6 weeks during as internship periods.
2	Students on joining Training at the concerned Industry must submit the permission letter from the office of Training & Placement cell of the college.
3	Students must regularly use dairy to record the details and submit attendance in internship report.
4	Students shall be obtained Training Certificate from industry.
5	Students shall submit training report after completion of internship to guide.
Evaluation process for internship	
1	Students must submit training report and training certificate from industry after completion of internship to guide.
2	Guide will access performance of student through presentation which is evaluated by institute guide and external examiner from institute itself.

IT302: 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			
<ol style="list-style-type: none"> 1. To understand the basics of System Programming. 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	Analyze and synthesize the System Software.		4
CO2	Evaluate the phases of Compiler.		2
CO3	Evaluate the Processes management.		3
CO4	Use of the Synchronization concepts.		3
CO5	Apply the concept of memory management techniques in Operating System.		3
CO6	Understand the I/O management.		2
			Analyze
			Understand
			Apply
			Apply
			Apply
			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	3	1	-	-	2	3	-	-	1	1	3	2	1
CO2	1	1	3	1	-	-	2	3	-	-	1	1	3	2	1
CO3	1	1	3	1	-	-	2	3	-	-	1	1	3	2	1
CO4	1	1	3	1	-	-	2	1	-	-	1	3	3	2	1
CO5	1	1	3	1	-	-	2	1	-	-	1	3	3	2	1
CO6	1	1	3	1	-	-	2	1	-	-	1	3	3	2	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 SYNCHRONIZATION	No. of Hours	COs
	Mutual Exclusion: Concurrency, Mutual Exclusion: Hardware Support, Semaphores and Mutex, Monitors. Producer and Consumer problem, Interprocess 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:
<ol style="list-style-type: none">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. Dhamdhare 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:
<ol style="list-style-type: none">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
<ol style="list-style-type: none">1. Online Course: Dr. S. Sasikala, “Operating Systems”, Swayam, https://onlinecourses.swayam2.ac.in/cec21_cs20/preview2. eBook: Operating System and Middleware: Supporting Controlled Interaction, https://gustavus.edu/mcs/max/os-book/osm-rev1.3.1.pdf

IT303: 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			
<ol style="list-style-type: none"> 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
CO2	Detect different techniques for error control and flow control.		2
CO3	Understand channel allocations and multiple access protocols.		2
CO4	Understand various routing algorithm.		2
CO5	Apply transportation in network programming.		3
CO6	Analyze different protocols of application layer.		4

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, 4 th Edition, ISBN: 978-0-07-070652-1.			
Reference Books:			
1. Behrouz A. Forouzan, “Data Communication and Networking”, McGraw Hill Education, 5 th 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.			

IT304: 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			
<ol style="list-style-type: none"> 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	-	2	-	-	-	-	-	-	-	2	-
CO2	-	-	-	3	-	2	-	-	-	-	-	-	-	2	-
CO3	-	-	-	3	-	2	-	-	-	-	-	-	-	2	-
CO4	-	-	-	3	-	2	-	-	-	-	-	-	-	2	-
CO5	-	-	-	3	-	2	-	-	-	-	-	-	-	2	-
CO6	-	-	-	3	-	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:			
<ol style="list-style-type: none"> 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:			
<ol style="list-style-type: none"> 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. Madiseti, “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.

IT305: 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			
<ol style="list-style-type: none"> To Learn Finite Automata and Finite State Machine. To Study Regular Expression, Pumping Lemma and Properties of Regular Languages. To Understand Context Free Grammar and Context Free Languages. To Learn Pushdown Automata, Post Machines and its construction. To Study Turing Machine and variants of Turing Machine. 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
CO2	Solve the different regular expressions for the regular languages.		3
CO3	Apply well defined rules for verification and simplification of context free grammar.		3
CO4	Apply the basic concepts of Push Down Automata and Post Machine for construction of Machines for context free languages.		3
CO5	Understand the variants of Turing Machine for formal languages.		2
CO6	Express the understanding 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	2	3	2	-	1	-	1	-	-	2	2	1	-	-
CO2	2	2	2	2	-	1	1	2	-	-	1	2	-	-	-
CO3	3	2	2	2	-	1	-	1	-	1	1	2	2	-	-
CO4	3	2	2	2	-	1	-	1	-	-	-	2	-	-	-
CO5	3	2	3	2	-	1	-	1	-	-	-	2	1	-	-
CO6	2	3	3	2	-	1	-	1	-	-	2	1	1	-	-

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 DFA, 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:			
<ol style="list-style-type: none"> 1. Michael Sipser, "Introduction to the Theory of Computation", CENGAGE Learning, 3rd Edition ISBN-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.

IT306A: Cloud Computing (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: Digital Electronics & Computer Organization	

Course Objectives			
<ol style="list-style-type: none"> 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
CO2	Understand the importance of IaaS service of Cloud computing		2
CO3	Understand PaaS service of Cloud computing		2
CO4	Understand the role of SLA in cloud computing		2
CO5	Understand Cloud Security		2
CO6	Understand the issues and challenges of cloud computing which will lead students towards research platform.		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
CO1	3	2	3	1	2	-	1	3	2	-	1	1	3	2	1
CO2	3	2	3	1	2	-	1	3	2	-	1	1	3	2	1
CO3	3	2	3	1	2	-	1	3	2	-	1	1	3	2	1
CO4	3	2	3	1	2	-	1	3	2	-	1	1	3	2	1
CO5	3	2	3	1	2	-	1	3	2	--	1	1	3	2	1
CO6	3	2	3	1	2	-	1	3	2	-	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.	06	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.	06	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.	06	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.	06	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	06	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.	06	CO6
Text Books:			
<ol style="list-style-type: none"> 1. Prof. K. Chandrashekhara, "Essentials of Cloud Computing", CRC Press, Taylor & Francis Group. 2. RajkumarBuyya, 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:

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.

IT306B: 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				
<ol style="list-style-type: none"> To introduce the data mining basics. To introduce the origins of big data. To introduce the fundamentals of big data. To introduce the classification techniques of data. To introduce the clustering techniques of data. 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:			
<ol style="list-style-type: none"> 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:			
<ol style="list-style-type: none"> 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.

IT306C: 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			
<ol style="list-style-type: none"> 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
CO2	Analyze the output generated by the pre-processing of data.		4
CO3	Explore the hidden patterns in the data		4
CO4	Demonstrate the algorithms used for text mining		3
CO5	Implement mining techniques for realistic data.		3
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:			
<ol style="list-style-type: none"> 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 Charkrobari, "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.

IT306D: Compiler Design (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: Theory of Computations	

Course Objectives			
<ol style="list-style-type: none"> 1. To understand the theory and practice of compiler implementation. 2. To study finite state machines and lexical scanning 3. To learn context free grammars, compiler parsing techniques. 4. To learn construction of abstract syntax trees and symbol tables. 5. To understand Intermediate machine representations. 6. To learn actual code generation and code optimization. 			
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 different phases of compiler and compiler construction tools.		2
CO2	Design and Implement lexical analyzer and syntax analyzer.		3
CO3	Apply the concepts of grammars and compiler parsing techniques.		3
CO4	Implement abstract syntax trees and symbol tables using syntax directed translation.		3
CO5	Understand the intermediate code generation phase.		2
CO6	Understand code generation and to identify the sources of optimization.		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	1	2	1	-	1	-	1	-	-	2	2	1	-	-
CO2	3	2	3	2	-	1	1	2	-	-	1	2	-	-	-
CO3	2	2	3	1	-	1	-	1	-	1	1	2	2	-	-
CO4	3	1	2	2	-	1	-	1	-	-	-	2	-	-	-
CO5	3	2	2	2	-	1	-	1	-	-	-	2	1	-	-
CO6	2	2	2	1	-	1	-	1	-	-	2	1	1	-	-

Course Contents			
Unit-I	INTRODUCTION	No. of Hours	COs
	Introduction: Compilers Analysis of the source program, Phases of a compiler, Cousins of the Compiler, Grouping of Phases, Bootstrapping and Compiler construction tools, Symbol Table. Introduction to Finite Automata and Regular Expression. Introduction to Grammar.	06	CO1
Unit-II	LEXICAL ANALYSIS	No. of Hours	COs
	Lexical Analysis: Role of Lexical Analyzer, Input Buffering, Specification of Tokens, Recognition of Tokens, From Regular expression to Automata and Design of Lexical Analysis generator.	06	CO2
Unit-III	SYNTAX ANALYSIS	No. of Hours	COs
	Role of the parse, Writing Grammars, Context-Free Grammars, Ambiguous Grammars, Top Down parsing, Recursive Descent Parsing, Predictive Parsing, Bottom-up parsing, Shift Reduce Parsing, Operator Precedence Parsing, LR Parsers, SLR Parser, Canonical LR Parser, LALR Parser.	06	CO3
Unit-IV	SYNTAX DIRECTED TRANSLATION	No. of Hours	COs
	Syntax Directed Translation: Syntax Directed Definitions, Application of SDT (Syntax Directed Translation) and SDT schemes.	06	CO4
Unit-V	INTERMEDIATE CODE GENERATION	No. of Hours	COs
	Intermediate Code Generation: Directed acyclic graphs, three-address code Intermediate languages - Declarations, Assignment Statements, Boolean Expressions, Array references, Back patching.	06	CO5
Unit-VI	CODE GENERATION AND OPTIMIZATION	No. of Hours	COs
	Code generation and Optimization: Issues, Basic Blocks and Flow Graphs, DAG representation of Basic Blocks, Optimization of basic Blocks, Peephole Optimization, Principal Sources of Optimization, Loop Optimization, Global Data Flow Analysis.	06	CO6
Text Books:			
<ol style="list-style-type: none"> 1. V Aho, R Sethi, J D Ullman, "Compilers: Principles, Techniques, and Tools", Pearson 2nd Edition, ISBN 81-7758-590-8. 2. Dick Grune, Bal, Jacobs, Langendoen, "Modern Compiler Design", Wiley, 2nd Edition, ISBN 81-265- 0418-8. 			
Reference Books:			
<ol style="list-style-type: none"> 1. Anthony J. Dos Reis, "Compiler Construction Using Java", JavaCC and Yacc Wiley, 1st Edition, ISBN 978-0-470-94959-7. 2. K Muneeswaran, "Compiler Design", Oxford University Press, 1st Edition, ISBN 0-19-806664-3. 3. J R Levin, T Mason, D Brown, "Lex and Yacc", O'Reilly, 2000, 2nd Edition, ISBN 81-7366-061-X. 			

IT307 : 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			
<ol style="list-style-type: none"> 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
CO2	Use system calls and process scheduling algorithms.		3
CO3	Apply process synchronization techniques.		3
CO4	Apply the Memory management algorithms and Disk scheduling		3

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 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 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:			
<ol style="list-style-type: none"> 1. Paul Gries, Jennifer Campbll, 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:			
<ol style="list-style-type: none"> 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. 			

IT308 : 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
CO2	Implementation of routing algorithms.		3
CO3	Implementation of Network Address Translation.		3
CO4	Demonstrate transport and application level protocols.		3

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.

IT309 : 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
CO2	Implement the web interface for IoT and solve Real World Problems		3
CO3	Demonstrate communication within the objects using IoT platforms such as Raspberry-Pi/Beagle Board/Arduino.		3
CO4	Implement cloud environment for IoT applications.		3

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:			
<ol style="list-style-type: none"> 1. Vijay Madiseti, "Internet of Things: A Hands-On Approach Arshdeep Bahga", VPT – Paperback 2015 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:			
<ol style="list-style-type: none"> 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. 			

IT310 : Skill Based Credit Course			
Teaching Scheme		Examination Scheme	
Lectures: 1 Hrs./Week		Continuous Assessment	50 Marks
		In-SemExam	NA
		End-Sem Exam	NA
Credits: 1		Total:	50 Marks
Prerequisite Course: Computer Network Technology			
Course Objectives			
1. To understand and recall Software Product development experience using industry standard. 2. To understand how teams are organized to deliver on software projects. 3. To analyze problem to be solved. 4. To create design document, white-boarding component diagram			
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 multithreading in java language.		2 Understand
CO2	Use Exception handling in Java programming		3 Apply
CO3	Demonstrate knowledge of AWT and Swings components		2 Understand
CO4	Apply knowledge of database in Java 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	2	-	1	2	3	1	2	1	2	3	2	1	3	2	2	
CO2	2	1	-	2	3	1	2	1	2	3	2	2	3	2	2	
CO3	-	-	1	1	3	1	2	1	1	3	2	1	3	2	2	
CO4	-	-	-	-	1	-	2	1	2	2	1	1	3	2	2	

<p>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 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.</p>			
<p>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.</p>			
Suggested List of Assignments			
Sr. No.	Assignment	No. of Hours	COs
1.	Introduction (software development process, mvpetc), 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.	4 Hrs.	CO1
2.	Presentations on design documents by groups, 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)	5 Hrs.	CO2
3.	Sprint demo local deployment by groups, sprint planning & sprint retrospective any 1 group at random, building a pipeline 30 mins, (by instructor)	4 Hrs.	CO3
4.	Sprint demo cloud deployment by groups, sprint planning & sprint retrospective any 1 group at random, how do you iterate, change management	4 Hrs.	CO4
5.	Final sprint demo cloud deployment by groups, sprint retrospective any 1 group at random, closing comments by instructor	4 Hrs.	CO5
Text Books:			
<ol style="list-style-type: none"> 1. Docker containers:- https://docs.docker.com/engine/install/ https://learning.oreilly.com/videos/docker-for-the/9781788991315/ 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=1BaedX4UAE (Selenium docker setup) https://www.youtube.com/watch?v=esb1v_d5-TM (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/ 			
Reference Books:			

**MC 311 : 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 the goal 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**

IT312: 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			
<ol style="list-style-type: none"> 1. Understand security attack, security services and security mechanism 2. Use the different cryptographic algorithms for implementing security. 3. Use the different Message digest algorithms to secure a message over insecure channel. 4. Understand various protocols for network security to protect against the threats in the networks. 5. Apply and exhibit knowledge to secure personal data, and secure computer networks in an organization. 6. Design and implement security solutions 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	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	1	-	2	-	1	2	-	1	-	-	1	1	2	3	-
CO2	1	-	2	-	1	2	-	1	-	-	1	1	2	3	-
CO3	1	-	2	-	1	2	-	1	-	-	1	1	2	3	-
CO4	1	-	2	-	1	2	-	1	-	-	1	1	2	3	-
CO5	1	-	2	-	1	2	-	1	-	-	1	1	2	3	-
CO6	1	-	2	-	1	2	-	1	-	-	1	1	2	3	-

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:			
<ol style="list-style-type: none"> 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:			
<ol style="list-style-type: none"> 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. 			

