SOMAIYA VIDYAVIHAR UNIVERSITY

K J Somaiya College of Engineering

Syllabus

B. Tech. Information Technology
(Third Year Semester V and VI)

From
Academic Year 2022–23
(SVU 2020)
Approved by FOET 06/05/2022 and Academic Board 06/07/2022
TY B.Tech./IT/Revision 1.0

K. J. Somaiya College of Engineering, Vidyavihar, Mumbai – 77
(A Constituent college of Somaiya Vidyavihar University)

It is notified for information of all concerned that the Board of Studies at its meeting held on 19/04/2022 and the subsequent meeting of Faculty of Engineering & Technology held on 06/05/2022 and the Academic Council held on 06/07/2022 amended the syllabus of TY B.Tech. in Information Technology and same be brought in to force from Academic Year 2022-23 with immediate effect. The notification and revised syllabus is uploaded on website.

Date: 08/07/2022 HOD, IT

Preamble

Technology is an integral part of everyday life. An Engineering education in Information Technology gives broad exposure to various technical subjects that develop skills that are transferable to most industries such as problem solving, decision making, innovation, project management, team working and communication which will contribute to a rapidly changing technological environment.

Academic Autonomy conferred by the University of Mumbai from the Academic Year 2014-15, gave us the freedom to develop and implement our own curriculum KJSCE2014 with features such as inclusion of choice based Interdisciplinary Course (IDC), Audit Courses, Add on Credit Courses, Add on Audit Courses, Exposure Courses, etc. Our revision in syllabus KJSCE2018, was introduced from the academic year 2018-19, has been designed based on the revised AICTE guidelines as well as various accrediting bodies. Some of the highlights of the KJSCE2018 syllabus are: more focus on hands on, wide choice for branch specific electives, more number of open or interdisciplinary electives, streamlined courses based on thrust areas, increased opportunity for internships, etc. Laboratory courses like Programming labs will enhance the practical skills of the students.
With the formulation of Somaiya Vidyavihar University, the curriculum of SVU 2020 started from the academic year 2020-2021. Some of the highlights are introduction of Minor degree, Honor degree. More option for programming Laboratory courses including a course of Competitive Programming laboratories to prepare the students better in terms of programming skills.

We at IT department of KJSCE endeavor continuously to enable our students to move forward and confidently embrace change rather than follow; to innovate rather than stagnate and to initiate rather respond to become efficient technocrats and dynamic entrepreneurs.

Dr. Ujwala Bhangale
Head, Chairperson Board of Studies
Department of Information Technology

Vision

To become a center of excellence for holistic education by preparing world class professionals in the dynamic field of Information Technology.

Mission

Providing quality education to,

- Develop competent IT professionals with ethical values and enable them in lifelong learning
- Promote conducive ambience for research and creativity

Program Educational Objectives (PEO)

A graduate of Information Technology will

PEO1: Excel in professional career and contribute to social needs through Information Technology

PEO2: Pursue higher education, conduct research, demonstrate professionalism and ethics

PEO3: Exhibit innovation, adaptability, team work, leadership and communication skills

Program Outcomes (PO):

Engineering Graduates will be able to:

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, cultural, environmental, health, safety and legal issues relevant to the professional engineering practice; understanding the need of sustainable development.

PO7: Multidisciplinary competence: Recognize/ study/ analyze/ provide solutions to real-life problems of multidisciplinary nature from diverse fields.

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

PSO 1: Articulate, design, implement reliable, scalable, secure IT based solutions using latest practices and technologies.

PSO 2: Demonstrate competency of data analytics, interpretation, artificial intelligence in design and development of software systems.

Acronym for category of courses		Acronyms used in syllabus document	
Acronym	**Definition**	**Acronym**	**Definition**
BS	Basic Science Course	**CA**	Continuous Assessment
ES	Engineering Science	**ESE**	End Semester Exam
HS	Humanities and Social Sciences including Management Course	**IA**	Internal Assessment
PC	Professional Core Course	**O**	Oral
PE	Professional Elective Course	**P**	Practical
OE	Open Elective Course	**P&O**	Practical and Oral
LC	Laboratory Course	**TH**	Theory
PR	Project	**TUT**	Tutorial
AC	Audit Course	**TW**	Term work
AOCC	Add on Credit Course	**ISE**	In semester exam
AOAC	Add on Audit Course	**CO**	Course Outcome
AVAC	Add on Value Audit Course	**PO**	Program Outcome
EX	Exposure Course	**PSO**	Program Specific Outcome
I	Interdisciplinary Course		

Acronyms used in Course Code e.g. 116U04C501

Acronym Serially as per code	Definition
1	First revision after Somaiya Vidyavihar University (First revision SVU 2020)
16	College code for KJSCE
U	Undergraduate
04	Department of Information Technology
C	Core Course
L	Laboratory Course
P	Project
E	Elective
T	Tutorial
S	Common to all
M	Mandatory Non Credit Course
5	5- Semester 5 / 6- Semester 6
01	Course Number

Semester V
Credit Scheme

Course Code	Course Name	Teaching Scheme (Hrs.) TH – P – TUT	Total (Hrs.)	Credits Assigned TH – P – TUT	Total Credits	Course Category
116U04C501	Theory of Computation	3 – 0 – 1	04	3 – 0 – 1	4	PC
116U04C502	Operating System	3 – 0 – 0	03	3 – 0 – 0	3	PC
116U04C503	Information and Network Security	3 – 0 – 0	03	3 – 0 – 0	3	PC
116U04E5XX	Departmental Elective- I	3 – 0 – 0	03	3 – 0 – 0	3	PE
116U06O5XX	Open elective Technical	3 – 0 – 0	03	2 – 0 – 0	2	OE
116U06H5XX	Open Elective Humanities/ Management	2 – 0 – 0	02	2 – 0 – 0	2	HS
116U04L501	Web Programming – II (Server Side)	0 – 4 – 0	04	0 – 2 – 0	2	PC
116U04L502	Operating System Laboratory	0 – 2 – 0	02	0 – 1 – 0	1	PC
116U04L503	Information and Network Security Laboratory	0 – 2 – 0	02	0 – 1 – 0	1	PC
116U04L5XX	Departmental Elective-I Laboratory	0 – 2 – 0	02	0 – 1 – 0	1	PE
Total		**17 – 10 – 01**	**28**	**16 – 05 – 01**	**22**	**--**

Core electives streams (Semester V to Semester VII)

Streams	ELECTIVE – I Sem V	ELECTIVE – II Sem VI	ELECTIVE – III Sem VII	ELECTIVE–IV Sem VII
Artificial Intelligence	Artificial Intelligence	Exploratory Data Analytics	Machine Learning	Deep Learning
Information Security	Cyber Laws	Vulnerability Analysis And Penetration Testing	Digital Forensic	Malware analysis
Computer Vision	Computer Graphics And Virtual Reality	Digital Signal And Image Processing	Computer Vision	Applications Of Image Processing
Application Development	UI Programming	Development Frameworks 1	Digital Marketing	DevOps
		Development Frameworks 2		
Data And Network Infrastructure	Advanced Computer Network	Internet Of Things	Massive Online Data analytics	High Performance Computing
				Cyber Physical Systems And Security

Semester V Departmental Elective-I Courses

Course Code	Name of the course
116U04E511	Artificial Intelligence
116U04E512	Cyber Laws
116U04E513	Computer Graphics and Virtual Reality
116U04E514	UI Programming
116U04E515	Advanced Computer Network

Semester V Open Elective Courses (Technical) offered by I.T. Department

Course Code	Name of the course
116U06O541	Development with Go
116U06O542	Fundamentals of Cloud Computing
116U06O543	Foundations of Cyber Security
116U06O544	E-Business

Semester V
Examination Scheme

Course Code	Course Name	Examination Scheme							
		Marks							
		CA		ESE	TW	O	P	P&O	Total
		ISE	IA						
116U04C501	Theory of Computation	30	20	50	25	--	--	--	125
116U04C502	Operating System	30	20	50	--	--	--	--	100
116U04C503	Information and Network Security	30	20	50	--	--	--	--	100
116U04E5XX	Departmental Elective- I	30	20	50	--	--	--	--	100
116U06O5XX	Open elective Technical	30	20	--	--	--	--	--	50
116U06H5XX	Open Elective Humanities/ Management	30	20	--	--	--	--	--	50
116U04L501	Web Programming – II (Server Side)	--	--	--	50	--	--	50	100
116U04L502	Operating System Laboratory	--	--	--	25	25	--	--	50
116U04L503	Information and Network Security Laboratory	--	--	--	25	--	25	--	50
116U04L5XX	Departmental Elective-I Laboratory	--	--	--	25	25	--	--	50
Total		**180**	**120**	**200**	**150**	**50**	**25**	**50**	**775**

Semester VI
Credit Scheme

Course Code	Course Name	Teaching Scheme (Hrs.) TH – P – TUT	Total (Hrs.)	Credits Assigned TH – P – TUT	Total Credits	Course Category
116U04C601	Object Oriented Software Engineering	3 – 0 – 0	03	3 – 0 – 0	3	PC
116U04C602	Modeling and Simulation	3 – 0 – 0	03	3 – 0 – 0	3	PC
116U04C603	Cloud Computing	3 – 0 – 0	03	3 – 0 – 0	3	PC
116U04E6XX	Departmental Elective-II	3 – 0 – 0	03	3 – 0 – 0	3	PE
116U06O6XX	Open Elective Technical	3 – 0 – 0	03	2 – 0 – 0	2	OE
116U06H6XX	Open Elective Humanities/ Management	2 – 0 – 0	02	2 – 0 – 0	2	HS
116U04L601	Object Oriented Software Engineering Laboratory	0 – 2 – 0	02	0 – 1 – 0	1	PC
116U04L602	Modeling and simulation Laboratory	0 – 2 – 0	02	0 – 1 – 0	1	PC
116U04L603	Cloud Computing Laboratory	0 – 2 – 0	02	0 – 1 – 0	1	PC
116U04L6XX	Departmental Elective-II Laboratory	0 – 2 – 0	02	0 – 1 – 0	1	PE
116U04P601	Mini project	0 – 2 – 0	02	0 – 2 – 0	2	PR
116U06N5XX	Mandatory Non Credit Course	1 – 0 – 0	01	0 – 0 – 0	--	MNCC
Total		**18 – 10 – 0**	**28**	**16 – 06 – 0**	**22**	**--**

Semester VI Departmental Elective-II Courses

Course code	Name of the Course
116U04E611	Exploratory Data Analytics
116U04E612	Vulnerability Analysis And Penetration Testing
116U04E613	Digital signal and Image Processing
116U04E614	Development Framework 1
116U04E615	Internet of Things
116U04E616	Development Framework 2

Semester VI Open Elective Courses offered by I.T. Department

Couse code	Name of the Course
116U06O641	User Interface Design and User Experience
116U06O642	Tools and Techniques for Ethical hacking
116U06O643	Blockchain
116U06O644	Software Program Management

Semester VI
Examination Scheme

Course Code	Course Name	Marks							
		CA		ESE	TW	O	P	P & O	Total
		ISE	IA						
116U04C601	Object Oriented Software Engineering	30	20	50	--	--	--	--	100
116U04C602	Modeling and Simulation	30	20	50	--	--	--	--	100
116U04C603	Cloud Computing	30	20	50	--	--	--	--	100
116U04E6XX	Departmental Elective-II	30	20	50	--	--	--	--	100
116U06O6XX	Open Elective Technical	30	20	--	--	--	--	--	50
116U04H6XX	Open Elective Humanities/ Management	30	20	--	--	--	--	--	50
116U04L601	Object Oriented Software Engineering Laboratory	--	--	--	25	--	--	25	50
116U04L602	Modeling and Simulation Laboratory	--	--	--	25	25	--	--	50
116U04L603	Cloud Computing Laboratory	--	--	--	25	--	--	50	75
116U04L6XX	Departmental Elective-II Laboratory	--	--	--	25	25	--	--	50
116U04P601	Mini project	--	--	--	25	25	--	--	50
116U06N5xx	Mandatory Non Credit Course	--	--	--	--	--	--	--	--
Total		**180**	**120**	**200**	**125**	**75**	**--**	**75**	**775**

Semester V

TY B. Tech. Information Technology

(KJSCE SVU 2020)

<table>
<tr><th>Course Code</th><th colspan="8">Course Title</th></tr>
<tr><td>116U04C501</td><td colspan="8">Theory of Computation</td></tr>
<tr><td></td><td colspan="2">TH</td><td>P</td><td colspan="2">TUT#</td><td colspan="3">Total</td></tr>
<tr><td>Teaching Scheme(Hrs.)</td><td colspan="2">3</td><td>--</td><td colspan="2">1</td><td colspan="3">4</td></tr>
<tr><td>Credits Assigned</td><td colspan="2">3</td><td>--</td><td colspan="2">1</td><td colspan="3">4</td></tr>
<tr><td rowspan="3">Examination Scheme</td><td colspan="9">Marks</td></tr>
<tr><td colspan="2">CA</td><td rowspan="2">ESE</td><td rowspan="2">TW</td><td rowspan="2">O</td><td rowspan="2">P</td><td rowspan="2">P&O</td><td rowspan="2">Total</td></tr>
<tr><td>ISE</td><td>IA</td></tr>
<tr><td></td><td>30</td><td>20</td><td>50</td><td>25</td><td>--</td><td>--</td><td>--</td><td>125</td></tr>
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Course prerequisites: Discrete Mathematics

Course Objectives: The course introduces students to the basics behind the modern age computer. Theory of Computer Science covers concepts and designing of basic as well as advanced mathematical models for computing. It also introduces the concept of un-decidability and intractable problems

Course Outcomes:

At the end of successful completion of the course the student will be able to

CO1: Design mathematical models of computation
CO2: Comprehend significance of regular expressions, grammars and its equivalence with automata
CO3: Understand advanced concepts in computation

Module No.	Unit No.	Details	Hrs.	CO
1	**Introduction to Finite Automata**		**10**	**CO1**
	1.1	●The concept of Automata, Computabilityand Complexity.Formal definition of a finite automaton		
	1.2	Deterministic Finite Automata		
	1.3	Non-Deterministic Finite Automata		
	1.4	Equivalence of DFAs and NFAs, DFA Minimization		
2	**Regular Expressions and Languages**		**08**	**CO2**
	2.1	Formal Definition of Regular Languages		
	2.2	Equivalence with Finite Automata		
	2.3	Regular Languages Properties		
	2.4	Chomsky Hierarchy, Pumping Lemma for Regular Languages		
3	**Context Free Languages**		**09**	**CO1, CO2**
	3.1	Formal definition of Context Free Grammars, Designing Context Free Grammars, Ambiguity		
	3.2	Chomsky Normal Form, Greibach Normal Form		
	3.3	Introduction to Pushdown Automata		
	3.4	Equivalence with Context Free Grammars, Pumping Lemma for Context Free Languages		
4	**Introduction to Turing Machines**		**09**	**CO1, CO3**
	4.1	The idea of Universal Computing Machine		
	4.2	Turing Machine definition, Variations of Turing Machines		
	4.3	Church's thesis, Halting Problem		
	4.4	●The Definition of Algorithm: Hilbert's problems, Terminology for describing Turing machines.		
5	**Un-decidability and Intractable Problems**		**09**	**CO3**

	5.1	●Decidability : Decidable Languages		
	5.2	A Language that is Not Recursively Enumerable, An Undecidable Problem That is RE		
	5.3	Undecidable Problems About Turing Machine, Post's Correspondence Problem		
	5.4	●The Classes P and NP		
		Total	**45**	

 # Term Work will consist of Tutorials covering entire syllabus. Students will be graded based on continuous assessment of their term work.

Recommended Books:

Sr. No.	Name/s of Author/s	Title of Book	Name of Publisher with country	Edition and Year of Publication
1.	John E. Hopcroft, Rajeev Motwani, Jefrey D. Ullman	*Automata Theory, Languages, and Computation*	Pearson Education, India	3rd Edition, 2009
2.	Michael Sipser	*Introduction to the Theory of Computation*	Cengage Learning Publications, India	3rd Edition, 2013
3.	Kavi Mahesh	*Theory of Computation : A problem solving approach*	Wiley India Pvt. Ltd.	1st Edition 2012

- **Instructor needs to provide additional resources to students for in-depth understanding and practical applicability of the indicated topic/topics.**

Course Code	Course Title							
116U04C502	Operating Systems							
	TH		P		TUT		Total	
Teaching Scheme(Hrs.)	03		--		--		03	
Credits Assigned	03		--		--		03	
Examination Scheme	Marks							
	CA		ESE	TW	O	P	P&O	Total
	ISE	IA						
	30	20	50	--	--	--	--	100

Course prerequisites:
Fundamentals of Computers.

Course Objectives:
In this course students will understand the basic structure of modern operating system. They will study the process management and demonstrate use of inter process communication, and will also understand the I/O management, memory management and file management system. They are also able to demonstrate open source operating systems like Linux.

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

CO1: Understand basic structure of modern operating system.
CO2: Demonstrate use of inter process communication.
CO3: Understand I/O management, memory management and file management.
CO4**:** Demonstrate open source standards usage.