IT313: 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				
<ol style="list-style-type: none"> 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, Forward and 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:			
<ol style="list-style-type: none"> 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:
<ol style="list-style-type: none"> 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
<p>Online Courses:</p> <ol style="list-style-type: none"> 1. An Introduction to Artificial Intelligence by Prof. Mausam, IIT Delhi, NPTEL Course. 2. AI for Everyone by Andrew Ng, Coursera Course. <p>eResources:</p> <ol style="list-style-type: none"> 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

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			
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
CO2	Understand the Software Requirements and SRS Documents		2
CO3	Describe the testing concepts and Quality Assurance		2
CO4	Analyze different test methodologies and approaches for web applications.		4
CO5	Apply Software Testing Life Cycle for testing an application		3
CO6	Select proper tool to perform Software Testing.		5

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
	<p>Introduction to Software Engineering: The evolving role of software, Changing Nature of Software, Software myths.</p> <p>A Generic view of process: Software engineering- A layered technology, a process framework, Process patterns, process assessment.</p> <p>Process models: The waterfall model, Incremental process models, Evolutionary process models.</p>	06	CO1
Unit-II	REQUIREMENT ANALYSIS & SOFTWARE DEVELOPMENT LIFE CYCLE	No. of Hours	COs
	<p>Software Requirements: Functional and non-functional requirements, User requirements, System requirements, Interface specification, the software requirements document.</p> <p>SDLC Phases: Requirements Phase, Analysis Phase, Design phase, Coding Phase, Testing phase, Delivery and Maintenance Phase,</p> <p>SDLC Models: Waterfall Model, V Model, Agile Model, Prototype Model, Spiral Model</p>	06	CO2
Unit-III	SOFTWARE TESTING	No. of Hours	COs
	<p>Testing as a process, Basic definitions, Software testing principles, The tester's role in a software development organization, Differences between Manual and Automation.</p> <p>Quality Assurance, Quality Control, Differences between QA & QC & Testing</p>	06	CO3
Unit-IV	SOFTWARE TESTING METHODOLOGIES AND TEST APPROACHES	No. of Hours	COs
	<p>White Box Testing, Black Box Testing, Grey Box Testing.</p> <p>Static Techniques: Informal Reviews, Walkthroughs, Technical Reviews, Inspection</p> <p>Dynamic Techniques: Functional Testing - Unit Testing, Integration Testing, System Testing, User Acceptance Testing, Sanity/Smoke Testing, Regression Test, Retest.</p> <p>Non Functional Testing - Performance Testing, Scalability Testing, Compatibility Testing, Security Testing, Session Testing, Recovery Testing, Installation Testing, Adhoc Testing, Risk Based Testing, I18N Testing, L10N Testing.</p>	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:
<ol style="list-style-type: none">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:
<ol style="list-style-type: none">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
<ol style="list-style-type: none">1. https://nptel.ac.in/courses/106/105/106105150/2. 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	
<ol style="list-style-type: none"> 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:			
<ol style="list-style-type: none"> 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:			
<ol style="list-style-type: none"> 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			
<ol style="list-style-type: none"> To understand the core concepts of Natural language processing and levels of language analysis. To understand the computational properties of natural languages and the commonly used algorithms for processing linguistic information. Learning state of art NLP research areas such as parsing algorithms, ambiguity resolution and machine translation. To study algorithmic examples in distributed, concurrent and parallel environments To apply algorithmic strategies while solving problems 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:			
<ol style="list-style-type: none"> Allen James, Natural Language Understanding, Pearson India, 2nd Edition, ISBN: 9788131708958, 8131708950. 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.

IT314D: Optimization Techniques (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: Mathematical preliminaries like Linear algebra, matrices, Elements of probability theory & Elementary multivariable calculus. Design and Analysis of Algorithms, Genetic Algorithms.	

Course Objectives	
<ol style="list-style-type: none"> 1. To enable the student to learn and acquire mathematical methods in engineering disciplines. 2. To introduce the methods of optimization to solve a linear programming problem by various methods. 3. To introduce few advanced optimization techniques. 4. To understand the need and origin of the optimization methods. 5. To get a broad picture of the various applications of optimization methods used in engineering. 6. To define optimization problem and its various components. 	
Course Outcomes (COs):	
After successful completion of the course, student will be able to	
Course Outcome (s)	Bloom's Taxonomy
	Level Descriptor
CO1 Implement various optimization techniques.	3 Apply
CO2 Learn model real-world problems in optimization framework.	2 Understand
CO3 Apply various optimization models to solve optimization problems in computer-science & IT Engineering.	3 Apply
CO4 Understand the need of optimization techniques	2 Understand
CO5 Solve the engineering optimization problems	3 Apply
CO6 Tackle problems of interdisciplinary nature	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	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
	Overview, Operation Research Modeling Approach and Various Real Life Situations, Linear Programming Problems (LPP): Basic LPP and Applications; Various Components of LP Problem Formulation, Solving Linear Programming Problems: Using Simultaneous Equations and Graphical Method; Simplex Method; Duality Theory; Charnes' Big – M Method. Transportation Problems and Assignment Problems, 0/1 knapsack problem using brute force and dynamic approach.	06	CO1
Unit-II	NETWORK ANALYSIS	No. of Hours	COs
	Shortest Path: Dijkstra Algorithm; Floyd Algorithm; Maximal Flow Problem (Ford-Fulkerson); PERT-CPM, network design algorithms.	06	CO2
Unit-III	INVENTORY CONTROL	No. of Hours	COs
	Introduction; Economic Order Quantity (EOQ) models, Deterministic and probabilistic Models, Safety Stock, Buffer Stock, Inventory Model of Central Warehouse.	06	CO3
Unit-IV	GAME THEORY	No. of Hours	COs
	Introduction ; 2- person Zero – sum Game; Saddle Point ; Mini-Max and Maxi-Min Theorems, Games without saddle point ; Graphical Method ; Principle of Dominance.	06	CO4
Unit-V	QUEUING THEORY	No. of Hours	COs
	Introduction; Basic Definitions and Notations; Axiomatic Derivation of the Arrival & Departure (Poisson Queue). Pure Birth and Death Models; Poisson Queue Models: M/M/1: ∞ /FIFO and M/M/1:N/ FIFO.	06	CO4
Unit-VI	ADVANCED OPTIMIZATION TECHNIQUES	No. of Hours	COs
	Direct and indirect search methods, Evolutionary algorithms for optimization and search, Concepts of multi-objective optimization, genetic algorithms and simulated annealing, optimization of machine learning algorithms, ant colony optimization, Applications of IT Engineering: Search Engine Optimization, Smart Grid Optimization.	06	CO6
Text Books:			
<ol style="list-style-type: none"> 1. H.A. Taha, "Operations Research", 5th Edition Macmillan Publishing Company, 1992. 2. K. Deb, "Optimization for Engineering Design- Algorithms and Examples", Prentice-Hall of India Pvt. Ltd., New Delhi, 1995. 3. Hadley G., "Linear Programming", Narosa Publishers, 1987. 4. Mital, "Optimization Methods", New Age International. 5. Kalyanmoy Deb, "Multiojective Optimization –An evolutionary Algorithmic Approach", John Wiley & Sons, New York. 			
Reference Books:			
<ol style="list-style-type: none"> 1. J.C.Pant, "Introduction to Optimization", Jain Brothers, New Delhi, 1983. 2. Rao, "Engineering Optimization", New Age International. 3. Edwin K P Chong, Stainslaw H Zak, "Introduction to Optimization" 			

IT315: Object Oriented Programming with C++/Java (Open Elective – I)	
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				
<ol style="list-style-type: none"> To understand the basics of object oriented programming paradigm and principles. To understand classes and objects. To understand inheritance and polymorphism. To understand exception handling mechanism. To understand multithreading. To understand library. 				
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 paradigm and principles..		2	Understand
CO2	Use classes and objects to write object oriented programs.		3	Apply
CO3	Use inheritance and polymorphism.		3	Apply
CO4	Use exception handling mechanism.		3	Apply
CO5	Use multithreaded programming.		3	Apply
CO6	Use inbuilt library functions.		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	-	-	-	-	-	-	1	2	2	-	-	3	-	-
CO2	2	2	3	-	1	-	-	1	2	2	-	-	3	-	-
CO3	2	2	3	2	1	-	-	1	2	2	1	-	3	-	2
CO4	2	-	3	-	1	-	-	1	2	2	1	-	3	-	2
CO5	2	-	2	2	1	-	1	1	2	2	1	-	3	-	2
CO6	2	-	2	2	1	1	-	1	2	2	1	3	3	-	2

Course Contents			
Unit-I	Object Oriented Programming Paradigm and Principles	No. of Hours	COs
	Procedure and object oriented paradigm, Basic Principles of Object Oriented Programming: Data abstraction and encapsulation, Inheritance, Polymorphism.	08	CO1
Unit-II	CLASSES AND OBJECTS	No. of Hours	COs
	Defining classes and objects, visibility, constructors, instance and static members, array of object.	08	CO2
Unit-III	INHERITANCE AND POLYMORPHISM	No. of Hours	COs
	Inheritance types, single inheritance, multiple inheritance, syntax, abstract class. Overloading and overriding functions/methods, dynamic polymorphism.	08	CO3
Unit-IV	EXCEPTION HANDLING	No. of Hours	COs
	Try-catch block, multiple catch, nested try catch, finally.	08	CO4
Unit-V	MULTITHREADING	No. of Hours	COs
	Introduction, main thread, creating child thread, inter-thread communication, synchronization.	08	CO5
Unit-VI	LIBRARY	No. of Hours	COs
	String, Stream, Standard Template Library/Networking, Date and Time.	08	CO6
Text Books:			
<ol style="list-style-type: none"> 1. E. Balagurusamy, "Object Oriented Programming with C++ and Java", 8th Edition, McGraw Hill. 2. Herbert Schildt, "Java: The Complete Reference", 11th Edition, McGraw Hill, 2017. 3. Herbert Schildt, "C++: The Complete Reference", 4th Edition, McGraw Hill, 2003. 			
Reference Books:			
<ol style="list-style-type: none"> 1. Bjarne Stroustrup, "C++ Programming Language", 4th Edition, Addison Wesley. 2. Somashekara M.T., "Object Oriented Programming with Java", PHI. 3. Vasapannarava, et al, "Object Oriented Programming Using C++ and Java" Pearson. 			
eLearning Resources			
<ol style="list-style-type: none"> 1. NPTEL Course: Programming in Java, https://onlinecourses.nptel.ac.in/noc22_cs47/preview 2. NPTEL Course: An Introduction to Programming Through C++, https://onlinecourses.nptel.ac.in/noc22_cs42/preview 3. Tutorials: Java T Point, https://www.javatpoint.com/java-tutorial , https://www.javatpoint.com/cpp-tutorial 			
Equivalent courses for IT315:			
<ol style="list-style-type: none"> 1. NPTEL Course: "Object Oriented Programming with C++". 2. NPTEL Course: "The Joy of Computing using Python". 3. NPTEL Course: "Programming in Java". 4. NPTEL Course: "Blockchain and it's Applications". 			

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

Course Objectives			
<ol style="list-style-type: none"> To introduce student with IPR. To explain IPR procedure in India such as Patents, Designs and Trademarks. To make aware economic importance of IPRs. To develop ability to search and analyse the IPRs. To instill a spirit of entrepreneurship among the student participants. 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
	<p>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.</p> <p>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.</p>	04	CO1
Unit-II	PATENTS	No. of Hours	COs
	<p>Introduction to Patents, Procedure for obtaining a Patent.</p> <p>Licensing and Assignment of Patents: Software Licensing, General public Licensing, Compulsory Licensing.</p> <p>Infringement of Patents, Software patent and Indian scenario.</p>	04	CO2
Unit-III	DESIGNS	No. of Hours	COs
	<p>Registrable and non-Registrable Designs, Novelty & Originality, Procedure for Registration of Design.</p> <p>Copyright under Design: Assignment, Transmission, License.</p> <p>Procedure for Cancellation of Design, Infringement, Remedies.</p>	04	CO3
Unit-IV	TRADEMARKS AND COPY RIGHTS	No. of Hours	COs
	<p>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.</p> <p>Copyright Right: Concept of Copyright Right, Assignment of Copyrights, Registration procedure of Copyrights, Infringement (piracy) of Copyrights and Remedies, Copyrights over software and hardware.</p>	04	CO4
Unit-V	ENTREPRENEURSHIP: INTRODUCTION	No. of Hours	COs
	<p>Concept and Definitions: Entrepreneur & Entrepreneurship, Entrepreneurship and Economic Development, A Typology of Entrepreneurs.</p> <p>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.</p> <p>Factor Affecting Entrepreneurial Growth: Economic & Non-Economic Factors, EDP Programmes.</p> <p>Steps in Entrepreneurial Process: Deciding Developing, Moving, Managing, Recognizing.</p>	04	CO5
Unit-VI	RESOURCES FOR ENTREPRENEURSHIP	No. of Hours	COs
	<p>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</p>	04	CO6

	<p>statement.</p> <p>Role of Support Institutions and Management of Small Business: Director of Industries, DIC, SIDO, SIDBI, Small Industries Development Corporation (SIDC), SISI, NSIC, NISBUED, State Financial Corporation (SFC), EPC, ECGC.</p> <p>Various Governmental Initiatives: Make in India, Start Up India, Stand Up India, Digital India, Skill India</p> <p>Case Studies of Successful Entrepreneurs.</p>		
Text Books:			
<ol style="list-style-type: none"> 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:			
<ol style="list-style-type: none"> 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”. 			

PR317: Intellectual Property Rights and Entrepreneurship Development Lab		
Teaching Scheme	Examination Scheme	
Practical: 2 Hrs./Week	Term Work:	50 Marks
	Oral:	NA
	Practical:	NA
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	-	-	-	-

List of experiments:

The term work shall consist following experiments/reports to be completed within the semester.

1. Searching of patent, design, trademarks, and copy rights at various databases and its report preparation.
2. Patent draft preparation for a sample invention.
3. Design draft preparation for a sample design.
4. Trademark draft preparation for a sample Trademark/Device.
5. Copy right draft preparation for a sample documents/audio/video.
6. Report preparation of patent Infringement.
7. Preparation of Detailed project report for new business/industry/startup.
8. Visit to industry to understand entrepreneurship and its report preparation.

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".

HS318: Corporate Readiness	
Teaching Scheme	Examination Scheme
Lectures: 1 Hrs./Week	Term Work 50 Marks
Practical: 2 Hrs/Week	
Credits: 2	Total: 50 Marks
Prerequisite Course: (Quantitative aptitude, Verbal and non verbal communication)	

Course Objectives			
<ol style="list-style-type: none"> To develop clarity in the exploration process of student career and to match his skills and interests with a chosen career path. To develop required aptitude skills. To design the functional and chronological resume. To demonstrate the importance of critical thinking ability and expression in group discussions. To prepare students for the various professional interviews. 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
CO2	Understand Industry Specific skill set with a view to design an Ideal Resume.		2
CO3	Apply the knowledge of GD & Presentation Skill during Industry Assessments for Placement/Internship/Industry Training/Higher Studies/Competitive Exams etc.		3
CO4	Analyze and apply the critical thinking ability as required during Aptitude/Technical Tests.		4
CO5	Evaluate Technical/General Dataset to interpret insights in it.		5
CO6	Create an ideal personality that fits Industry requirement.		6

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:			
<ol style="list-style-type: none"> 1. R.S. Agarwal, "A Modern Approach to Verbal & Non-Verbal Reasoning". 2. B. S. Sijwali, "Reasoning verbal and non verbal". 			
Reference Books:			
<ol style="list-style-type: none"> 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:			
<ol style="list-style-type: none"> 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:			
<ol style="list-style-type: none"> 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 			

IT319 : 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. Use the different cryptographic algorithms for implementing security. 2. Use the different Message digest algorithms to secure a message over insecure channel. 3. 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	1	-	2	-	1	2	-	1	-	-	1	1	2	3	-
CO2	1	-	2	-	1	2	-	1	-	-	1	1	2	3	-
CO3	1	-	2	-	1	2	-	1	-	-	1	1	2	3	-

Guidelines: This 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", Wiley 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", 2 edition, TMH, ISBN :978007070208.

IT320 : 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
CO2	Use uninformed and informed search strategies for implementation of search algorithms.		3
CO3	Apply Artificial Neural Network for various learning algorithms.		3
CO4	Apply Fuzzy logic for the implementation of real life problems.		3

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.	Assignment Based on direct heuristic search techniques.	2 Hrs.	CO1
2.	Implement any one technique from the following a) Best First Search and A* Algorithm b) AO* Algorithm c) Hill Climbing	2 Hrs.	CO1
3.	Implement Perceptron Learning Algorithm.	2 Hrs.	CO2
4.	Implement a real life application in AI libraries Python.	2 Hrs.	CO2
5.	Implement an expert system in Python.	2 Hrs.	CO3
6.	Implement any two player game using min-max search algorithm.	2 Hrs.	CO3
7.	Design a fuzzy set for shape matching of handwritten character.	2 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.

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
<p>Faculty in-charge will facilitate students to organize and conduct following extra-curricular activities:</p> <ol style="list-style-type: none"> 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 - 2019 PATTERN
THIRD YEAR B. TECH. HONORS
SPECIALIZATIONS

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 **T.Y. B.Tech. Information Technology Honors Specialization** of Pattern **2019** 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 - 431 003

Approved by



Dean Academics

Dean Academics
Sanjivani College of Engineering
Kopargaon - 431 003



Director
Director

Sanjivani College of Engineering
Kopargaon



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		

About offered 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- 2019 PATTERN
THIRD YEAR B. TECH.INFORMATION TECHNOLOGY

SEMESTER- V

HONORS SPECIALIZATION IN CYBER SECURITY

Course		Course Title	Teaching Scheme			Credits	Evaluation Scheme-Marks						
Cat.	Code		Hours/ Week				Theory			OR	PR	TW	Total
			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			Credits	Evaluation Scheme-Marks						
Cat.	Code		Hours/ Week				Theory			OR	PR	TW	Total
			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			Credits	Evaluation Scheme-Marks						
Cat.	Code		Hours/ Week				Theory			OR	PR	TW	Total
			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			Credits	Evaluation Scheme-Marks						
Cat.	Code		Hours/ Week				Theory			OR	PR	TW	Total
			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			
<ol style="list-style-type: none"> 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:			
<ol style="list-style-type: none"> 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:			
<ol style="list-style-type: none"> 1. RaefMeeuwisse, "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			
<ol style="list-style-type: none"> To understand use of sensors and signal conditioning in IoT. To understand use of various actuators in IoT. To understand use of exemplary devices in IoT. To analyze security challenges in IoT. To make use IoT in various application. 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
CO2	Demonstrate use of various actuators IoT.		3
CO3	Demonstrate use of exemplary devices in IoT.		3
CO4	Analyze security challenges in IoT.		4
CO5	Use IoT in various applications.		3
CO6	Create prototype for an IoT System		6

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 Factory Initiative, 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:			
<ol style="list-style-type: none"> 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:			
<ol style="list-style-type: none"> 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		Term Work:	NA
		Oral :	NA
		Practical:	NA
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	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)

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 whitelisting 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:			
<ul style="list-style-type: none"> • Basic Security Tools 			
Course Objectives			
<ol style="list-style-type: none"> 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)

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:			
<ol style="list-style-type: none"> 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:			
<ol style="list-style-type: none"> 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:			
<ol style="list-style-type: none"> 1. Web Security: Common Vulnerability and their Mitigation. 2. Web Application Security. 			
Coursera:			
<ol style="list-style-type: none"> 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 - 2019 PATTERN
FINAL YEAR B. TECH.

PROFILE

Sanjivani College of Engineering (An Autonomous Institute), Kopergaon 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 Thought 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- 2019 PATTERN
FINAL YEAR B. TECH. INFORMATION TECHNOLOGY

SEMESTER- VII

Course		Course Title	Teaching Scheme Hours/ Week			Credits	Evaluation Scheme - Marks						
Cat.	Code		L	T	P		Theory			OR	PR	TW	Total
							ISE	ESE	CIA				
PRJ	IT401	Professional Internship-III	-	-	-	2	-	-	-	50	-	-	50
PC	IT402	Software Engineering, Modeling and Design	3	-	-	3	30	50	20	-	-	-	100
PC	IT403	Machine Learning	3	-	-	3	30	50	20	-	-	-	100
PE	IT404	Professional Elective-III	3	-	-	3	30	50	20	-	-	-	100
OE	IT405	Open Elective-II	3	-	-	3	30	50	20	-	-	-	100
OE	IT406	Open Elective-III	2	-	-	2	30	50	20	-	-	-	100
PC	IT407	Software Modeling And Design Laboratory	-	-	2	1	-	-	-	50	-	-	50
PC	IT408	Machine Learning Laboratory	-	-	2	1	-	-	-	-	50	-	50
PRJ	IT409	Project Stage-I	-	-	4	2	-	-	-	-	-	50	50
MC	MC410	Mandatory Course – VII	1	-	-	Non Credit	-	-	-	-	-	-	- Pass/ Fail
Total			15	-	8	20	500			100	50	50	700

IT404 Professional Elective- III		IT405 Open Elective-II	
Course Code	Course	Course Code	Course
IT404A	Project Management	IT 405	Programming in Java (NPTEL)
IT404B	Digital Twin	IT406 Open Elective-III	
IT404C	Cognitive Intelligence	Course Code	Course
IT404D	Fog Computing	IT 406	AWS DevOps (Coursera)

Mandatory Course-VII	
MC410	Spiritual, Mindfulness and Meditation

SEMESTER- VIII

Course		Course Title	Teaching Scheme Hours/ Week			Credits	Evaluation Scheme - Marks						
Cat.	Code						Theory			OR	PR	TW	Total
			L	T	P		ISE	ESE	CIA				
PC	IT411	Cryptocurrency Technology and Smart contract	3	-	-	3	30	50	20	-	-	-	100
PC	IT412	Ethical Hacking	3	-	-	3	30	50	20	-	-	-	100
PC	IT413	Distributed Systems	3	-	-	3	30	50	20	-	-	-	100
PE	IT414	Professional Elective-IV	3	-	-	3	30	50	20	-	-	-	100
PC	IT415	Cryptocurrency Technology and Smart Contract Laboratory	-	-	2	1	-	-	-	50	-	-	50
PC	IT416	Ethical Hacking Laboratory	-	-	2	1	-	-	-	-	50	-	50
PRJ	IT417	Project Stage-II	-	-	8	4	-	-	-	50	-	100	150
MC	MC418	Mandatory Course -VIII	1	-	-	Non Credit	-	-	-	-	-	-	Pass/ Fail
Total			13	12	18	18	400	400	20	100	50	100	650

IT414 Professional Elective- IV	
Course Code	Course
IT414A	Software Architecture
IT414B	Ubiquitous Computing
IT414C	Business Intelligence
IT414D	Software Defined Network

Mandatory Course-VII	
MC418	To be finalized at institute level

**Final Year
B. Tech
Information
Technology
Semester VII**

IT401 : Professional Internship-III

Teaching Scheme	Examination Scheme
Lectures: NA	Oral Exam: 50 Marks
Credits: 2	Total : 50 Marks

Course Objectives				
<ol style="list-style-type: none"> 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. To get exposure of the industrial environment. 				
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

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

Course Contents	
Guidelines for Internship	
Minimum of six weeks in an Industry in the area of Information Technology. The summer 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.	
1	Two guides shall supervise the internship project work, one from the department and another one from industry.
2	Industry shall submit the month-wise satisfactory attendance of the students to the institute/department
3	Student must regularly use daily diary which is to cultivate the habit of documenting.
4	The presentation is way to evaluate student performance, so student must be ready as they are evaluated by institute guide, internal and external examiner.
5	Student must submit a comprehensive report to the department before presentation.
Steps to apply for internship	
1	Students shall ask for permission letter from IT Department office/office of Training & Placement cell of the college in consultation of guide (Institute) to allot various slots of 4 to 6 weeks during as internship periods.
2	Students on joining Training at the concerned Industry must submit the permission letter from the office of Training & Placement cell of the college.
3	Students must regularly use dairy to record the details and submit attendance in internship report.
4	Students shall be obtained Training Certificate from industry.
5	Students shall submit training report after completion of internship to guide.
Evaluation process for internship	
1	Students must submit training report and training certificate from industry after completion of internship to guide.
2	Guide will access performance of student through presentation which is evaluated by institute guide and external examiner from institute itself.

IT402: 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 Explore and analyze use case modeling, domain/ class modeling.
4. To teach the student Interaction and Behavior Modeling,
5. To Make aware students with design process in software development
6. To Orient students with the software design principles and patterns

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	Analyze software requirements by applying various modeling techniques.	2	Understand
CO3	Apply use case modeling, domain/ class modeling	2	Understand
CO4	Demonstrate Interaction and Behavior Modeling	3	Apply
CO5	Apply design process in software development	3	Apply
CO6	Use software design principles and patterns	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	-	-	1	1	2	1	-	3	1	1	-	3
CO2	3	3	2	1	1	1	-	2	1	3	3	1	1	-	3
CO3	3	3	2	1	1	1	-	2	1	3	3	1	1	-	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
	Agility & the cost of change, Agile process, Extreme Programming, Other agile process models: Adaptive Software Development (ASD), Scrum, Dynamic Systems Development Method (DSDM), Crystal, Feature Driven Development (FDD), Lean Software Development (LSD), Agile Modeling (AM), Agile Unified Process (AUP)	06	CO3
Unit-IV	OBJECT ORIENTED ANALYSIS		
	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	CO3
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,	06	CO4

	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		
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	CO5
Text Books:			
<ol style="list-style-type: none"> 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:			
<ol style="list-style-type: none"> 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. 			

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: Basic of Mathematics, Data Structure.	