Module No.	Unit No.	Details	Hrs.	CO
1	**Overview of Operating System**		**06**	**CO1**
	1.1	**Introduction to OS :**Interaction of OS and hardware, Goals of OS, Basic functions of OS, OS Services, System Calls, Types of system calls.		
	1.2	**Types of OS**: Batch, Multiprogramming, Time sharing, Parallel, Distributed & Real-time OS.		
	1.3	**Structures of OS**: Monolithic, Layered, Virtualization-Virtual Machines, Microkernels		
	1.4	Modern UNIX systems		
2	**Process Management**		**10**	**CO2**
	2.1	**Processes:** Process Concept, process creation, suspension and termination, Process States: 2, 5, 7 state models, Process Description, Process Control block.		
	2.2	**Threads**: Multithreading models, Thread implementations – user level and kernel level threads, Symmetric Multiprocessing.		
	2.3	**Uniprocessor Scheduling**: Scheduling Criteria, Types of Scheduling: Preemptive, No preemptive, Long-term, Medium-term, Short-term schedulers. **Scheduling Algorithms**: FCFS, SJF, SRTF, RR, Priority.		
	2.4	**Multiprocessor Scheduling**: Granularity, Design Issues, Process Scheduling. Thread Scheduling, Real Time Scheduling		
	2.5	Process Security		
3	**Inter process Communication**		**09**	**CO2**
	3.1	**Concurrency**: Issues with concurrency, Principles of Concurrency, critical section and race condition, Pipe and types of pipe.		
	3.2	**Mutual Exclusion**: Hardware and Software approaches, OS/Programming Language support: Semaphores, Mutex and Monitors.		
	3.3	**Classical Problems of Synchronization**: Readers-Writers problem, Producer Consumer problem, Dining Philosopher problem		
	3.4	**Deadlock**: Principles of deadlock, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Deadlock Recovery		
4	**Memory Management**		**12**	CO3
	4.1	**Memory Management concepts:** Memory Management requirements, Memory Partitioning: Fixed, Dynamic Partitioning, Buddy Systems, Fragmentation, Paging, Segmentation, Address translation.		
	4.2	**Placement Strategies**: First Fit, Best Fit, Next Fit and		

		Worst Fit.		
	4.3	**Virtual Memory**: Cache memory organization, Cache architecture (L1, L2, L3), address mapping techniques. Cache Coherence, Swapping issues, Thrashing, VM with Paging, Page Table Structure, Inverted Page Table, Translation Lookaside Buffer, Page Size, VM with Segmentation,VM with combined paging and segmentation.		
	4.4	**Page Replacement Policies**: FIFO, LRU, Optimal		
	4.5	Windows/Linux memory management		
5	**Input Output and File Management**		**08**	**CO3, CO4**
	5.1	**I/O management:** I/O Devices - Types, Characteristics of devices, OS design issues for I/O management, I/O Buffering.		
	5.2	**Disk scheduling** : Disk scheduling algorithms		
	5.3	**File Management**: Concepts, File Organization and access, File Directories, File Sharing, File allocation, Secondary Storage Management, Free Space management, Security.		
	5.4	• **Windows file system** : FAT, FAT32, NTFS, ReFS		
	5.5	• **Linux file system** : ext-2,3,4, reiserFS, XFS, JFS		
		Total	**45**	

Recommended Books:

Sr. No.	Name/s of Author/s	Title of Book	Name of Publisher with country	Edition and Year of Publication
1.	Silberschatz A, Galvin P, Gagne G,	*Operating System Concepts*	Wiley	VIIIth Edition, 2011.
2.	William Stallings	*Operating Systems:- Internals & Design Principles*	Pearson	VIIth Edition, , 2012.
3.	Andrew S. Tanenbaum, Herbert Bos,	*Modern Operating Systems*	Prentice Hall,	IVth Edition, 2014.
4.	D M Dhamdhere	*Operating System Programming and Operating Systems*	Tata McGraw	IInd Revised Edition, 2012
5.	Richard Blum and Christine Bresnahan,	*Linux Command Line & Shell Scripting*	Wiley	IInd Edition edition, , 2012.

- **Instructor needs to provide additional resources to students for in-depth understanding and practical applicability of the indicated topic/topics.**

Course Code	Course Title						
116U04C503	Information and Network Security						
	TH		P	TUT	Total		
Teaching Scheme(Hrs.)	3		--	--	3		
Credits Assigned	3		--	--	3		
Examination Scheme	Marks						
	CA		ESE	TW	O	P	P&O	Total
	ISE	IA						
	30	20	50	--	--	--	--	100

Course prerequisites: Fundamentals of Number theory, Networking, Software development and Web development.

Course Objectives: Information is one of the most important organization assets. For an organization, information is valuable and should be appropriately protected. So Information security goals, vulnerabilities, threats and various attacks are covered in this course. Cryptography in digital world offers three core areas that protect us and our data from attempt theft, theft or an unauthorized use of our data and possible fraud. This course describes basics of cryptography, types of cryptography and Hash functions. Access to any type of information should be authenticated by some means. This course helps to understand different Authentication methods, protocols and Authorization methods. Different software, web and network security issues are also covered in this course.

Course Outcomes:

At the end of successful completion of the course the student will be able to

CO1: Describe the basics of Information Security
CO2: Illustrate different cryptographic algorithms for security.
CO3: Describe various access control policies and models.
CO4: Understand Security issues related to Software, Web and Networks.

Module No.	Unit No.	Details	Hrs.	CO
1	**Introduction**		**2**	**CO1**
	1.1	Information Security and its goals – CIA.		
	1.2	Threats, Vulnerabilities and Attacks. OSI security architecture: Security Services and Mechanisms. Mapping of goals to security services and mechanisms.		
2	**Cryptography**		**16**	**CO 2**
	2.1	Basics of Cryptography - Shannon's characteristics of good cipher, confusion and diffusion, concepts of encryption, decryption, non-repudiation. Historical background, Transposition - Row transposition, Column transposition and Double transposition cipher, Substitution- Mono-alphabetic Ciphers - shift cipher or additive cipher, multiplicative cipher, affine cipher, Polyalphabetic Ciphers - Playfair, Vignere.		
	2.2	Classification of cipher algorithms, Stream Ciphers- RC4, A5/1, Block Ciphers: Festal structure, DES, AES, problems with symmetric key cryptography, compare and contrast ciphers, shared key generation using Diffie-Hellman key exchange protocol, Asymmetric key cryptography : concept and applications, RSA: Key generation, encryption/decryption, concept of digital signature.		
	2.3	Cryptographic Hash Function: Properties, avalanche effect, Message Digest-MD5, SHA-1, MAC.		
	Self Learning : 3DES, attacks on Diffie-Hellman and countermeasures, Knapsack cipher. PKI: Functions, architecture, certificate revocation, HMAC.			
3	**Access Control**		**10**	**CO 3**
	3.1	Basic concepts of Access Control.		
	3.2	Authentication Methods: Password authentication, Token based, Biometric, Single – sign on.		
	3.3	Authentication Protocols–Introduction to properties of authentication protocols, Needham–Schroeder and Kerberos, Zero-Knowledge Proof.		
	3.4	Authorization: Access Control Matrix, ACLs, MAC, DAC, Role based access control. Covert channel, CAPTCHA		
	Self Learning : Multilevel security models-Bell-La-Padula and Biba's, Multilateral security models.			
4	**Software Security**		**04**	**CO 4**
	4.1	Software Flaws: Buffer Overflow, Incomplete Mediation, Race Conditions and associated attacks. Salami attack, Linearization attack.		
	4.2	Malwares, malware analysis – approaches, difficulties		

		and defense against untrusted code.		
5	**Network and Web Security**		**13**	**CO4**
	5.1	TCP/IP vulnerabilities, protocol flaws. Reconnaissance of network, Social Engineering, Packet sniffing and attacks - Session Hijacking and ARP Spoofing, IP spoofing, DoS, DDoS.		
	5.2	Firewall, IDS and Honeypots		
	● **5.3**	Web security basics and secure web programming. SSL/TLS and IPSec protocol		
	Self Learning : OWASP top 10 vulnerabilities, Email Privacy : PGP and S/MIME.			
		Total	**45**	

Recommended Books:

Sr. No.	Name/s of Author/s	Title of Book	Name of Publisher with country	Edition and Year of Publication
1.	Mark Stamp	*Information Security :Principles and Practice*	Wiley	2nd Edition 2011
2.	William Stallings	*Cryptography and Network Security*	Pearson Education	4th Edition 2014
3.	Behrouz A. Forouzan	*Cryptography and Network Security*	McGraw – Hill	2nd edition 2008
4.	Atul Kahate	*Cryptography and Network Security*	McGraw – Hill	4th Edition 2019
5.	Menezes Bernard	*Network Security And Cryptography*	Cenange Learning India Pvt. Ltd	Edition 2011

- **Instructor needs to provide additional resources to students for in-depth understanding and practical applicability of the indicated topic/topics.**

Course Code	Course Title							
116U04E511	Artificial Intelligence							
	TH		P	TUT	Total			
Teaching Scheme(Hrs.)	03		--	--	03			
Credits Assigned	03		--	--	03			
Examination Scheme	Marks							
	CA		ESE	TW	O	P	P&O	Total
	ISE	IA						
	30	20	50	--	--	--	--	100

Course prerequisites: Mathematics- Probability Theory, Data structure, Analysis of Algorithms

Course Objectives: This course introduces basic principles, techniques, and applications of Artificial Intelligence. The course coverage includes knowledge representation, logic, inference, problem solving, search algorithms, game theory, perception, learning, planning, and agent design. Students will develop familiarity with programming for AI applications.

Course Outcomes:

At the end of successful completion of the course the student will be able to

CO1: Understand structure, types and PEAS parameters of an AI (Artificial Intelligence) agent and formalize the problem.

CO2: Analyze and formalize the problem (as a state space, graph, etc.) and select the appropriate search method and write the algorithm.

CO3: Ability to formally state the problem and develop the appropriate proof for a given logical deduction problem.

CO4: Comprehend problems with uncertainty, formalize the problem and understand how solutions are found.

CO5: Understand fundamentals of learning in AI.

Module No.	Unit No.	Details	Hrs.	CO
1	**Introduction to AI and Intelligent Agents**		08	CO1
	1.1	Introduction to AI, AI Problems and AI techniques		
	1.2	ure of Intelligent agents, Types of Agents		
	1.3	Agent Environments PEAS representation for an Agent		
	1.4	Solving problems by searching, Problem Formulation		
2	**Uninformed , Informed and Adversarial Search Techniques**		13	CO2
	2.1	Uninformed search, DFS, BFS, Uniform cost search, Depth Limited Search, Iterative Deepening, Bidirectional search, Comparing different techniques		
	2.2	Informed search, Heuristic functions, Best First Search, Greedy BFS, A* Crypto-Arithmetic Problem, CSP and Backtracking for CSP, Performance Evaluation		
	2.3	●Local search algorithms and optimization problems, Hill Climbing, Simulated Annealing, Genetic algorithms		
	2.4	●Game Playing, Min-Max Search, Alpha Beta pruning		
	2.5	●Defining constraint satisfaction problems(CSP), constraint propagation, backtracking search for CSPs		
3	**Knowledge and Reasoning**		08	CO3
	3.1	A Knowledge Based Agent, Wumpus world Environment, Logic, Propositional Logic, Propositional theorem proving,		
	3.2	Syntax and semantics of first-order logic, propositional vs. First-order inference, Unification and Lifting		
	3.3	●Forward and Backward Chaining, Resolution		
4	**Uncertain Knowledge and Reasoning**		08	CO4
	4.1	Acting under uncertainty, Basic probability notation, Inference using full joint distributions, Bayes' rule and its use.		
	4.2	Representing knowledge in an uncertain domain, Semantics of Bayesian networks, Efficient representation		

		of conditional distributions		
	4.3	●Exact inference in Bayesian networks		
5	●**Learning**		**08**	**CO5**
	5.1	tive and Inductive learning, Supervised learning, Decision nduction Algorithm, Random Forest		
	5.2	Unsupervised Learning, Supervised vs Unsupervised Learning Introduction to fitting		
	5.3	Reinforcement Learning, Markov Decision Process, Q-learning		
		Total	**45**	

Recommended Books:

Sr. No.	Name/s of Author/s	Title of Book	Name of Publisher with country	Edition and Year of Publication
1.	Stuart Russell and Peter Norvig	*Artificial Intelligence: A Modern Approach*	Pearson, 2004	3rd Edition
2.	Luger, George F.	*Artificial intelligence : structures and strategies for complex problem solving*	Pearson Education, 2009	6th Edition
3.	Jason Brownlee.	*Master Machine Learning Algorithms*	eBook, 2017	Edition, v1.12
4.	Patrick H. Winston	*Artificial Intelligence*	Pearson Education, 1992	3rd Edition

- **Instructor needs to provide additional resources to students for in-depth understanding and practical applicability of the indicated topic/topics.**

Course Code	Course Title						
116U04E512	Cyber Laws						
	TH		P		TUT		Total
Teaching Scheme(Hrs.)	03		--		--		03
Credits Assigned	03		--		--		03
Examination Scheme	Marks						
	CA		ESE	TW	O	P	P&O	Total
	ISE	IA						
	30	20	50	--	--	--	--	100

Course prerequisites: Nil

Course Objectives:
The course "Cyber Law" introduces the students to cyber crimes, its categories and cases. Then it talks about the details of Cyber Laws and Policies. It gives the student idea about different laws applicable for the cyber crimes. Also students will understand the need of legal aspects of the digital business and e-commerce.

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

CO1: Understand Cyber Crime and its types.
CO2: Understand the fundamentals of Cyber laws pertaining to Cyber Crime.
CO3: Relate cyber laws to its applications in business and e-commerce

Module No.	Unit No.	Details	Hrs.	CO
1	**Introduction to Cyber-crime and IT Act 09 CO1**		**09**	**CO1**
	1.1	Concept of cyber space, Cyber-crime, Classification of Cyber Crime, Categories of Cybercrime ●Cybercrime – Examples and Cases		
	1.2	Need of Cyber Laws, Basics of Information Technology Laws.		
	1.3	IT Act; and Amendments: OFFENCES, UNCITRAL model		
2	**Intellectual Property Rights(IPR)**		**09**	**CO1**
	2.1	Introduction to Intellectual property rights ,Copyright, Patents, Trademarks, Trade secrets, Antitrust		
	2.2	Infringement and applicable laws-National and International perspective, Copyright act India, Patent Act India		
	2.3	●Case studies		
3	**Cyber Security Standards**		**09**	**CO2**
	3.1	General Data Protection Regulation(GDPR)		
	3.2	Children's online privacy protection ACT(COPPA)		
	3.3	North American Electric Reliability Corporation Critical Infrastructure Protection		
	3.4	NIST Cyber Security Framework		
4	**IT Security Law and Policy**		**09**	**CO3**
	4.1	E-Discovery, Electronic Evidences, Records retention and destruction, Evidence law		
	4.2	Email Retention, Forensics, Privacy Policies		
	4.3	E surveillance, whistle blowing, Vicarious Liability Self study- corporate policies		
5	**Contracting for Data Security and Digital Transactions**		**09**	**CO3**
	5.1	Digital Signatures		
	5.2	E-Contract: Click Through Agreements		
	5.3	Contract Formation, Battle of the Forms ●Case Studies		
		Total	**45**	

Recommended Books:

Sr. No.	Name/s of Author/s	Title of Book	Name of Publisher with country	Edition and Year of Publication
1.	Nina Godbole, Sunit Belapure	*Cyber Security- Understanding Cyber Crimes,Computer Forensics and Legal Prespectives"*	Wiley- India	First, 2011
2.	N. S. Nappinai	*Technology Laws Decoded*	LexisNexis	1st, 2017
3.	Nandan Kamath	*Laws relating to Computers, Internet and E- Commerce*	Universal Law Pub. Co., 2000	5th Edition 2012

- **Instructor needs to provide additional resources to students for in-depth understanding and practical applicability of the indicated topic/topics.**

Course Code	Course Title						
116U04E513	Computer Graphics and Virtual Reality						
	TH		P	TUT	Total		
Teaching Scheme(Hrs.)	3		--	--	3		
Credits Assigned	3		--	--	3		
Examination Scheme	Marks						
	CA		ESE	TW	O	P	P&O	Total
	ISE	IA						
	30	20	50	--	--	--	--	100

Course prerequisites: Basic Mathematics

Course Objectives: This course introduces different components of a graphics system to become familiar with building approach of graphics system components and algorithms related with them. Basic principles of 2-D and 3-D computer graphics are covered. It provides an understanding of how to scan convert the basic geometrical primitives, mapping from a world coordinates to device coordinates, clipping, and projections. Overview of virtual reality, underlying technologies, principles, and applications in covered in this course.