Course Objectives

1. To understand human learning aspects and relate it with machine learning concepts.
2. To understand the different types of Machine Learning.
3. To explore the Machine Learning classification techniques.
4. To get the knowledge of Regression.
5. To acquire the knowledge of different models through unsupervised learning.
6. To understand the 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	Recognize the characteristics of machine learning that makes it useful to real world problems.	2	Understand
CO2	Understand different linear methods for regression and classification with their optimization through different regularization techniques.	2	Understand
CO3	Apply the different supervised learning methods of support vector machine and tree based models.	3	Apply
CO4	Apply the Regression methods.	3	Apply
CO5	Apply the Association rule and Clustering technique.	3	Apply
CO6	Understand the Deep learning and Tensore Flow.	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	3	2	3	2	1	1	1	1	2	3	3	1	3
CO2	2	3	3	2	3	2	1	1	1	1	2	3	3	1	3
CO3	3	3	3	3	3	2	1	1	1	1	2	3	3	1	3
CO4	3	3	3	3	3	2	1	1	1	1	2	3	3	1	3
CO5	3	3	3	3	3	2	1	1	1	1	2	3	3	1	3
CO6	2	2	2	1	3	1	1	1	1	1	2	2	3	1	3

Course Contents			
Unit-I	FOUNDATION OF ML AND DATA CLEANING	No. of Hours	COs
	History of ML, Examples of Machine Learning Applications, Learning Types, Dataset for Machine Learning, Data Preparation: Data gathering, Data cleaning, Case study for different tools for Data cleaning, Data capturing, Data processing.	06	CO1
Unit-II	TYPES OF LEARNING	No. of Hours	COs
	ML Life cycle, AI & ML Training versus Testing, Positive and Negative Class, Cross-validation. Types of Learning: Supervised, Unsupervised and Semi-Supervised Learning. Supervised: Learning a Class from Examples, Types of supervised Machine learning Algorithms, Unsupervised: Types of Unsupervised Learning Algorithm, Dimensionality Reduction, Subset Selection, Feature Reduction/Dimensionality reduction, Principal components analysis (Eigen values, Eigen vectors, Orthogonality).	06	CO2
Unit-III	CLASSIFICATION	No. of Hours	COs
	Classification: Binary and Multiclass Classification: Assessing Classification Performance, Handling more than two classes, Multiclass Classification-One vs One, One vs Rest. Support Vector Machines: Linear learning machines and Kernel space, Making Kernels and working in feature space SVM for classification and regression problem. The Support Vector Classifier, Support Vector Machines and Kernels-Computing the SVM for Classification, The SVM as a Penalization Method, Function Estimation and Reproducing Kernels, SVMs and the Curse of Dimensionality, A Path Algorithm for the SVM Classifier, Decision Tree: Decision Trees ID4, C4.5, CART Naïve Bayes Classifier, Model Assumptions, Probability estimation Required data processing, M-estimates.	06	CO3
Unit-IV	REGRESSION	No. of Hours	COs
	Regression: Assessing performance of Regression: Error measures, Over-fitting and Under-fitting, MSE, Least Square Error. Linear Regression, Logistic Regression in Machine Learning, working with logistic regression. Support Vector Machines for Regression, Regression and Kernels Tree Based Methods-Regression Trees, Classification Trees, Random Forests-Definition of Random Forests, Details of Random Forests- Out of Bag Samples, Variable Importance, Proximity Plots, Random Forests and Over-fitting, Analysis of Random Forests-Variance and the De-Correlation Effect, Bias, Adaptive Nearest Neighbors.	06	CO4
Unit-V	UNSUPERVISED LEARNING	No. of Hours	COs
	Clustering: Distance measures Different clustering methods (Distance, Density, Hierarchical) Iterative distance-based clustering; Dealing with continuous, categorical values in K-Means Constructing a hierarchical cluster, K-Medoids, k-Mode and density-based clustering, Measures of	06	CO5

	<p>quality of clustering</p> <p>Nearest neighbor algorithm, how to do calculation to find neighbor node, K-Nearest Neighbors Computational geometry; Voronoi Diagrams; Delaunay Triangulations K-Nearest Neighbor algorithm; Wilson editing and triangulations Aspects to consider while designing K-Nearest Neighbor.</p> <p>Association Rules-Market Basket Analysis, The Apriori Algorithm, Unsupervised as Supervised Learning, Generalized Association Rules, Cluster Analysis Proximity Matrices.</p>		
Unit-VI	DEEP LEARNING	No. of Hours	COs
	<p>Deep Learning: Introduction, Why to go deep ?, Architecture of Deep Network, Restricted Boltzman Machines, Deep belief Network, Tensor Flow, Deep Learning libraries, Deep Learning platform, Theano, Caffe, Deep Learning Use Cases, Introduction to TensorFlow.</p>	06	CO6
Text Books:			
<ol style="list-style-type: none"> 1. Ethem Alpaydin, "Introduction to Machine Learning", 2nd Edition, The MIT Press, ISBN: 978-0-262-01243-0 2. Tom Mitchell, "Machine Learning", 1st Edition, McGraw- Hill. ISBN: 1259096955 3. Trevor Hastie, Robert Tibshirani and Jerome Friedman, "The Elements of Statistical Learning", 2nd Edition. Springer ISBN: 978-0-387-84858-7. 			
Reference Books:			
<ol style="list-style-type: none"> 1. Shai Shalev-Shwartz, Shai Ben-David, "Understanding Machine Learning: From Theory to Algorithms", 1st Edition, Cambridge University Press. ISBN: 978-1107057135 2. Christopher Bishop, "Pattern Recognition and Machine Learning", Springer. 2006 ISBN: 0241973376. 			
eLearning Resources			
<ol style="list-style-type: none"> 1. NPTEL Course on Introduction to Machine Learning, https://onlinecourses.nptel.ac.in/noc21_cs85/preview 2. NPTEL Course on Practical Machine Learning with Tensorflow https://nptel.ac.in/courses/106106213 3. Coursera Course on Supervised Machine Learning: Regression and Classification by Andrew Ng https://www.coursera.org/learn/machine-learning 			

IT404A : Project Management (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	

Course Objectives

1. To understand the Software Project Planning and Evaluation techniques.
2. To plan and manage projects at each stage of the software development life cycle.
3. To learn about the activity planning.
4. To learn about the risk management principles.
5. To manage software projects and control software deliverables.
6. To develop skills to manage the various phases involved in project management, people 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 Project Management principles while developing software.	2	Understand
CO2	Understand extensive knowledge about the basic project management concepts, framework and the process models.	2	Understand
CO3	Obtain adequate knowledge about software process models and software effort estimation techniques.	2	Understand
CO4	Understand Estimate the risks involved in various project activities.	2	Understand
CO5	Understand the checkpoints, project reporting structure, project progress and tracking mechanisms using project management principles.	2	Understand
CO6	Understand staff selection process and the issues related to people 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	1	-	-	-	-	-	-	-	1	1	3	1	-	-	3
CO2	1	-	-	-	-	-	-	-	1	1	3	1	-	-	3
CO3	1	-	-	-	-	-	-	-	1	1	3	1	-	-	3
CO4	1	-	-	-	-	-	-	-	1	1	3	1	-	-	3
CO5	1	-	-	-	-	-	-	-	1	1	3	1	-	-	3
CO6	1	-	-	-	-	-	-	-	1	1	3	1	-	-	3

Course Contents			
Unit-I	PROJECT EVALUATION AND PROJECT PLANNING	No. of Hours	COs
	Importance of Software Project Management – Activities - Methodologies – Categorization of Software Projects – Setting objectives – Management Principles – Management Control – Project portfolio Management – Cost-benefit evaluation technology – Risk evaluation – Strategic program Management – Stepwise Project Planning.	06	CO1
Unit-II	PROJECT LIFE CYCLE AND EFFORT ESTIMATION	No. of Hours	COs
	Software process and Process Models – Choice of Process models - Rapid Application development – Agile methods – Dynamic System Development Method Effort and Cost estimation techniques – COSMIC Full function points - COCOMO II – a Parametric Productivity Model.	06	CO2
Unit-III	ACTIVITY PLANNING	No. of Hours	COs
	Objectives of Activity planning – Project schedules – Activities – Sequencing and scheduling – Network Planning models – Formulating Network Model – Forward Pass & Backward Pass techniques – Critical path (CRM) method.	06	CO3
Unit-IV	RISK MANAGEMENT	No. of Hours	COs
	Risk identification – Assessment – Risk Planning – Risk Management – – PERT technique – Monte Carlo simulation – Resource Allocation – Creation of critical paths – Cost schedules.	06	CO4
Unit-V	PROJECT MANAGEMENT AND CONTROL	No. of Hours	COs
	Framework for Management and control – Collection of data – Visualizing progress – Cost monitoring – Earned Value Analysis – – Project tracking – Change control – Software Configuration Management – Managing contracts – Contract Management.	06	CO4
Unit-VI	STAFFING IN SOFTWARE PROJECTS	No. of Hours	COs
	Managing people – Organizational behavior – Best methods of staff selection – Motivation – The Oldham – Hackman job characteristic model – Stress – Health and Safety – Working in teams – Decision making – Communications genres – Leadership.	06	CO6
Text Books:			
1. Bob Hughes, Mike Cotterell and Rajib Mall, “Software Project Management”, 5 th Edition, Tata McGraw Hill, New Delhi, 2012.			
Reference Books:			
1. Robert K. Wysocki, “Effective Software Project Management”, Wiley Publication, 2011. 2. Walker Royce, “Software Project Management”, Addison-Wesley, 1998. 3. Gopalaswamy Ramesh, “Managing Global Software Projects”, McGraw Hill Education (India), 14 th Reprint 2013.			

IT404B: Introduction to Digital Twins (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 knowledge of digital twin prototype.
6. To understand the process to build digital twin.

Course Outcomes (COs):

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

Course Outcome (s)		Bloom's Taxonomy	
		Level	Descriptor
CO1	Understand digital twin approach.	2	Understand
CO2	Understand the knowledge of digital twin development plan.	2	Understand
CO3	Understand the role of digital twin in industry.	2	Understand
CO4	Understand the digital twin framework.	2	Understand
CO5	Understand the digital twin prototype.	2	Understand
CO6	Understand the process to build digital twin.	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	-	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	-	-	-	-	-	2	2	1	1	1
CO6	1	2		2	3		-	-	-	-	-	2	-	-	-

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.	06	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.	06	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.	06	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.	06	CO4
Unit-V	SETTING UP A DIGITAL TWIN PROTOTYPE	No. of Hours	COs
	The perspective of the asset owner, Required IoT capabilities, build versus buy of the capabilities, Evaluating public cloud, IoT, and specialty platforms for a Digital Twin, Configuration and setup.	06	CO5
Unit-VI	BUILDING THE DIGITAL TWIN PROTOTYPE	No. of Hours	COs
	Development process of our Digital Twin, Wind turbine as our Digital Twin prototype, using an ontology to define Digital Twin models, Configuring Digital Twin instances for the wind farms and turbines, Testing framework.	06	CO6
Text Books:			
<ol style="list-style-type: none"> 1. Shyam Varan Nath, Pieter van Schalkwyk, Dan Isaacs, "Building Industrial Digital Twins", ISBN: 9781839219078, Packt Publishing. 2. Gopal Chaudhary, Manju Khari, Mohamed Elhoseny, "Digital Twin Technology", 1st Edition, ISBN 9781003132868, Published October 5, 2021 by CRC press. 3. F Tao, M Zhang, AYC Nee, "Digital twin driven smart manufacturing", Academic Press, ISBN-978-0-12-817630-6. 4. Nassim Khaled, BibinPattel, Affan Siddiqui "Digital Twin Development and Deployment on the Cloud: Developing Cloud-Friendly Dynamic Models Using Simulink®/Simscape™ and Amazon AWS", Academic Press, 2020, ISBN: 9780128216316. 			
Reference Books:			
<ol style="list-style-type: none"> 1. Christoph Herwig, Ralf Pörtner, Johannes Möller, "Digital Twins Tools and Concepts for SmartBiomanufacturing", Springer, ISBN 978-3-030-71660-8. 2. Arup, "Digital Twins towards a meaningful framework", W1T 4BQ, www.arup.com. 3. Rolf H. Weber, Romana Weber, "Internet of Things Legal Perspectives", Springer 2010, ISBN 978-3-642-11709-1. 			
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/>

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:	

Course Objectives

1. To explain cognitive computing and design principles.
2. To distinguish between NLP and cognitive computing.
3. To apply advanced analytics to cognitive computing.
4. To discuss application of cognitive computing in business.
5. To illustrate various applications of cognitive computing.
6. 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	-	-	-	-	-	-	-	-	3	-	2
CO2	3	2	2	2	-	-	-	-	-	-	-	-	3	-	2
CO3	3	2	2	2	-	-	-	-	-	-	-	-	3	-	2
CO4	3	2	2	2	-	-	-	-	-	-	-	-	3	-	2
CO5	3	2	2	2	-	-	-	-	-	-	-	-	3	-	2
CO6	3	2	2	2	-	-	-	-	-	-	-	-	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.	06	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.	06	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	06	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.	06	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.	06	CO5
Unit-VI		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 to cognition.	06	CO6
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.

IT404D: Fog Computing (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: Cloud Computing, Internet of Things	

Course Objectives

1. To understand the basic concepts of fog computing.
2. To understand the concept of protocols in fog computing..
3. To introduce students to Edge and Fog and Internet of Things Technology
4. To make students learn and understand the concept of the design space and conduct trade-off analysis between performance and resources.
5. To devise appropriate data dissemination protocols and model links cost.
6. To learn security issues in fog 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 basic concepts of fog computing.	2	Understand
CO2	Understand the concept of protocols in fog computing.	2	Understand
CO3	Apply & construct working model of fog computing.	3	Apply
CO4	Apply Big Data tools in fog computing.	3	Apply
CO5	Understand real time applications in fog computing.	2	Understand
CO6	Analyze security issues in fog computing.	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	2	-	1	-	-	1	1	2	3	-
CO2	1	-	2	-	1	2	-	1	-	-	1	1	2	3	-
CO3	1	-	2	-	1	2	-	1	-	-	1	1	2	3	-
CO4	1	-	2	-	1	2	-	1	-	-	1	1	2	3	-
CO5	1	-	2	-	1	2	-	1	-	-	1	1	2	3	-
CO6	1	-	2	-	1	2	-	1	-	-	1	1	2	3	-

Course Contents			
Unit-I	INTRODUCTION TO FOG COMPUTING	No. of Hours	COs
	Fog Computing-Definition-Characteristics-Application Scenarios - Issues -Fog Computing and Internet of things-Pros and Cons-Myths of Fog Computing -Need and Reasons for Fog Computing Fog Computing and Edge Computing-IoT , FOG, Cloud benefits.	06	CO1
Unit-II	ARCHITECTURE & TECHNOLOGIES	No. of Hours	COs
	Architecture: Communication and Network Model, Programming Models. Fog Architecture for smart cities, healthcare and vehicles. Fog Computing Communication Technologies: Introduction, IEEE 802.11, 4G, 5G. standards, WPAN, Short-Range Technologies, LPWAN and other medium and Long-Range Technologies.	06	CO2
Unit-III	FOG COMPUTING REQUIREMENTS WHEN APPLIED TO IOT	No. of Hours	COs
	Scalability, Interoperability, Fog-IoT architectural model, Challenges on IoT Stack Model via TCP/IP Architecture. Data Management, filtering, Event Management, Device Management, cloudification, virtualization, security and privacy issues. Integrating b IoT, Fog, Cloud Infrastructures: Methodology , Integrated C2F2T Literature by Modeling Technique re by Use-Case Scenarios , Integrated C2F2T Literature by Metrics.	06	CO3
Unit-IV	MANAGEMENT OF DATA AND SECURITY ANALYSIS	No. of Hours	COs
	Smart Management of Big Data-Smart Data-Structure of Smart Data-Smart Data Life Cycle-System Architecture-Multi-dimensional Payment Plan- -Security and Privacy Issues-Multimedia Fog Computing-Architecture-Deduplication-Hybrid Secure Deduplication- Security Challenges-Security Requirements.	06	CO4
Unit-V	SOFTWARE DEFINED NETWORKING AND APPLICATION IN FOG COMPUTING	No. of Hours	COs
	Open Flow Protocol, OpenFlow Switch, SDN in Fog Computing, Home Network using SDN. Security and Privacy issues: Trust and privacy issues in IoT Network, web Semantics and trust Management for Fog Computing, Machine Learning based security in Fog Computing, Cyber-Physical Energy Systems over Fog Computing.	06	CO5
Unit-VI	CASE STUDY & SECURITY	No. of Hours	COs
	Case Study: Wind Farm - Smart Traffic Light System, Wearable Sensing Devices, Wearable Event Device, Wearable System, Demonstrations , Post Application Example . . Event Applications Example. Fog computing security: a review of current applications, challenges and security solutions.	06	CO6

Text Books:

1. Fog Computing: Theory and Practice by Assad Abbas, Samee U. Khan, Albert Y. Zomaya
2. Fog and Edge Computing: Principles and Paradigms (Wiley Series on Parallel and Distributed Computing) by Rajkumar Buyya and Satish Narayana Srirama
3. Amir Vahid Dastjerdi and Rajkumar Buyya, —Fog Computing: Helping the Internet of

Things Realize its Potentiall, University of Melbourne.