Course Outcomes:

At the end of successful completion of the course the student will be able to

CO1: Understand basic concepts used in computer graphics.
CO2: Illustrate different techniques in 2D transformations.
CO3: Apply various transformations in 3D domain.
CO4**:** Describe the fundamentals of virtual reality and its related technologies

Module No.	Unit No.	Details	Hrs.	CO
1	**Introduction to Computer graphics And Scan conversion**		12	CO 1
	1.1	Introduction, Display Devices, Bitmap and Vector based graphics, Overview of Coordinate system		
	1.2	Scan Conversion of: point, line using Digital differential analyzer& Bresenham's algorithm, circle using midpoint approach,		
	1.3	Curve Generation: Bezier and B-Spline curves. Introduction to fractals: generation procedure, classification, dimension and Koch Curve		
	1.4	Scan Converting Lines, Mid-point criteria, Problems of Aliasing, end-point ordering and clipping lines, Scan Converting Circles, Scan Converting Ellipses, Filling Polygons, edge data structure,		
	1.5	Clipping Lines algorithms– Cyrus-Beck, Cohen-Sutherland and Liang Barsky, Clipping Polygons, problem with multiple components.		
2	**Two-Dimensional Transformations**		12	CO 2
	2.1	Transformations and Matrices, Transformation Conventions, 2D Transformations, Homogeneous Coordinates and Matrix Representation of 2D Transformations		
	2.2	Translations and Homogeneous Coordinates, Rotation, Reflection, Scaling, Combined Transformation,		
	2.3	Transformation of Points, Transformation of The Unit Square, Solid Body Transformations, Rotation About an Arbitrary Point, Reflection through an Arbitrary Line, A Geometric Interpretation of Homogeneous Coordinates, The Window-to-Viewport Transformations		
3	**Three-Dimensional Transformations**		07	CO 3
	3.1	•Three Dimensional transformations**:** Translation, Scaling, Rotations, Composite Transformations, Projections: Parallel (Oblique and orthographic), Perspective (one Point)		
	3.2	Three Dimensional Viewing Pipeline , Viewing transformation		
	3.3	•Three-Dimensional object representation: Polygon Surfaces, Tables, Meshes		
4	**Virtual Reality and Virtual Environments**		06	CO 4
	4.1	The historical development of VR: Scientific landmarks Computer Graphics, Real-time computer graphics, Flight simulation, Virtual environments, Requirements for VR, benefits of Virtual reality		
	4.2	Hardware Technologies for 3D User Interfaces: Visual Displays Auditory Displays, Haptic Displays, Choosing Output Devices for 3D User Interfaces.		
	4.3	•3D User Interface Input Hardware: Input device		

		characteristics, Desktop input devices, Tracking Devices, 3D Mice, Special Purpose Input Devices, Direct Human Input, Home - Brewed Input Devices, Choosing Input Devices for 3D Interfaces.		
5	**Software Technologies**		**08**	**CO 4**
	5.1	Software Technologies: Database - World Space, World Coordinate, World Environment, Objects - Geometry, Position / Orientation, Hierarchy, Bounding Volume, Scripts and other attributes		
	5.2	•VR Environment - VR Database, Tessellated Data, LODs, Cullers and Occluders, Lights and Cameras, Scripts		
	5.3	Interaction - Simple, Feedback, Graphical User Interface, Control Panel, 2D Controls, Hardware Controls, Room / Stage / Area Descriptions, World Authoring and Playback, VR toolkits, Available software in the market		
	5.4	Self Learning Topic- VR Applications : Engineering, Architecture, Education, Medicine, Entertainment, Science, Training		
		Total	**45**	

Recommended Books:

Sr. No.	Name/s of Author/s	Title of Book	Name of Publisher with country	Edition and Year of Publication
1.	Donald D Hearn M. Pauline Baker Warren Carithers	*Computer Graphics with Open GL*	Pearson Education, India	Fourth, 2014
2.	R. K Maurya	*Computer Graphics with Virtual Reality*	Wiley India	Third, 2018
3.	Alan B Craig, William R Sherman and Jeffrey D Will	*Developing Virtual Reality Applications: Foundations of Effective Design*	Morgan Kaufmann, USA	First, 2009
4.	Doug A Bowman, Ernest Kuijff, Joseph J LaViola, Jr and Ivan Poupyrev	*3D User Interfaces, Theory and Practice*	Addison Wesley, USA	Second, 2017
5.	Gerard Jounghyun Kim	*Designing Virtual Systems: The Structured Approach*	Springer	2005

- **Instructor needs to provide additional resources to students for in-depth understanding and practical applicability of the indicated topic/topics.**

Course Code	Course Title							
116U04E514	UI Programming							
	TH			P		TUT		Total
Teaching Scheme(Hrs.)	3			--		--		03
Credits Assigned	3			--		--		03
Examination Scheme	Marks							
	CA		ESE	TW	O	P	P&O	Total
	ISE	IA						
	30	20	50	--	--	--	--	100

Course prerequisites: Nil

Course Objectives:
This course introduces concepts of user interface programming from user and programing perspective. The user interface programming broadly considers domain of user interaction and the World Wide Web (WWW or Web) and mobile. The course content imparts knowledge about web and mobile interface design.

At the end of successful completion of the course the student will be able to

CO1: Comprehend role of user and designer in User Interface Deign
CO2: Apply principles of information organization and navigation along with data handling in web interface design
CO3: Design mobile user interface with UI design patterns

Module No.	Unit No.	Details	Hrs.	CO
1	**Understanding User**		10	CO1
	1.1	Common problems with usability		
	1.2	Human Characteristics and Consideration in Design		
	1.3	Ordering of Screen Data and Content		
	1.4	Screen Navigation and Flow		
	1.5	Visual style and Aesthetics		
2	**Organization and navigation of the content**		07	CO2
	2.1	Information Architecture and Application structure patterns		
	2.2	Navigation, Signposts and wayfinding patterns		
3	**Web Interface Design**		10	CO2
	3.1	• In-Page Editing		
	3.2	Drag and Drop		
	3.3	Contextual tools		
	3.4	•Overlays and Inlays		
	3.5	Static and dynamic invitation		
	3.6	Transition patterns		
4	•**Interface Design for Data Handling**		8	CO2
	4.1	Patterns for information graphics		
	4.2	Patterns with form design		
	4.3	Pattern with social content production		
5	**Pattern with mobile interface design**		10	CO3
	5.1	Patterns for page composition		
	5.2	Managing mobile component - Display of information, control and confirmation		
	5.3	Pattern for Lateral access		
	5.4	Pattern for Drill down		
	5.5	Pattern for Labels and Indicators		
	5.6	Patterns for screen, light and sensor		
		Total	**45**	

Recommended Books:

Sr. No.	Name/s of Author/s	Title of Book	Name of Publisher with country	Edition and Year of Publication
1.	Wilbert O. Galitz	*The Essential Guide to User Interface Design - An Introduction to GUI Design Principles and Techniques*	Wiley Computer Publishing	Second Edition, 2002
2.	Jenifer Tidwell	*Designing interfaces: Patterns for effective interaction design*	O'rielly Media	Second Edition, 2011
3.	Bill Scott, Theresa Neil	*Designing Web Interfaces Principles & Patterns for Rich Interaction*	O'rielly Media	First Edition, 2009
4.	Steven Hoober, Eric Berkman	*Designing Mobile Interfaces: Patterns for Interaction Design*	O'rielly Media	First Edition, 2012

- **Instructors need to provide additional resources to students for in-depth understanding and practical applicability of the indicated topic/topics.**

Course Code	Course Title						
116U04E515	Advanced Computer Network						
	TH		P	TUT	Total		
Teaching Scheme(Hrs.)	03		--	--	03		
Credits Assigned	03		--	--	03		
Examination Scheme	Marks						
	CA		ESE	TW	O	P	P&O	Total
	ISE	IA						
	30	20	50	--	--	--	--	100

Course prerequisites: Data Communication and Networking

Course Objectives:

In this course students understand the advanced data communication and WAN technologies like frame relay and ATM. At Network layer all the unicast and multicast protocols are studied and Next generation IP IPv6 Protocol, IPv6 addressing, Transition from IPv4 to IPv6 also covered. The principles of network design and enable students to setup, configure and interconnect an IP networks and their management. Basics of software defined networking are also introduced.

Course Outcomes:

At the end of successful completion of the course the student will be able to

CO1: Understand the advanced data communication and WAN technologies.
CO2: Understand the routing principles, addressing and implementation of protocols for IPV4 and IPV6 at network layer.
CO3: Understand issues in the design of network processors and apply them to design and manage network systems.
CO4: Understand the basics of software defined networking.

Module No.	Unit No.	Details	Hrs.	CO
1	**Data Communications**		**06**	**CO1**
	1.1	Defining Data Communication needs, Transmission Hierarchy		
	1.2	Optical Networks: SONET/SDH standard, Architecture, layers and Format.		
2	**WAN Technology**		**10**	**CO1**
	2.1	Frame Relay : Introduction , Architecture and frame relay layers		
	2.2	Introducing ATM Technology, Architecture, Need and Benefit, Faces of ATM		
	2.3	Why ATM, B-ISDN Reference Model, ATM Layer, ATM Adaptation Layer, ATM Signaling		
3	**Network Layer**		**12**	**CO2**
	3.1	Unicast routing protocols: Optimization, Intra and Interdomain routing, Distance vector, Link state and path vector routing		
	3.2	Multicast routing protocols: Multicasting Basics, Design requirements of multicasting routing protocol, Classification of multicast routing protocols.		
	3.3	Next generation IP: IPv6 Protocol, IPv6 addressing,		
	3.4	Host Configuration: BOOTP, DHCP		
	3.5	Private Networks, Virtual private networks and Network Address Translation		
4	**Network Design and Management**		**12**	**CO3**
	4.1	Designing the network topology and solutions-Top down Approach: PPDIOO – Network Design Layers - Access Layer, Distribution Layer, Core/Backbone Layer, Access Layer Design, Backbone Network Design, Enterprise LAN Design: Ethernet Design Rules and Campus Design best practices, • Virtualisation and Data Center Design, Wireless LAN Design		
	4.2	Network Management : SNMP Concept and format, Management Components: SMI and MIB , Remote Monitoring		
5	**Software Defined Networking and OpenFlow**		**05**	**CO4**
	5.1	Introduction to Software Defined Networking, Control and Data Planes, SDN Controllers, Introduction to Openflow Protocol, Network Function Virtualization		
		Total	**45**	

Recommended Books:

Sr. No.	Name/s of Author/s	Title of Book	Name of Publisher with country	Edition and Year of Publication
1.	William Stallings,	*High Performance Networks and Internet, Performance and Quality of Service*	Pearson	Fifth Edition.
2.	Behrouz Forouzan	*TCP/IP Protocol Suite*	McGraw-Hill,	Fifth Edition
3.	Behrouz Forouzan,	*Data Communications and Networking*	McGraw-Hill,	Fourth Edition
4.	Anthony Bruno, Steve Jordan	*Official Cert Guide: CCDA*	Cisco Press,	-
5.	Thomas D NAdeau and Ken Grey	*Software Defined Networking*	O'Reilly	2013

- **Instructor needs to provide additional resources to students for in-depth understanding and practical applicability of the indicated topic/topics.**

<table>
<tr><th colspan="2">Course Code</th><th colspan="8">Course Title</th></tr>
<tr><td colspan="2">116U04L501</td><td colspan="8">Web Programming-II</td></tr>
<tr><td colspan="2"></td><td colspan="2">TH</td><td colspan="2">P</td><td colspan="2">TUT</td><td colspan="2">Total</td></tr>
<tr><td colspan="2">Teaching Scheme(Hrs.)</td><td colspan="2">--</td><td colspan="2">04</td><td colspan="2">--</td><td colspan="2">04</td></tr>
<tr><td colspan="2">Credits Assigned</td><td colspan="2">--</td><td colspan="2">02</td><td colspan="2">--</td><td colspan="2">02</td></tr>
<tr><td colspan="2" rowspan="3">Examination Scheme</td><td colspan="8">Marks</td></tr>
<tr><td colspan="2">CA</td><td rowspan="2">ESE</td><td rowspan="2">TW</td><td rowspan="2">O</td><td rowspan="2">P</td><td rowspan="2">P&O</td><td rowspan="2">Total</td></tr>
<tr><td>ISE</td><td>IA</td></tr>
<tr><td colspan="2">--</td><td>--</td><td>--</td><td>--</td><td>50</td><td>--</td><td>--</td><td>50</td><td>100</td></tr>
</table>

Course prerequisites: Basic knowledge of Programming

Course Objectives: The process of development of web application consists of integration of client-side, server-side and database modules. The objective of this course is to introduce web application development using PHP Technology. In this course, fundamentals of PHP technology will be covered. Further create, read, update and delete operations will be carried out using PHP and MySQL. Session Handling mechanisms shall be incorporated in web applications. Advanced functionalities such as fundamentals of REST architecture and using REST APIs, sending and receiving email and carrying out internationalization and localization will be covered. And finally students will develop web applications using PHP technology.

Course Outcomes:

At the end of successful completion of the course the student will be able to:-

CO1: Illustrate use of basic PHP concepts to develop applications
CO2: Design forms and use session handling mechanism with web applications
CO3: Carry out database operations using PHP
CO4: Demonstrate the use advanced features such as REST API, email handling, Localization and internationalization in PHP.

Module No.	Unit No.	Details	Hrs.	CO
1	**Introduction to PHP**		6	CO1
	1.1	Introduction, Installation and Configuration, PHP tags, PHP statements, Whitespace, Comments		
	1.2	Variable declaration, datatypes, constants, scope of variables		
	1.3	Operators -Arithmetic, String, Assignment, Comparison, logical, Bitwise, Conditional Statements-if else and switch case, loop statements-for, while, do while and for each loops.		
2	**Arrays and Functions in PHP**		8	CO1
	2.1	Numerical Arrays-Initializing and accessing array contents, Associative Arrays - Initializing and accessing array contents, Array operators, Multidimensional arrays, Array functions for sorting array		
	2.2	calling functions, user defined functions, passing parameters, return keyword, recursive functions, scope of variables using function		
	2.3	**Self-Learning Topic:** String, Date, Time, Math, Image and File handling functions		
3	**Form Handling and Session Handling in PHP**		8	CO2
	3.1	Super globals -$_POST, $_GET, $_REQUEST, $_SERVER, include(),require()		
	3.2	Form Validation using regular expressions, in-built functions		
	3.3	Introduction to cookies, setting cookies, using cookies with sessions		
	3.4	Introduction to session handling, starting session, registering session variables, using session variables, un-setting variables and destroying session.		
4	**Database operations using PHP**		4	CO3
	4.1	Checking and Filtering Input data, Setting up connection, Choosing Database in MySQL		
	4.2	Querying Database in MySQL, using prepared statements, Retrieving Query results, disconnecting from database.		
	4.3	Introduction to PHP Data Objects (PDO), the PDO class, PDO Exceptions and error handling.		
	4.4	**Self-Learning Topic:** Introduction to MongoDB, documents and collections, MongoDB queries, PHP-MongoDB database interfacing.		

5	• **Advanced Functionalities in PHP**		**4**	**CO4**
	5.1	Introduction to REST Architecture, Create and Consume REST API		
	5.2	Web scraping, sending and receiving email		
	5.3	Internationalization and Localization		
Total			**30**	

Recommended Books:

Sr. No.	Name/s of Author/s	Title of Book	Name of Publisher with country	Edition and Year of Publication
1	Luke Welling, Laura Thomson	*PHP and MySQL Web Development*	Addison-Wesley Professional	5th Edition 2016
2.	Peter MacIntyre, Kevin Tatroe	*Programming PHP*	O'Reilly Media, Inc	4th Edition 2020
3.	Frank M. Kromann	*Beginning PHP and MySQL: From Novice to Professional*	Apress	1st Edition, 2018

- Instructor needs to provide additional resources to students for in-depth understanding and practical applicability of the indicated topic/topics.

Course Code	Course Title						
116U04L502	Operating System Laboratory						
	TH		P		TUT		Total
Teaching Scheme(Hrs.)	--		02		--		02
Credits Assigned	--		01		--		01
Examination Scheme	Marks						
	CA		ESE	TW	O	P	P&O	Total
	ISE	IA						
	--	--	--	25	25	--	--	50

- **Term-Work will consist of practical covering entire syllabus of "Operating System" (116U04C502). Students will be graded based on continuous assessment of their term work.**

  Oral Examination will be based on laboratory work and entire theory syllabus of "Operating System" (116U04C502).

Course Code	Course Title							
116U04L503	Information and Network Security Laboratory							
	TH		P		TUT		Total	
Teaching Scheme(Hrs.)	--		02		--		02	
Credits Assigned	--		01		--		01	
Examination Scheme	Marks							
	CA		ESE	TW	O	P	P&O	Total
	ISE	IA						
	--	--	--	25	--	25	--	50

- **Term-Work will consist of practical covering entire syllabus of "Information and Network Security" (116U04C503). Students will be graded based on continuous assessment of their term work.**
- **Practical Examination will be based on laboratory work and entire theory syllabus of "Information and Network Security" (116U04C503).**

Course Code	Course Title						
116U04L511	Artificial Intelligence Laboratory						
	TH		P		TUT		Total
Teaching Scheme(Hrs.)	--		02		--		02
Credits Assigned	--		01		--		01
Examination Scheme	Marks						
	CA		ESE	TW	O	P	P&O	Total
	ISE	IA						
	--	--	--	25	25	--	--	50

- **Term-Work will consist of practical covering entire syllabus of "Artificial Intelligence" (116U04E511). Students will be graded based on continuous assessment of their term work.**
- **Oral Examination will be based on laboratory work and entire theory syllabus of "Artificial Intelligence" (116U04E511).**

Course Code	Course Title							
116U04L512	Cyber Laws Laboratory							
	TH			P		TUT		Total
Teaching Scheme(Hrs.)	--			02		--		02
Credits Assigned	--			01		--		01
Examination Scheme	Marks							
	CA		ESE	TW	O	P	P&O	Total
	ISE	IA						
	--	--	--	25	25	--	--	50

- **Term-Work will consist of practical covering entire syllabus of "Cyber Laws" (116U04E512). Students will be graded based on continuous assessment of their term work.**
- **Oral Examination will be based on laboratory work and entire theory syllabus of "Cyber Laws" (116U04E512).**