4. Sensors, Cloud, and Fog: The Enabling Technologies for the Internet of Things Paperback by SudipMisra , Subhadeep Sarkar , Subarna Chatterjee.

Reference Books:

1. Flavio Bonomi, Rodolfo Milito, Preethi Natarajan and Jiang Zhu, —Fog Computing: A
2. Platform for Internet of Things and Analytics, Big Data and Internet of Things: A
3. Roadmap for Smart Environments, Studies in Computational Intelligence 546, DOI:
4. 10.1007/978-3-319-05029-4_7, © Springer International Publishing Switzerland 2014.
5. Amir Vahid Dastjerdi and Ajkumar Buyya,” Fog Computing: Helping the Internet of Things Realize its Potential”, University of Melbourne.
6. Amir M. Rahmani ,Pasi Liljeberg, Preden, Axel Jantsch, —Fog Computing in the Internet
7. of Things - Intelligence at the Edge, Springer International Publishing, 2018.
8. Ivan Stojmenovic, Sheng Wen, “The Fog Computing Paradigm: Scenarios and Security
9. Issues”, Proceedings, Federated Conference on Computer Science and Information Systems, pp. 1–8, 2014.

IT405:Open Elective II(NPTEL) Programming In Java

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 principles of object oriented programming paradigm including abstraction, encapsulation, inheritance and polymorphism.
2. To understand fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries, etc.
3. To inculcate concepts of inheritance to create new classes from existing one & Design the classes needed given a problem specification.
4. To understand the concepts of multithreading, Applets and Servlets.
5. To facilitate students in handling Java Swing and Abstract Windowing Toolkit.
6. To demonstrate the concept of Java Object Database Connectivity (ODBC).

Course Outcomes (COs):

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

Course Outcome (s)		Bloom's Taxonomy	
		Level	Descriptor
CO1	Understand principles of object oriented programming paradigm including abstraction, encapsulation, inheritance and polymorphism	2	Understand
CO2	Understand fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries, etc.	2	Understand
CO3	Inculcate concepts of inheritance to create new classes from existing one & Design the classes needed given a problem specification	3	Apply
CO4	Understand the concepts of multithreading, Applets and Servlets.	2	Understand
CO5	Facilitate students in handling Java Swing and Abstract Windowing Toolkit	2	Understand
CO6	Demonstrate the concept of Java Object Database Connectivity (ODBC).	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	2	-	1	-	-	1	1	2	3	-
CO2	1	-	2	-	1	2	-	1	-	-	1	1	2	3	-
CO3	1	-	2	-	1	2	-	1	-	-	1	1	2	3	-
CO4	1	-	2	-	1	2	-	1	-	-	1	1	2	3	-
CO5	1	-	2	-	1	2	-	1	-	-	1	1	2	3	-
CO6	1	-	2	-	1	2	-	1	-	-	1	1	2	3	-

Course Contents			
Unit-I	OVERVIEW OF OBJECT-ORIENTED PROGRAMMING AND JAVA	No. of Hours	COs
	Java Programming Elements, History of Java, Java buzzwords, JVM architecture, Data types, Variables, Scope and life time of variables, arrays, operators, control statements, type conversion and casting, simple java program, constructors, methods, Static block, Static Data, Static Method String and String Buffer Classes, Using Java API Document.	06	CO1
Unit-II	INPUT-OUTPUT HANDLING IN JAVA AND ENCAPSULATION	No.of Hours	COs
	Input-Output Handling in Java, Encapsulation in Java, How to achieve encapsulation, Data Hiding, Tightly encapsulated class, Getter and setter method in Java, Naming convention of getter and setter method.	06	CO2
Unit-III	INHERITANCE AND EXCEPTION HANDLING	No. of Hours	COs
	Inheritance And Polymorphism: Basic concepts, Types of inheritance, Member access rules, Usage of this and Super key word, Method Overloading, Method overriding, Abstract classes, Dynamic method dispatch, Usage of final keyword. Exception Handling: Exception types, Usage of Try, Catch, Throw, Throws and Finally keywords, Built-in Exceptions, Creating own Exception classes.	06	CO3
Unit-IV	MULTITHREADED PROGRAMMING, JAVA APPLETS AND SERVLETS	No. of Hours	COs
	Multithreaded Programming Concepts of Thread, Thread life cycle, creating threads using Thread class and Runnable interface, Synchronization, Thread priorities, Inter Thread communication. Java Applets and Servlets Life cycle of an Applet, Differences between Applets and Applications, Developing applets, simple applet.	06	CO4
Unit-V	JAVA SWING AND ABSTRACT WINDOWING TOOLKIT (AWT)	No. of Hours	COs
	Introduction to Swings, Hierarchy of swing components. Containers, Top level containers -JFrame, JWindow, JDialog, JPanel, JButton, JToggleButton, JCheckBox, JRadioButton, JLabel, JtextField, JTextArea, JList, JComboBox, JScrollPane. Networking with Java Connecting to a Server, Implementing Servers, Sending E-Mail, Making URL Connections, Advanced Socket Programming.	06	CO5
Unit-VI	JAVA OBJECT DATABASE CONNECTIVITY (ODBC)	No. of Hours	COs
	The Design of JDBC. The Structured Query Language, JDBC Installation, Basic JDBC Programming Concepts, Query Execution, Scrollable and Updatable Result Sets, Metadata, Row Sets, Transactions. Interface and Packages for Software Development. Defining a Package, CLASSPATH, Access protection, importing packages. Interfaces- defining an interface, implementing interfaces, Nested interfaces, applying interfaces, variables in interfaces and extending interfaces.	06	CO6
Text Books:			
1. Herbert schildt (2010), The complete reference, 7th edition, Tata Mc graw Hill, New Delhi.			
Reference Books:			

1. T. Budd (2009), An Introduction to Object Oriented Programming, 3rd Edition, Pearson Education, India.
2. J. Nino, F. A. Hosch (2002), An Introduction to programming and OO design using Java, John Wiley & sons, New Jersey.
3. Y. Daniel Liang (2010), Introduction to Java programming, 7th Edition, Pearson education, India.

eLearning Resources

1. Programming In Java By Prof. Debasis Samanta IIT Kharagpur [12 Weeks]
https://onlinecourses.nptel.ac.in/noc22_cs102/preview

IT406 AWS DevOps (Coursera) (Open Elective-III)

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

Course Objectives

1. To Understand AWS database and storage offerings, including Amazon Relational Database Service (Amazon RDS), Amazon DynamoDB, and Amazon S3..
2. To Understand the DevOps philosophies and its lifecycle
3. To Understand How to use the right tools to measure code quality by identifying workflow steps
4. To Understand the The importance of Continuous Integration and Continuous Delivery, Infrastructure as Code, Test Driven Development, Behavior Driven Development.
5. To Understand the The organizational impact of DevOps, including breaking down silos, working in cross functional teams, and sharing responsibilities.
6. To Design the Essential DevOps concepts: software engineering practices, cloud native microservices, automated continuous deployments, and building resilient code.

Course Outcomes (COs):

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

Course Outcome (s)		Bloom's Taxonomy	
		Level	Descriptor
CO1	Understand AWS database and storage offerings, including Amazon Relational Database Service (Amazon RDS), Amazon DynamoDB, and Amazon S3..	2	Understand
CO2	Understand the DevOps philosophies and its lifecycle.To Understand How to use the right tools to measure code quality by identifying workflow steps	3	Apply
CO3	Understand how to use the right tools to measure code quality by identifying workflow steps	2	Understand
CO4	Understand the The importance of Continuous Integration and Continuous Delivery, Infrastructure as Code, Test Driven Development, Behavior Driven Development.	2	Understand
CO5	Understand the The organizational impact of DevOps, including breaking down silos, working in cross functional teams, and sharing responsibilities.	2	Understand
CO6	Design the Essential DevOps concepts: software engineering practices, cloud native microservices, automated continuous deployments, and building resilient code.	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	2	-	1	-	-	1	1	2	3	-
CO2	1	-	2	-	1	2	-	1	-	-	1	1	2	3	-
CO3	1	-	2	-	1	2	-	1	-	-	1	1	2	3	-
CO4	1	-	2	-	1	2	-	1	-	-	1	1	2	3	-
CO5	1	-	2	-	1	2	-	1	-	-	1	1	2	3	-
CO6	1	-	2	-	1	2	-	1	-	-	1	1	2	3	-

Course Contents			
Unit-I	AWS CLOUD TECHNICAL ESSENTIALS	No. of Hours	COs
	Definition of cloud computing , cloud value proposition. differentiate between workloads that run on-premises versus in the cloud, create an AWS account. Amazon differentiate between AWS Regions and Availability Zones, and the different ways that you can interact with AWS using AWS Identity and AccessManagement (IAM). AWS Compute and NetworkingAWS compute services differ from other AWS services. Amazon Elastic Compute Cloud (Amazon EC2) architecture, and how to differentiate container and a virtual machine. serverless technologies, basic networking concepts, and the features of Amazon Virtual Private Cloud (Amazon VPC).	06	CO1
Unit-II	DEVOPS ON AWS: CODE, BUILD, AND TEST	No. of Hours	COs
	AWS Storage and Databases AWS storage services—such as buckets and objects for Amazon Simple Storage Service (Amazon S3), and how Amazon Elastic Block Store (Amazon EBS) is used on AWS. You will also explore databases on AWS, and the use cases for each AWS storage service.Monitoring and Optimizing Solutions on AWS Monitoring on AWS, and how to optimize solutions on AWS. You will also learn about the function of Elastic Load Balancing (ELB), and how to differentiate between vertical scaling and horizontal scaling.	06	CO2
Unit-III	DEVOPS ON AWS: OPERATION	No. of Hours	COs
	DevOps cultural philosophies, practices, and tools that you can use to deliver applications and services faster and at a higher quality. Building off this knowledge, you will get hands-on with AWS services, such as AWS Cloud9, by setting up a development environment for a sample application. software development lifecycle at different stages of the continuous integration and continuous delivery (CI/CD) pipeline. You will get hands-on with AWS solutions by performing various application tests with AWS CodeBuild, automate your release process with AWS CodePipeline, and automate code deployments with AWS CodeDeploy.	06	CO3
Unit-IV	DEVOPS ON AWS: MONITOR	No. of Hours	COs
	DevOps on AWS series. You will then learn about the importance of monitoring and why instrumenting your environment is helpful. You will explore how Amazon CloudWatch provides you with data and actionable insights to monitor your applications, respond to system-wide performance changes, optimize resource utilization, and get a unified view of operational health. Lastly, you will get hands-on with other important AWS solutions to monitor pipeline changes	06	CO4
Unit-V	DEVOPS ON AWS: RELEASE	No. of Hours	COs
	Operation in continuous integration and continuous delivery (CI/CD) pipelines and discover how to detect unmanaged configuration changes to your cloud resources. Though this course focused on AWS solutions for DevOps operations and monitoring, you will also learn about third-party,	06	CO5

	open-source tooling that are well-known and widely used by the DevOps community. Lastly, you will get hands-on and run commands using AWS Systems Manager, and output logs to Amazon CloudWatch.		
Unit-VI	DEVOPS ON AWS: DEPLOYMENT	No. of Hours	COs
	Differences between continuous integration, continuous delivery, and continuous deployment. In Exercises 1 and 2, you will set up AWS CodeDeploy and make revisions that will then be deployed. If you use AWS Lambda, you will explore ways to address additional considerations when you deploy updates to your Lambda functions. Lastly, you will end the week by discovering ways to troubleshoot deployment errors. (IaC) helps organizations achieve automation, and which AWS solutions provide a DevOps-focused way of creating and maintaining infrastructure. In Exercise 3, you will be provided with an AWS CloudFormation template that will set up backend services, such as AWS CodePipeline, AWS CodeCommit, AWS CodeDeploy, and AWS CodeBuild. You will then upload new revisions to the pipeline.	06	CO6
Text Books:			
<ol style="list-style-type: none"> 1. Learning DevOps: The complete guide to accelerate collaboration with Jenkins, Kubernetes, Terraform and Azure DevOps Paperback – Import, 25 October 2019 2. Hands on Linux Devops Alisson Machado de Menezes 4th Kindle edition 3. The Devops Handbook: How to Create World-Class Agility, Reliability, & Security in Technology Organizations Paperback – 30 November 2021 by John allspaw 			
Reference Books:			
<ol style="list-style-type: none"> 1. DevOps For Beginners: A Complete Guide To DevOps Best Practices (Including How You Can Create World-Class Agility, Reliability, And Security In Technology ... With DevOps 2. Practical Devops second edition by joakim Verona kindle edition 3. Continuous Delivery by jez humble and David Farley foreword by Martin Fowler 			
eLearning Resources:			
<ol style="list-style-type: none"> 1. Introduction to DevOps by coursera https://www.coursera.org/learn/android-app/ 2. https://aws.amazon.com/training/learn-about/devops/ 3. https://www.guru99.com/devops-tutorial.html 4. https://www.udacity.com/course/intro-to-devops--ud611-Good online course with sample exercises 5. http://www.edureka.co/devops-Online Training covering high level process and tools. (Needs Registration) 6. http://devops.com/-A good blog, has lots of contents. 7. http://coursera.org/learn/intro-to-devops 			

IT407 : Software Modeling and Design Laboratory

Teaching Scheme		Examination Scheme	
Lectures: 2 Hrs./Week		Term Work:	NA
		Oral :	50 Marks
		Practical:	NA
Credits: 1		Total:	50 Marks
Prerequisite Course: Object Oriented Programming			
Course Objectives			
<ol style="list-style-type: none"> 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
CO2	Design Use Case, Domain Class Model.		3
CO3	Design Structural Model		3
CO4	Design Interaction and behavior Model.		3

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 that. The practical examination will comprise of implementation and related theory. All assignments are to be performed in a 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 a 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
8.	Prepare a Component and Deployment Model.	2 Hrs.	CO3

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.