Course Code	Course Title							
116U04L513	Computer Graphics and Virtual Reality Laboratory							
	TH			P		TUT		Total
Teaching Scheme(Hrs.)	--			02		--		02
Credits Assigned	--			01		--		01
Examination Scheme	Marks							
	CA		ESE	TW	O	P	P&O	Total
	ISE	IA						
	--	--	--	25	25	--	--	50

- **Term-Work will consist of practical covering entire syllabus of "Computer Graphics and Virtual Reality" (116U04E513). Students will be graded based on continuous assessment of their term work.**
- **Oral Examination will be based on laboratory work and entire theory syllabus of "Computer Graphics and Virtual Reality" (116U04E513).**

Course Code	Course Title						
116U04L514	UI Programming Laboratory						
	TH		P		TUT		Total
Teaching Scheme(Hrs.)	--		02		--		02
Credits Assigned	--		01		--		01
Examination Scheme	Marks						
	CA		ESE	TW	O	P	P&O	Total
	ISE	IA						
	--	--	--	25	25	--	--	50

- **Term-Work will consist of practical covering entire syllabus of "UI Programming" (116U04E514). Students will be graded based on continuous assessment of their term work.**
- **Oral Examination will be based on laboratory work and entire theory syllabus of "UI Programming" (116U04E514).**

Course Code	Course Title							
116U04L515	Advanced Computer Network Laboratory							
	TH			P		TUT		Total
Teaching Scheme(Hrs.)	--			02		--		02
Credits Assigned	--			01		--		01
Examination Scheme	Marks							
	CA		ESE	TW	O	P	P&O	Total
	ISE	IA						
	--	--	--	25	25	--	--	50

- **Term-Work will consist of practical covering entire syllabus of "Advanced Computer Network" (116U04E515). Students will be graded based on continuous assessment of their term work.**
- **Oral Examination will be based on laboratory work and entire theory syllabus of "Advanced Computer Network" (116U04E515).**

Semester VI

TY B. Tech. Information Technology

(KJSCE SVU 2020)

Course Code	Course Title							
116U04C601	Object Oriented Software Engineering							
	TH		P	TUT	Total			
Teaching Scheme(Hrs.)	3		--	--	3			
Credits Assigned	3		--	--	3			
Examination Scheme	Marks							
	CA		ESE	TW	O	P	P&O	Total
	ISE	IA						
	30	20	50	--	--	--	--	100

Course prerequisites: Object Oriented Concepts

Course Objectives:
This course imparts the knowledge about object oriented approach of software development phases including requirement analysis, modeling, design and testing. The course content emphasizes the significance of project estimation and planning. The course encourages use of design and modeling principles for software development.

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

CO1: Comprehend process models.
CO2: Describe software planning and management.
CO3: Demonstrate requirements, modeling and design of a system.
CO4: Demonstrate test case design.

Module No.	Unit No.	Details	Hrs.	CO
1	**Introduction**		**7**	CO1
	1.1	Software Engineering, Layered Technology, Process Framework, Capability Maturity Model (CMMI)		
	1.2	Prescriptive Models, Waterfall Model, Incremental, RAD, Evolutionary Process Models, Prototyping, Spiral, Test Driven Development		
	1.3	Agile Process, Scrum- Industry Perspective, DevOps Development Practice		
2	**Software Project Planning and Management**		**10**	CO2
	2.1	Software Estimation, LOC, FP, Basic COCOMO Model, Software Project Management Plan (SPMP)		
	2.2	Scheduling, Work Breakdown Structure, Gantt Chart, Tracking the Schedule		
	2.3	Risk Identification, Risk Assessment, Risk Projection, RMMM Plan		
	2.4	Software Configuration Items, SCM Process, Identification, Version Control, Change Control, Configuration Audit, Status Reporting		
3	**Requirements Analysis**		**4**	CO3
	3.1	Requirements Engineering Tasks, OO Requirements		
	3.2	Functional and Non-Functional Requirements		
	3.3	Eliciting Requirements		
	3.4	Software Requirements Specification (SRS)		
4	**Modeling and Design**		**20**	CO3
	4.1	Importance of Modeling, Conceptual Model of the UML		
	4.2	Use Case Diagram, Activity Diagram, State Diagram, Interaction Diagrams, Class Diagram, Deployment Diagram, Component Diagram, Data Flow Diagram (DFD)		
	4.3	Design Concepts, Analysis Model, Design Model, Design Principles and Concepts, Software Design Document (SDD)		

	4.4	Software Design, Data Design, EER, Class, Architecture Styles, Data Centered, ●MVC, Client Server, User Interface Design Rules and Process, Component Level Design, Component, Views, Effective Modular Design, Cohesion and Coupling, Design Patterns, Singleton, Observer, Adapter, Façade		
5	**Software Testing and Maintenance**		**04**	CO4
	5.1	OO Testing Methods, OO Testing Strategies, Test Case Design, Class Level and Interclass Level, Software Test Document (STD)		
	5.2	Software Maintenance,Types, Reverse Engineering, Re-engineering		
		Total	**45**	

Recommended Books:

Sr. No.	Name/s of Author/s	Title of Book	Name of Publisher with country	Edition and Year of Publication
1.	Roger S. Pressman	*Software Engineering: A Practitioners Approach*	Tata McGraw Hill	8th Edition, 2019
2.	Timothy C. Lethbridge, Robert Laganiere	*Object-Oriented Software Engineering – A Practical Software Development using UML and Java*	Tata McGraw-Hill	2nd Edition, 2004
3.	Bernd Bruegge, Allen H. Dutoit	*Object-Oriented Software Engineering using UML, Patterns, and Java*	Pearson Education	3rd Edition, 2009
4.	Michael Blaha and James Rumbaugh	*Object - Oriented Modeling and Design with UML*	Pearson Education	2nd edition, 2007

- **Instructor needs to provide additional resources to students for in-depth understanding and practical applicability of the indicated topic/topics.**

Course Code	Course Title							
116U04C602	Modeling and Simulation							
	TH		P		TUT		Total	
Teaching Scheme(Hrs.)	03		--		--		03	
Credits Assigned	03		--		--		03	
Examination Scheme	Marks							
	CA		ESE	TW	O	P	P&O	Total
	ISE	IA						
	30	20	50	--	--	--	--	100

Course prerequisites: Mathematics- Probability Theory and Statistics

Course Objectives: This course introduces system modeling and simulation techniques and its application in real life domain. It imparts the knowledge of random numbers generation and its testing methods. It includes Verification and Validation of simulation model, Input modeling and Analysis of output.

Course Outcomes:

At the end of successful completion of the course the student will be able to

CO1: Apply the experimental process of simulation for model building using simulation languages and tool.

CO2: Generate pseudorandom numbers and perform empirical tests to measure the quality of a pseudo random number generator.

CO3: Analyze simulation results to reach an appropriate conclusion.

Module No.	Unit No.	Details	Hrs.	CO
1	**Introduction to Modeling and Simulation**		**7**	**CO1**
	1.1	Model Characterization, Model Development		
	1.2	Simulation Studies, Programming Languages		
	1.3	Organization and Terminology		
	1.4	Simulation Examples, Single Server Queue, Simple Inventory system		
2	**Random Number Generation**		**8**	**CO2**
	2.1	Lehmer Random Number Generators, Monte Carlo Simulation		
	2.2	Empirical tests of Randomness: Kolmogorov-Smirnov, Chi Square, Runs, Gap, Autocorrelation		
3	**Discrete Event Simulation & Statistics**		**10**	**CO1**
	3.1	Discrete –Event Simulation		
	3.2	Multi-Stream Lehmer Random Number Generators		
	3.3	Discrete-Event Simulation examples		
	3.4	Sample Statistics, Discrete-Data Histogram, Continuous-Data Histogram, Correlation		
	3.5	Next-Event Simulation, Introduction, Terminology, Algorithmic approach, Examples		
	3.6	Event List Management, Introduction, schemes, examples		
	3.7	●Overview on a Network of Single-Server Service Nodes		
4	**Random Variables and Variates**		**10**	**CO1**
	4.1	Discrete Random Variables, Introduction, Generation, Algorithmic approach, Applications, Models		
	4.2	Random Sampling and Shuffling		
	4.3	Continuous Random Variables, Introduction, Generation, Algorithmic, approach, Applications, Models		
	4.4	Nonstationary Poisson Processes, Acceptance-Rejection technique		
	4.5	●Overview on Birth Death Processes, Finite-State Markov Chains		
5	**Verification, Validation, Input Modeling and Output Analysis**		**10**	**CO3**
	5.1	Verification, Calibration and Validation of Simulation Models		
	5.2	Input Modeling, Trace-Driven Modeling of stationary Processes, Parametric, Modeling of Stationary Processes, Modeling Non stationary Processes		
	5.3	Output Analysis, Interval Estimation, Monte Carlo Estimation, Finite- Horizon and Infinite-Horizon Statistics, Batch Means, Steady -state Single-Server Node Statistics,		

		Atomicity, Log based recovery, Shadow paging		
		Total	**45**	

Recommended Books:

Sr. No.	Name/s of Author/s	Title of Book	Name of Publisher with country	Edition and Year of Publication
1.	Jerry Banks, John Carson, Barry Nelson, and David M. Nicol	*Discrete Event System Simulation*	Pearson	5th Edition, 2010
2.	Averill M. Law and W. David Kelton	*System Modeling and Analysis*	McGraw Hill	5th Edition, 2014
3.	Geoffrey Gordon	*System Simulation*	Prentice Hall India	2nd Edition, 2006

- **Instructor needs to provide additional resources to students for in-depth understanding and practical applicability of the indicated topic/topics.**

Course Code	Course Title						
116U04C603	Cloud Computing						
	TH		P	TUT	Total		
Teaching Scheme(Hrs.)	03		--	--	03		
Credits Assigned	03		--	--	03		
Examination Scheme	Marks						
	CA		ESE	TW	O	P	P&O	Total
	ISE	IA						
	30	20	50	--	--	--	--	100

Course prerequisites: Nil

Course Objectives

Cloud computing is the on-demand availability of computer system resources, especially data storage and computing power, without direct active management by the user. The term is generally used to describe data centres available to many users over the Internet. To study IOT cloud.