IT408 : Machine Learning Laboratory

Teaching Scheme		Examination Scheme		
Lectures: 2 Hrs./Week		Term Work:	NA	
		Oral :	NA	
		Practical:	50 Marks	
Credits: 1		Total:	50 Marks	
Prerequisite Course: Python Programming Language				
Course Objectives				
<ol style="list-style-type: none"> To make use of Data sets and python library in implementing the Machine learning algorithms. To implement various Classification and Regression Machine Learning algorithms in Python Programming Language. To implement various Clustering Machine Learning algorithms in Python Programming Language To implement Deep Learning in Python Programming Language. 				
Course Outcomes (COs):				
After successful completion of the course, student will be able to				
Course Outcome (s)			Bloom's Taxonomy	
			Level	
			Descriptor	
CO1	Use Data sets and python library in implementing the Machine learning algorithms .		3	Apply
CO2	Implement various Classification and Regression Machine Learning algorithms in Python Programming Language.		3	Apply
CO3	Implement various Clustering Machine Learning algorithms in Python Programming Language		3	Apply
CO4	Implement Deep Learning in Python Programming 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	1	1	-	-	3	-	-	-	-	-	2	2	3	2	1
CO2	3	3	-	-	3	-	-	-	-	-	2	2	3	2	1
CO3	3	3	-	-	3	-	-	-	-	-	2	2	3	2	1
CO4	3	3	-	-	3	-	-	-	-	-	2	2	3	2	1

Guidelines: This Machine Learning Laboratory course has Machine Learning 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 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 Python Language.

Suggested List of Assignments

Sr. No.	Assignment	No. of Hours	COs
1.	Python Installation with various IDE's and Downloading the dataset and perform cleaning of data.	2 Hrs.	CO1
2.	Data Analysis & visualization-using NumPy, pandas matplotlib, SciPy etc.	2 Hrs.	CO1
3.	Assignment based on Naive Bayes classifier.	2 Hrs.	CO2
4.	Assignment based on Decision Tree classifier.	2 Hrs.	CO2
5.	Assignment based on regression on any dataset .	2 Hrs	CO2
6.	Assignment based on K-means Clustering Algorithm	2 Hrs.	CO3
7.	Assignment based on Association rules and Apriori Algorithm	2 Hrs.	CO3
8.	Assignment based on Deep Learning	2 Hrs.	CO4

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.

Reference Books:

1. Ethem Alpaydin, "Introduction to Machine Learning", PHI 2nd Edition, 2013.
2. Peter Flach, "Machine Learning: The Art and Science of Algorithms that Make Sense of Data", Cambridge University Press, Edition 2012.

IT409 : Project Stage - I

Teaching Scheme		Examination Scheme	
Lectures: 4 Hrs./Week		Term Work:	50 Marks
		Oral :	NA
		Practical:	NA
Credits: 2		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 and formulate problem statement.		4
CO2	Analyze problem to get software requirement specifications.		4
CO3	Design software model for proposed system.		3

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	-	-	-	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

Course Contents

Introduction

Students will have three types of options for their final year projects

1. Industry Sponsored Projects
2. Project as a Entrepreneur
3. Internal Project

1. Internal Projects

B.E. Projects can be application oriented and/or will be based on some innovative/ theoretical work. In Project Phase-I the student will undertake project over the academic year, which will involve problem identification, analysis, design of a system or sub system in the area of a particular Engineering discipline or interdisciplinary. The project will be undertaken preferably by a group of 3-4 students who will jointly work and implement the project. The group will select a project in relevant domain with approval from a committee formed by the department of senior faculty to check the feasibility.

Guidelines for Students and Faculty

- 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.
- There shall be two reviews in Project phase –I in semester-I by the review committee.
- The Project Review committee will be responsible for evaluating the timely progress of the projects.
- Student should identify Project of enough complexity, which has at least 4-5 major functionalities.
- The project should be based on the latest research work published in standard research journals/conferences.
- Student should identify stakeholders and write detail problem statement for system
- Review committee should finalize the scope of the project.
- 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.
- Every project group shall maintain a project log-book indicating the
- The students or project group shall make presentation on the progress made by them before the committee.
- The record of the remarks/suggestions of the review committee should be properly maintained and should be made available at the time of examination.

Each student/group is required to give presentation as part of review for 10 to 15 minutes followed by a detailed discussion.

Review 1: Literature review and problem identification

Deliverables:

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.
7. Project plan 1.0.

Review 2: Requirement Analysis & System Design

Deliverables:

1. Requirement Analysis
2. Detailed architecture/System design(UML Diagrams)/algorithms/techniques/methodology.
3. 10-20 implementation.
4. Project plan 2.0

One paper should be published in reputed International conference/International journal based on project work done.

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. Snap shots of working system.
9. Project Plan
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 students on the project allotted to them. There will be examination of students in which students will

**MC 410 : Spiritual, Mindfulness and Meditation
(Mandatory Course-VII)**

Teaching Scheme	Examination Scheme	
Lectures: 1 Hrs./Week	Term Work:	NA
	Oral :	NA
	Practical:	NA
Credits: Non Credit	Total:	NA

Course Contents

The human mind especially among the youth needs to transcend its preoccupation with negative experiences such as fear, anxiety, anger and obsession and to become more comfortable with the experience of compassion, acceptance and forgiveness. The student's attitude of acceptance towards negativity, aggression and turbulent emotions should be diffused with the practice of mindfulness. Rather than suppressing emotions or by indulging in them, the student be taught to handle such vibes with acceptance and generosity and with the observation of the self.

A mindful state has to be achieved when negative thoughts and experiences are becoming more personalized and do not serve as dictators of subsequent feelings and activities (e.g. suicide attempts, violence etc.). Both concentrative and insight meditation techniques may be practiced for 10-day sessions during every two months. Behavioral techniques of self monitoring should also be practiced to observe the stream of consciousness from the perspective of a vigilant but detached observer.

The students should be trained to practice different models of mindfulness and meditation so as to elicit a state of deep physical and behavioral relaxation. They may work on selectively influencing or changing the symmetry in hemispheric brain activity. Positive addiction, meta-cognitive practices etc. are exercised to make the students experience the universal human capacity through spiritual experiences.

The students may learn to turn-off or bypass the cognitive processing of usual daily pre-occupations and concerns, allowing access to mindful, spiritual and meditative state of self realization.

Activities:

Reading (10 books/ narrations)

Exercises (Mindfulness based Stress Reduction (MBSR) and 10 more)

Sessions: multiple 10-day sessions may be organized over a semester.

**B. Tech
Information
Technology
Semester VIII**

IT411 : Cryptocurrency Technology and Smart Contract

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 the basic concepts and technology used for blockchain.
2. To understand the primitives distributed computing and cryptography related to blockchain.
3. To demonstrate the concepts of Bitcoin and their usage.
4. To demonstrate Ethereum block chain contract.
5. To remember the security features in blockchain technologies.
6. To understand smart contract in real world applications

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 basic concepts of Cryptography and Cryptocurrencies.	2	Understand
CO2	Understand the Distributed Computing & Crypto primitives.	2	Understand
CO3	Demonstrate the concepts of Bitcoin and their usage.	3	Apply
CO4	Demonstrate the use of Ethereum block chain contract.	3	Apply
CO5	Remember the security features in blockchain technologies.	1	Remember
CO6	Understand smart contract in real world 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	3	1	3	1	2	3	0	0	2	1	3	0	3	0
CO2	2	3	2	2	0	0	0	0	0	2	2	2	2	2	0
CO3	2	2	2	2	2	2	2	2	0	2	2	2	2	2	0
CO4	3	2	2	2	0	0	0	0	0	2	2	2	2	2	0
CO5	2	2	2	2	2	2	2	2	0	1	2	2	2	2	2
CO6	2	2	2	2	2	2	2	2	0	1	2	2	2	2	2

Course Contents			
Unit-I	INTRODUCTION TO CRYPTOGRAPHY AND CRYPTOCURRENCIES	No. of Hours	COs
	Need for Distributed Record Keeping, Modeling faults and adversaries, Byzantine Generals Problem in Blockchain, Consensus Algorithms, Cryptographic Hash Functions, Hash Pointers and Data Structures – Block Chains and Merkle Trees, Digital Signatures	06	CO1
Unit-II	BASIC DISTRIBUTED COMPUTING & CRYPTO PRIMITIVES	No.of Hours	COs
	Atomic Broadcast, Consensus, Byzantine Models of fault tolerance, Hash functions, Puzzle friendly Hash, Collision resistant hash, digital signatures, public key cryptography, verifiable random functions, Zero-knowledge systems.	06	CO2
Unit-III	MECHANICS OF BITCOIN	No. of Hours	COs
	Bitcoin Transactions, Bitcoin Scripts, Applications of Bitcoin Scripts, Bitcoin Blocks, The Bitcoin Network, Limitations and Improvements	06	CO3
Unit-IV	ETHEREUM: A PROGRAMMABLE BLOCKCHAIN	No. of Hours	COs
	Introduction, Blockchain Recap, Ethereum: a Programmable Blockchain, Ether, Smart Contracts, State, History, Solidity and a Sample Smart Contract, Current and Potential Uses, The Decentralized Autonomous Organization - A Central Bank or Your Own Coin, A Crowdfunding System, Prove That You Said Something in the Past, Proof of Existence for Digital Assets	06	CO4
Unit-V	GOVERNANCE, NECESSARY EVIL OF REGULATED INDUSTRIES	No. of Hours	COs
	Decentralization and Governance, Exploring Business Models – Blockchain Benefits, From benefits to Profits, Network Business Model, Role of Governance in Business Network, Business Domains and Processes, Governance Structures.	06	CO5
Unit-VI	CASE STUDIES	No. of Hours	COs
	Block chain in Financial Service, Supply Chain Management, Insurance, Energy, Agriculture and Government Services.	06	CO6
Reference Books:			
<ol style="list-style-type: none"> 1. Narayanan, Bonneau, Felten, Miller and Goldfeder, “<i>Bitcoin and Cryptocurrency Technologies – A Comprehensive Introduction</i>”, Princeton University Press. 2. Josh Thompson, ‘<i>Blockchain: The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming</i>’, Create Space Independent Publishing Platform, 2017. 3. Imran Bashir, “<i>Mastering Blockchain: Distributed ledger technology, decentralization, and smart contracts explained</i>”, Packt Publishing. 4. MerunasGrincalaitis, “<i>Mastering Ethereum: Implement Advanced Blockchain Applications Using Ethereum-supported Tools, Services, and Protocols</i>”, Packt Publishing. 			
eLearning Resources:			

1. Prof. Sandip Chakraborty, Dr. Praveen Jayachandran, “*Blockchain Architecture Design And Use Cases*”[MOOC], NPTEL: <https://nptel.ac.in/courses/106/105/106105184/>

IT412 : Ethical Hacking

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: Cryptography & Cyber Security	

Course Objectives

1. To understand the importance of information security and ethical hacking.
2. To understand different scanning & enumeration methodologies and tools.
3. To understand footprinting and its tools.
4. To implement password hacking and its countermeasures.
5. To implement penetration testing using various devices.
6. To understand different web application attacks and countermeasures.

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 importance of information security and ethical hacking.	2	Understand
CO2	Understand different scanning & enumeration methodologies and tools.	2	Understand
CO3	Understand footprinting and its tools.	2	Understand
CO4	Implement password hacking and its countermeasures.	3	Apply
CO5	Implement penetration testing using various devices.	3	Apply
CO6	Understand different web application attacks and countermeasures.	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	3	3	2	2	3	2	1	1	2	2	3	1
CO2	3	3	2	3	3	2	2	3	2	1	1	2	2	3	1
CO3	3	3	2	3	3	2	2	3	2	1	1	2	2	3	1
CO4	3	3	2	3	3	2	2	3	2	1	1	2	2	3	1
CO5	3	3	2	3	3	2	2	3	2	1	1	2	2	3	1
CO6	3	3	2	3	3	2	2	3	2	1	1	2	2	3	1

Course Contents			
Unit-I	INTRODUCTION TO HACKING	No. of Hours	COs
	Introduction to Hacking – Importance of Security – Elements of Security – Phases of an Attack – Types of Hacker Attacks – Hacktivism – Vulnerability Research	06	CO1
Unit-II	SCANNING AND ENUMERATION	No.of Hours	COs
	Introduction to Scanning – Objectives – Scanning Methodology – Tools – Introduction to Enumeration – Enumeration Techniques – Enumeration Tools.	06	CO2
Unit-III	FOOTPRINTING	No. of Hours	COs
	Introduction to Footprinting – Information Gathering Methodology – Footprinting Tools – WHOIS Tools – DNS Information Tools – Locating the Network Range – Meta Search Engines.	06	CO3
Unit-IV	SYSTEM HACKING	No. of Hours	COs
	Introduction – Cracking Passwords – Password Cracking Websites – Password Guessing – Password Cracking Tools – Password Cracking Countermeasures – Executing Applications – Keyloggers and Spyware	06	CO4
Unit-V	PENETRATION TESTING	No. of Hours	COs
	Introduction – Security Assessments – Types of Penetration Testing- Phases of Penetration Testing– Tools.	06	CO5
Unit-VI	WEB APPLICATION ATTACKS AND COUNTERMEASURES	No. of Hours	COs
	Introduction - Web Server Concepts and Attacks, Different Web Server Attack Tools and Countermeasures, Overview of Web Application Architecture and Vulnerability Stack, Different Web Application Threats and Attacks, Different Types of SQL Injection Attacks and Tools.	06	CO6
Text Books:			
<ol style="list-style-type: none"> 1. EC-Council, “Ethical Hacking and Countermeasures: Attack Phases”, Cengage Learning, 2010. 2. Jon Erickson, “Hacking, 2nd Edition: The Art of Exploitation”, No Starch Press Inc., 2008. 3. Michael T. Simpson, Kent Backman, James E. Corley, “Hands-On Ethical Hacking and Network Defense”, Cengage Learning, 2013. 			
Reference Books:			
<ol style="list-style-type: none"> 1. Patrick Engebretson, “The Basics of Hacking and Penetration Testing – Ethical Hacking and Penetration Testing Made Easy”, Second Edition, Elsevier, 2013. 2. RafayBoloach, “Ethical Hacking and Penetration Testing Guide”, CRC Press, 2014. 			
eLearning Resources:			
<ol style="list-style-type: none"> 1. Ethical Hacking Masterclass offered by Infosys Springboard https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_0130944176014540801893_shared/overview 2. Ethical Hacking Essentials (EHE) offered by EC-Council https://www.coursera.org/learn/ethical-hacking-essentials-ehe/home 			

IT413: 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: Operating System, Computer Network, Data Structure and Algorithm	

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 working components and fault tolerance of distributed systems.
4. To understand the significance of agreement, fault tolerance and recovery protocols in 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, the student will be able to

Course Outcome (s)		Bloom's Taxonomy	
		Level	Descriptor
CO1	Demonstrate the core concepts of distributed systems.	3	Apply
CO2	Understand the concept of middleware of distributed systems.	2	Understand
CO3	Understand Inter-process communication methods and analyze different coordination algorithms.	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	Analyze
CO6	Understand various Recent Trends 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	1	1	1	1	1	1	1	1	1	1	2	3	1
CO2	3	1	2	2	1	1	1	2	2	1	2	2	2	3	1
CO3	3	1	2	2	1	1	1	2	2	1	2	2	2	3	1
CO4	3	2	2	2	1	1	1	2	2	1	2	1	2	3	1
CO5	3	2	2	2	1	1	1	2	2	1	2	1	2	3	1
CO6	2	2	2	2	1	1	1	1	1	1	1	2	2	3	1

Course Contents			
Unit-I	INTRODUCTION TO DISTRIBUTED SYSTEMS	No. of Hours	COs
	Introduction: Network operating System VS Distributed operating systems, Characteristics, Design goals, challenges of Distributed Systems, Examples of Distributed Systems, Trends in Distributed systems: Pervasive networking and the modern Internet, Mobile and ubiquitous computing, Focus on resource sharing Distributed Computing Models: Physical, Architecture and Fundamental models. Case Study: WWW 1.0,2.0, 3.0	06	CO1
Unit-II	MIDDLEWARE	No. of Hours	COs
	Introduction to middleware, middleware Framework, Role of middleware, Examples of Middleware, Origins of middleware, Architecture vs Middleware, RMI, CORBA, General Approaches to adaptive software, Types of middleware-messages oriented middleware, intelligent middleware, content centric middleware, middleware protocol, middleware Services, Distributed computing Environment (DCE), middleware Issues, middleware Analyst. Case Study: - XML Based middleware	06	CO2
Unit-III	INTER-PROCESS COMMUNICATION	No. of Hours	COs
	IPC: Introduction, Layered protocols, 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	06	CO3
Unit-IV	REPLICATION AND FAULT TOLERANCE	No. of Hours	COs
	Replication: 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	06	CO4
Unit-V	DISTRIBUTED FILES, MULTIMEDIA AND WEB BASED SYSTEM	No. of Hours	COs
	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.	06	CO5

	Case Study: The Global Name Service, The X.500 Directory Service, Bit Torrent		
Unit-VI	RECENT TRENDS IN DISTRIBUTED SYSTEMS	No. of Hours	COs
	Recent Trends: Introduction, Portable and handheld Devices, Wearable devices, Devices embedded in appliances, 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	06	CO6
Text Books:			
<ol style="list-style-type: none"> 1. George Coulouris, J Dollimore and Tim Kindberg, “Distributed Systems: Concepts and Design”, Pearson Education, 5th Edition, 2017, ISBN: 9789332575226. 2. Andrew S. Tanenbaum, Maarten van Steen, “Distributed Systems”, PHI ,2nd Edition, ISBN: 978-0130888938. 3. P. K. Sinha, “Distributed Operating Systems: Concepts and Design”, PHI, ISBN: 978-0780311190 			
Reference Books:			
<ol style="list-style-type: none"> 1. Sunita Mahajan and Seema Shah, “Distributed Computing”, Oxford University, ISBN: 0-19-806186-2. 2. Hagit Attiya and Jennifer Welch, “Distributed Computing, Fundamentals, Simulations and Advanced topics”, 2nd Edition, Wiley India, ISBN: 81-265-0916-3. 			
E-Learning Resources:-			
<ol style="list-style-type: none"> 1. Cloud Computing and Distributed Systems By Prof. Rajiv Misra IIT Patna https://onlinecourses.nptel.ac.in/noc23_cs27/preview. 			

IT414A Software Architecture (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: Software Engineering	

Course Objectives

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

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 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	-	-	1	1	2	3	-
CO2	1	1	2	-	1	2	-	1	-	-	1	1	2	3	-
CO3	1	1	2	-	1	2	-	1	-	-	1	1	2	3	-
CO4	1	1	2	-	1	2	-	1	-	-	1	1	2	3	-
CO5	1	1	2	-	1	2	-	1	-	-	1	1	2	3	-
CO6	1	1	2	-	1	2	-	1	-	-	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)	06	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	06	CO2
Unit-III	Architectural Views	No. of Hours	COs
	Introduction – Definitions – Structures and views - Representing views available 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	06	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.	06	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.	06	CO4
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.	06	CO6
Text Books:			
<ol style="list-style-type: none"> 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 Gopalswamy, "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). 5. Humphery Watts, "Managing the Software Process", Addison Wesley, 1989.(Revised) 			

IT414B: 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 Ubiomp.
4. To explore the concept of human computer interaction in the context of Ubiomp.
5. To explain Ubiomp privacy and challenges to privacy.
6. To describe Ubiomp network with design issues and Ubiomp management.

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 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	-	-	-	-	-	-	1	3	1	1
CO2	-	-	-	1	3	1	-	-	-	-	-	1	2	1	1
CO3	2	1	2	1	2		-	-	-	-	-	3	2	1	1
CO4	-	2	-		2	2	-	-	2	1		3	2	1	1
CO5	-	-	-	3	-	-	-	-	-	-	2	2	1	1	1
CO6	2	1	-	3	2	-	-	-	-	-	-	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	06	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)	06	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	06	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	06	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.	06	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	06	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", 2 nd Edition, TMH, ISBN :9780070702080.			
eResources:			
1. Dr. Willian Cope, University of Illinois, Ubiquitous Learning and Instructional Technologies, - https://www.coursera.org/learn/ubiquitouslearning			

IT414C: 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 understand the data sources to populate data warehouse.
3. To study the Design of data warehouse models using appropriate schemas.
4. To study the Design and Development of data warehouse for a domain using Data warehouse tools.
5. To understand to operate data warehouse to meet business objectives.
6. To apply data analysis techniques for building Decision support system.

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 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 and apply BI Techniques for various performance situations.	2	Understand
CO5	Understand the concept and process modelling and Analysis of Data.	2	Understand
CO6	Understand students for learning BI techniques involving predictive and statistical approach.	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	-	2	-	1	2	-	1	-	-	1	1	-	-	2
CO2	2	2	2	-	1	2	-	1	-	-	1	1	-	-	2
CO3	2	2	2	2	1	2	-	1	-	-	1	1	-	-	2
CO4	2	2	2	2	1	2	-	1	-	-	1	1	-	-	2
CO5	2	2	2	2	1	2	-	1	-	-	1	1	-	-	2
CO6	2	2	2	-	1	2	-	1	-	-	1	1	-	-	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.	06	
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	06	
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.	06	
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.	06	
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.	06	
Unit-VI	FUTURE OF BUSINESS INTELLIGENCE	No. of Hours	COs
	Emerging Technologies, Machine Learning, Predicting the Future with the help of Data Analysis, BI Search & Text Analytics – Advanced Visualization – Rich Report, Future beyond Technology.	06	
Text Books:			
<ol style="list-style-type: none"> 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.

IT414D: Software Defined Network (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: Computer Network	

Course Objectives

1. To learn the fundamentals of software defined networks.
2. To understand the separation of the data plane and the control plane.
3. To study about the Data Center
4. To study about the SDN Programming.
5. To learn about security issues and challenges in SDN.
6. To study about the various applications of SDN

Course Outcomes (COs):

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

Course Outcome (s)		Bloom's Taxonomy	
		Level	Descriptor
CO1	Analyze the evolution of software defined networks	2	Understand
CO2	Express the various components of SDN and their uses	3	Apply
CO3	Explain the use of SDN in the current networking scenario	3	Apply
CO4	Understand SDN Programming.	2	Understand
CO5	Understand security issues and challenges in SDN.	3	Understand
CO6	Design and develop various applications of SDN	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	-	-
CO2	3	-	-	3	-	-	-	-	-	-	-	-	3	-	-
CO3	3	-	-	3	-	-	-	-	-	-	-	-	3	-	-
CO4	3	-	-	3	-	-	-	-	-	-	-	-	3	-	-
CO5	3	-	-	3	-	-	-	-	-	-	-	-	3	-	-
CO6	3	-	-	3	-	-	-	-	-	-	-	-	3	-	-

Course Contents			
Unit-I	INTRODUCTION TO SDN	No. of Hours	COs
	History of Software Defined Networking (SDN) – Modern Data Center – Traditional Switch Architecture – Why SDN – Evolution of SDN – How SDN Works – Centralized and Distributed Control and Data Planes	06	CO1
Unit-II	OPEN FLOW & SDN CONTROLLERS	No. of Hours	COs
	Open Flow Specification – Drawbacks of Open SDN, SDN via APIs, SDN via Hypervisor- Based Overlays – SDN via Opening up the Device – SDN Controllers – General Concepts	06	CO2
Unit-III	DATA CENTERS	No. of Hours	COs
	Multitenant and Virtualized Multitenant Data Center – SDN Solutions for the Data Center Network – VLANs – EVPN – VxLAN – NVGRE	06	CO3
Unit-IV	SDN PROGRAMMING	No. of Hours	COs
	Programming SDNs: Northbound Application Programming Interface, Current Languages and Tools, Composition of SDNs -Network Functions Virtualization (NFV) and Software Defined Networks: Concepts, Implementation and Applications	06	CO4
Unit-V	SDN SECURITY	No. of Hours	COs
	Security Characteristics of SDN, Security Analysis and Potential attacks in SDN, Security Principles of SDN, Solutions to the security issues in SDN, Network Security enhancement using the SDN Framework – Issues and Challenges, Threats to SDN -Networks, Controllers, Applications.	06	CO4
Unit-VI	SDN APPLICATIONS	No. of Hours	COs
	SDN applications-Reactive versus Proactive Applications, Analysing Simple SDN Applications, A Simple Reactive Java Application, Using the Floodlight Controller, Using the Open Daylight Controller, Access Control for the Campus, Traffic Engineering for Service Providers.	06	CO6
Text Books:			
<ol style="list-style-type: none"> 1. Paul Goransson and Chuck Black, —Software Defined Networks: A Comprehensive Approach, First Edition, Morgan Kaufmann, 2014. 2. Thomas D. Nadeau, Ken Gray, —SDN: Software Defined Networks, O'Reilly Media, 2013. 3. SiamakAzodolmolky, “Software Defined Networking with Open Flow, Packt Publishing, 2013, ISBN: 9781849698726. 			
Reference Books:			
<ol style="list-style-type: none"> 1. Vivek Tiwari, —SDN and Open Flow for Beginners, Amazon Digital Services, Inc., 2013. 2. Fei Hu, Editor, —Network Innovation through Open Flow and SDN: Principles and Design, CRC Press, 2014. Berouz Forouzan, “Cryptography and Network Security”, 2 edition, TMH, ISBN :9780070702080 3. Open Networking Foundation (ONF) Documents, https://www.opennetworking.org, 2015. 			

IT415 :Cryptocurrency technology and Smart ContractLaboratory

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

Prerequisite Course: Basic of Mathematics, Computer Fundamentals& Programming

Course Objectives:

1. Understand and explore the working of Blockchain technology.
2. Apply the learning of solidity and de-centralized apps on Ethereum
3. Apply the Blockchain activities in real world application.

Course Outcomes (COs): After successful completion of the course, student will be able to

Course Outcome (s)		Bloom's Taxonomy	
		Level	Descriptor
CO1	Understand and explore the working of Blockchain technology.	2	Understand
CO2	Apply the learning of solidity and de-centralized apps on Ethereum	3	Apply
CO3	Apply the working of Smart Contracts	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	1	2	2	1	2	-	1	-	-	1	1	2	3	-
CO2	1	1	2	2	1	2	-	1	-	-	1	1	2	3	-
CO3	1	1	2	2	1	2	-	1	-	-	1	1	2	3	-

Guidelines: This Cryptocurrency technology and Smart Contract Laboratory course has Cryptocurrency technology and Smart Contract 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 examination will comprise of implementation of assignments and related theory. 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 using open-source platform.

Suggested List of Assignments

Sr. No.	Assignment	No. of Hours	COs
1.	Create a Simple Blockchain in any suitable programming language.	2 Hrs.	CO1
2.	Using Java Implement Digital Signatures in Cryptography	2 Hrs.	CO1
3.	Use Geth to Implement Private Ethereum Block Chain.	2 Hrs.	CO2
4.	Build Smart Contract using Solidity Language using Remix IDE.	2 Hrs.	CO2
5.	Create Case study of Block Chain being used in illegal activities in real world.	2 Hrs	CO3
6.	Using Python Libraries to develop Block Chain Application	2 Hrs.	CO3

Text Books:

1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, "Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction", Princeton University Press, 2016.

Reference Books:

1. Antonopoulos, "Mastering Bitcoin".
2. Antonopoulos and G. Wood, "Mastering Ethereum".
3. D. Drescher, "Blockchain Basics", Apress, 2017.

IT416 : Ethical Hacking Laboratory

Teaching Scheme		Examination Scheme	
Practical: 2 Hrs./Week		Term Work:	NA
		Oral:	NA
		Practical:	50 Marks
Credits: 1		Total:	50 Marks
Prerequisite Course: Cyber Security			

Course Objectives			
<ol style="list-style-type: none"> 1. To implement different scanning & enumeration methodologies. 2. To implement password hacking and its countermeasures. 3. To implement penetration testing using various devices 			
Course Outcomes (COs):			
After successful completion of the course, the student will be able to			
Course Outcome (s)			Bloom's Taxonomy
			Level
			Descriptor
CO1	Implement different scanning & enumeration methodologies		3
CO2	Implement password hacking and its countermeasures.		3
CO3	Implement penetration testing using various devices.		3

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	2	2	3	2	1	1	2	2	3	1
CO2	3	3	2	3	3	2	2	3	2	1	1	2	2	3	1
CO3	3	3	2	3	3	2	2	3	2	1	1	2	2	3	1

Guidelines: This Ethical Hacking Laboratory course has Ethical Hacking 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 examination will comprise of implementation of assignments and related theory. 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 using open-source platform.

Suggested List of Assignments

Sr. No.	Assignment	No. of Hours	COs
1.	Installation of Kali Linux Operating System using VMware.	02	CO1
2.	Implement Network and Port Scanning using Scanning Tools.	02	CO1
3.	Implement Persistent and Non-Persistent XSS Attack.	02	CO2
4.	Implement Password Cracking Using the Password Cracking Tools.	02	CO2
5.	Implement SQL Injection on a Live Webpage.	02	CO2
6.	Implement Network Pentesting and execute various Meterpreter commands.	02	CO3

Text Books:

1. EC-Council, "Ethical Hacking and Countermeasures: Attack Phases", Cengage Learning, 2010.
2. Jon Erickson, "Hacking, 2nd Edition: The Art of Exploitation", No Starch Press Inc., 2008.
3. Michael T. Simpson, Kent Backman, James E. Corley, "Hands-On Ethical Hacking and Network Defence", Cengage Learning, 2013.

Reference Books:

1. Patrick Engebretson, "The Basics of Hacking and Penetration Testing – Ethical Hacking and Penetration Testing Made Easy", Second Edition, Elsevier, 2013.
2. RafayBoloach, "Ethical Hacking and Penetration Testing Guide", CRC Press, 2014.

eLearning Resources:

1. Ethical Hacking Masterclass offered by Infosys Springboard
https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013094417601454080_1893_shared/overview
2. Ethical Hacking Essentials (EHE) offered by EC-Council
<https://www.coursera.org/learn/ethical-hacking-essentials-ehe/home>

IT419: Project Stage - II	
Teaching Scheme	Examination Scheme
Lectures: 8 Hrs./Week	Term Work: 100 Marks
	Oral: 50 Marks
	Practical: NA
Credits: 4	Total: 150 Marks
Prerequisite Course: Project Stage-I	

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				

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															

Course Contents

Review 3: Implementation

Deliverables:

1. 50% Implementation

Review 4: Complete project & Testing

Deliverables:

1. 100% implementation.
2. Testing.
3. Performance Analysis.
4. 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.

**MC 418 : Group Reading (saamuhik vaachan) of classics
(Mandatory Course-VIII)**

Teaching Scheme	Examination Scheme
Lectures: 1 Hrs./Week	Term Work: NA
	Oral : NA
	Practical: NA
Credits: Non Credit	Total: NA

Course Contents

This will make group to read one or two books during a semester.

Process: An hour may be fixed for a small group for a particular classic. Group sits and each person reads aloud (if possible with proper modulation) taking turns. This if done properly for an hour one may complete 30-40 pages in an hour. A normal classic can be finished in 15 to 20 days. If serious books on philosophy etc. are taken up a discussion can be held after every idea is complete.

SANJIVANI RURAL EDUCATION SOCIETY'S
SANJIVANI COLLEGE OF ENGINEERING
KOPARGAON

(An Autonomous Institute Affiliated to SPPU Pune)



DEPARTMENT OF INFORMATION
TECHNOLOGY
COURSE CURRICULUM - 2019 PATTERN
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		

About offered 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- 2019 PATTERN
FINAL YEAR B. TECH. INFORMATION TECHNOLOGY

SEMESTER- VII

HONORS SPECIALIZATION IN CYBER SECURITY

Course		Course Title	Teaching Scheme Hours/ Week			Credits	Evaluation Scheme-Marks						
Cat.	Code		L T P				Theory			OR	PR	TW	Total
			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

SEMESTER- VIII

HONORS SPECIALIZATION IN CYBER SECURITY

Course		Course Title	Teaching Scheme Hours/ Week			Credits	Evaluation Scheme-Marks						
Cat.	Code		L T P				Theory			OR	PR	TW	Total
			ISE	ESE	CIA								
HSIT	IT8106	Mobile Hacking	4	-	-	4	30	50	20	-	-	-	100
HSIT	IT8107	Mobile Hacking Laboratory	-	-	2	1	-	-	-	-	-	50	50
		Total	4	-	2	5	30	50	20	-	-	50	150

IT8104 : Ethical Hacking & Digital Forensic Tools (Honor 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:			
<ul style="list-style-type: none"> Foundation for Cyber Security 			
Course Objectives			
<ul style="list-style-type: none"> To understand the basics of ethical hacking. To analyze different Vulnerabilities in a web application and servers. To explore the penetration testing skills To implement Pentest tools. To understand the basics of Incidence Response. 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	--	--	1	--	1	1	--	1	--	3	--
CO2	--	3	--	1	--	--	1	--	2	--	1	2	--	3	--
CO3	--	--	2	--	2	1	--	--	2	--	--	2	--	3	--
CO4	2	--	3	--	3	1	--	2	2	1	2	2	--	3	--
CO5	--	--	--	1	--	--	1	--	1	--	--	1	--	3	--
CO6	--	--	--	1	--	--	1	--	1	1	--	1	--	3	--

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

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	6 Hrs.	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	6 Hrs.	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	6 Hrs.	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	6 Hrs.	CO4
Unit-V	INCIDENCE RESPONSE	No.of Hours	COs
	Introduction, Investigation Preparation, Detection and analysis, Containment, Eradication & Recovery, Post Incident Activities	6 Hrs.	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	6 Hrs.	CO6
Text Books:			
<ol style="list-style-type: none"> 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:			
<ol style="list-style-type: none"> 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/>

Online Course :

<https://www.udemy.com/course/the-complete-ethical-hacking-course/>

<https://www.udemy.com/course/fundamentals-of-computer-forensics/>

<https://www.coursera.org/learn/ibm-penetration-testing-incident-response-forensics#syllabus>

IT8105: Ethical Hacking & Digital Forensic Tools Laboratory			
Teaching Scheme	Examination Scheme		
Lectures: 2 Hrs./Week	Term Work:	NA	
	Oral :	50 Marks	
	Practical:	NA	
Credits: 01	Total:	50 Marks	
Prerequisite Course:			
<ul style="list-style-type: none"> Ethical Hacking & Digital Forensic Tools 			
Course Objectives			
<ul style="list-style-type: none"> To install different softwares and set up OS for ethical hacking practicals. To analyze different Vulnerabilities in a web application and networks. To implement security and hacking tools with Python. To implement SQL injection to find Vulnerabilities. To understand the basics of Incidence Response. To implement tools like keylogger and backdoor. 			
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	Implement security and hacking tools with Python.	3	Apply
CO4	Implement SQL injection to find Vulnerabilities.	3	Apply
CO5	Understand the basics of Incidence Response.	2	Understand
CO6	Implement tools like keylogger and backdoor.	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	--
CO5	--	3	--	1					2	1		2	--	3	--
CO6	2	--	1		3			2			2		--	3	--

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

Guidelines: This Ethical Hacking & Digital Forensic Tools Laboratory course has Ethical Hacking & Digital Forensic Tools as the theory course. 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.

Suggested List of Assignments

Sr. No.	ASSIGNMENTS	No.of Hours	Cos
1	Assignment on installation of virtual box	2 Hrs.	CO1
2	Assignment on installation of Kali Linux	2 Hrs.	CO1
3	Assignment on Dark Web	2 Hrs.	CO2
4	Assignment on Network pentesting	2 Hrs.	CO2
5	Assignment on SQL injection	2 Hrs.	CO4
6	Assignment on setup of python for ethical hacking	2 Hrs.	CO3
7	Assignment on keylogger	2 Hrs.	CO6
8	Assignment on Backdoor	2 Hrs.	CO6
9	Case study on Incidence Response	2 Hrs.	CO5

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/>

Online Course :

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

IT8106: Mobile Hacking			
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	
Course Objectives			
<ol style="list-style-type: none"> 1. To understand the fundamental techniques of Android OS and Nethunter. 2. To Understand the vulnerabilities of Man-In-Middle attack applications and to protect those applications from attacks. 3. To Implement pentesting on Andriod OS. 4. To understand the fundamentals of Reverse Engineering for Andriod mobile. 5. To learn fundamentals and advanced concepts SQL injection. 6. To find vulnerabilities of Andriod applications and various attacks. 			
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 fundamental techniques of Android OS and Nethunter.		2
CO2	Understand the vulnerabilities of Man-In-Middle attack applications and to protect those applications from attacks.		2
CO3	Implement pentesting on Andriod OS.		3
CO4	understand the fundamentals of Reverse Engineering for Andriod mobile.		2
CO5	Learn fundamentals and advanced concepts of SQL injection.		2
CO6	Find vulnerabilities of Andriod applications and various attacks.		3

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)

Course Contents			
Unit-I	INTRODUCTION	No.of Hours	COs
	Android: Introduction, OS, Architecture, Debug Bridge, Manifest. Kali Nethunter: Introduction, Different Versions, Working and Features.	Hrs. 6	CO1
Unit-II	SPYING	No.of Hours	COs
	Spying: Introduction, Man-In-Middle Attack, Bad USB with MIMA, ARP poisoning with MIMA, and Fake Access Point Theory with MIMA.	Hrs. 6	CO2
Unit-III	PENTESTING	No.of Hours	COs
	Pentesting: Introduction, Scope, Analyze log file and find the secret information using Logcat.	Hrs. 6	CO3
Unit-IV	REVERSE ENGINEERING	No.of Hours	COs
	Reverse Engineering: Introduction, information about Task, Details about Dex2Jar tool and JD-Gui Tool for reverse engineering.	Hrs. 6	CO4
Unit-V	SQL INJECTION	No.of Hours	COs
	SQL Injection: Introduction, SQL Injection attack on Android, Drozer: Introduction, Commands, and SQL Injection.	Hrs. 6	CO5
Unit-VI	CRACK ENCRYPTION	No.of Hours	COs
	Crack Encryption: Introduction, Algorithms, details of the encryption process in Android, information about the Task, Analyze the code and find the Encryption algorithm.	Hrs. 6	CO6
Text Books:			
<ol style="list-style-type: none"> 1. Hacking Exposed Mobile Security Secrets & Solutions - Security Secrets and Solutions by Bergman Neil ,McGraw Hill Education India, ISBN: 9789351342786, 9789351342786 2. Hacking Android by Srinivasa Rao Kotipalli, Mohammed A. Imran, Packt Publishing, ISBN: 9781785883149 			
Reference Books:			
<ol style="list-style-type: none"> 1. Android Hacking : Advance Practical Guide with Tools 2022, By Aamer Khan, Publisher: Code Academy, ISBN: 9789395478786 2. Android™ Hacker's Handbook By Joshua J. Drake, Pau Oliva Fora, Zach Lanier, Collin Mulliner, Stephen A. Ridley and Georg Wicherski, Published by John Wiley & Sons, Inc, ISBN: 978-1-118-60864-7 			
Online Course :			
Udemy:			
<ol style="list-style-type: none"> 1) https://www.udemy.com/course/the-complete-mobile-ethical-hacking-course/ 2) https://www.udemy.com/course/full-mobile-hacking-course/ 			
Infosys Spring Board:			
Learn Hacking Using Android			

IT8107: Mobile Hacking Laboratory				
Teaching Scheme		Examination Scheme		
Lectures: 2 Hrs./Week		Term Work:	NA	
		Oral :	50 Marks	
		Practical:	NA	
Credits: 01		Total:	50 Marks	
Prerequisite Course:				
<ul style="list-style-type: none"> • Basic Ethical Hacking and Digital Forensics Tool 				
Course Objectives				
<ol style="list-style-type: none"> 1. To Understand the fundamental mechanisms of Netwhunter and Spying of Andriod. 2. To Implement SQL injection to find Vulnerabilities 3. To be able to Implement reverse engineering and security mechanisms. 				
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 Netwhunter and Spying of Andriod.		2	Understand
CO2	Implement SQL injection to find Vulnerabilities		3	Apply
CO3	To be able to Implement reverse engineering and security mechanisms.		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

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

Suggested List of Assignments			
Sr. No.	ASSIGNMENTS	No.of Hours	Cos
1	Assignment on Nethunter	2 Hrs.	CO1
2	Assignment on Spying	2 Hrs.	CO1
3	Assignment on Pentesting	2 Hrs.	CO2
4	Assignment on SQL injection	2 Hrs.	CO2
5	Assignment on Reverse Engineering	2 Hrs.	CO3
6	Assignment on Cracking security	2 Hrs.	CO4
Text Books:			
3. Hacking Exposed Mobile Security Secrets & Solutions - Security Secrets and Solutions by Bergman Neil ,McGraw Hill Education India, ISBN: 9789351342786, 9789351342786			
4. Hacking Android by Srinivasa Rao Kotipalli, Mohammed A. Imran, Packt Publishing, ISBN: 9781785883149			
Reference Books:			
1. Android Hacking : Advance Practical Guide with Tools 2022, By Aamer Khan, Publisher: Code Academy, ISBN: 9789395478786			
2. Android™ Hacker's Handbook By Joshua J. Drake, Pau Oliva Fora, Zach Lanier, Collin Mulliner, Stephen A. Ridley and Georg Wicherski, Published by John Wiley & Sons, Inc, ISBN: 978-1-118-60864-7			
Online Course :			
Udemy:			
1) https://www.udemy.com/course/the-complete-mobile-ethical-hacking-course/			
2) https://www.udemy.com/course/full-mobile-hacking-course/			
Infosys Spring Board:			
Learn Hacking Using Android			