Course Outcomes

At the end of successful completion of the course the student will be able to

CO1: Understand Virtualization.
CO2:Study the Evolution of Cloud Computing and its models
CO3: Analyze different cloud architectures and IOT-cloud
CO4: Examine various security issues in cloud

Module No.	Unit No.	Details	Hrs.	CO
1	**Understanding Virtualization**		12	CO1
	1.1	Introduction to virtualization, Types of virtualization- CPU, Storage, Memory, OS, Hardware, Virtualization of physical computing resources, understanding abstraction, business benefits of virtualization, machine or server level virtualization		
	1.2	Type 1 and type 2 Hypervisors, High level language virtual machine, emulation, advantages and disadvantages of virtualization		
	1.3	Virtualization security threats		
	1.4	Resource Pooling, Sharing and Provisioning		
2	**Evolution of Cloud Computing and its models**		12	CO 2
	2.1	Evolution and Enabling Technologies: Evolution of Cloud Computing, Comparison between Cluster, Grid and Cloud Computing		
	2.2	Benefit and challenge of Cloud Computing		
	2.3	Weak Cloud Computing models: Standard and Deployment models, choosing the best deployment model		
	2.4	Type Cloud Computing Services: Service delivery models, service abstraction, SPI model, Traditional Vs Cloud system model, Saas, PaaS, IaaS, XaaS		
	2.5	Vertical and Horizontal scaling in cloud		
3	**Architecture of Cloud and IOT**		12	CO 3
	3.1	Architecture, features, modes of operation of Eucalyptus, OpenStack and Nimbus		
	3.2	•Architecture Diagram, Features, Advantages and Disadvantages and comparison of Closed architectures of cloud like Amazon, Microsoft Azure and Google App Engine		
	3.3	IOT and cloud computing, benefits and functions of IoT cloud, comparison of IoT and cloud computing, role of cloud computing in internet of things		
4	**Security in Cloud**		14	CO 4
	4.1	Security issues in cloud: Threats, Information Security, Identity management and access control, cloud security design principles, cloud security management frameworks		
	4.2	Host and data security in SaaS, PaaS, IaaS		
5	Self-Learning Topic: Any research topic in Cloud Computing to be assessed in IA			CO4
		Total	45	

Recommended Books:

Sr. No.	Name/s of Author/s	Title of Book	Name of Publisher with country	Edition and Year of Publication
1	Kailash Jayaswal, Jagannath Kallakurchi, Donald J. Houde, Dr. Deven Shah	*KLSI Cloud computing Black Book*	Dreamtech Publication	January 2014
2	Gautam Shroff	*Enterprise Cloud Computing*	Cambridge University Press	December 2010
3	Antohy T Velte	*Cloud Computing : A Practical Approach*	McGraw Hill	1st Edition, October 2009
4	Sandeep Bhowmik	*Cloud Computing*	Cambridge University Press	1st Edition , 2017
5	Stefano Ferretti	*QoS–aware Clouds*	2010 IEEE 3rd International Conference on Cloud Computing	2011

- **Instructor needs to provide additional resources to students for in-depth understanding and practical applicability of the indicated topic/topics.**

<table>
<tr><th>Course Code</th><th colspan="8">Course Title</th></tr>
<tr><td>116U04E611</td><td colspan="8">Exploratory Data Analytics</td></tr>
<tr><td></td><td colspan="2">TH</td><td colspan="2">P</td><td colspan="2">TUT</td><td colspan="2">Total</td></tr>
<tr><td>Teaching Scheme(Hrs.)</td><td colspan="2">03</td><td colspan="2">--</td><td colspan="2">--</td><td colspan="2">03</td></tr>
<tr><td>Credits Assigned</td><td colspan="2">03</td><td colspan="2">--</td><td colspan="2">--</td><td colspan="2">03</td></tr>
<tr><td rowspan="3">Examination Scheme</td><td colspan="8">Marks</td></tr>
<tr><td colspan="2">CA</td><td rowspan="2">ESE</td><td rowspan="2">TW</td><td rowspan="2">O</td><td rowspan="2">P</td><td rowspan="2">P&O</td><td rowspan="2">Total</td></tr>
<tr><td>ISE</td><td>IA</td></tr>
<tr><td>30</td><td>20</td><td>50</td><td>--</td><td>--</td><td>--</td><td>--</td><td>100</td></tr>
</table>

Course prerequisites: Basic concepts of databases

Course Objectives:

This course includes the processes essential to perform initial investigations on data so as to discover patterns, to spot anomalies, to test hypotheses and to check assumptions with the help of summary statistics and visual representations. It attempts to understand the data first and then efforts can be applied to extract as many insights from it.

Course Outcomes:

At the end of successful completion of the course the student will be able to

CO1: Summarize the data
CO2: Comprehend descriptive and proximity measures of data
CO3: Apply the transformations required on data to make it suitable for mining
CO4: Comprehend various data visualization techniques and its interpretation

Module No.	Unit No.	Details	Hrs.	COs
1	**Introduction to data**		06	CO1
	1.1	Understanding data, Types of attributes, Nominal, ordinal, interval, ratio, Discrete and continuous attributes		
	1.2	Types of datasets: Record data, Graph-based data, Sequence data, time series data, spatial data, General characteristics of datasets		
	1.3	Data quality problems, issues related to applications, ●Data transformations to make data suitable for data mining, EDA vs. classical data analytics		
2.	**Exploring data using descriptive measures**		12	CO2
	2.1	Frequency distribution : simple, grouped, cumulative and relative frequency distribution, graphs for frequency distribution (Histogram, frequency polygon, frequency curve, cumulative frequency curve)		
	2.2	Measures of central tendency: Mean (Arithmetic, weighted and geometric mean), , median, mode, mid range ●Predicting missing data using regression modeling, interpolation		
	2.3	Measures of dispersion: range, inter-quartile range, variance, standard deviation, root mean square deviation, Coefficients of dispersion based upon range, quartile deviation, mean deviation, standard deviation, ANOVA. ●Boxplot, Quantile–Quantile Plot, Scatter Plots and Data Correlation, Covariance, Bregman divergence. Measures of Skewness: Pearson's coefficient, Bowley's coefficient, coefficient based upon moments		
3.	**Data similarity and dissimilarity**		09	CO2
	3.1	Similarity measures for numeric data, Minkowski distance, Euclidean distance, Manhattan distance, supremum distance, Mahalanobis distance, Bhattacharyya distance		
	3.2	Similarity measures for symmetric and asymmetric binary data, simple matching coefficient, Jaccard coefficient, hamming distance		
	3.3	Similarity measures for textual data, edit distance, cosine distance, Jaro distance, n-Gram distance , longest common subsequence,		

		Dissimilarity between attributes of mixed type		
4.	**Data normalization, discretization and reduction techniques**		**10**	**CO3**
	4.1	Data Normalization, Min-Max normalization, z-score normalization, Decimal scaling		
	4.2	Data discretization, Binning, Histogram, discretization using data clustering techniques, discretization using classification techniques		
	4.3	Data reduction, filtering techniques, sampling techniques, attribute subset selection techniques, detecting outliers		
5	**Data Visualization and interpretation**		**08**	**CO4**
	5.1	Pixel Oriented visualization techniques, Geometric projection visualization techniques, Icon based visualization techniques, Hierarchical visualization techniques		
	5.2	Visualizing complex data and Relations, Scoreboard Vs Dashboard, Graph Vs Chart		
		Total	**45**	

Recommended Books:

Sr. No.	Name/s of Author/s	Title of Book	Name of Publisher with country	Edition and Year of Publication
1.	S.C. Gupta , V. K. Kapoor	*Fundamentals of mathematical statistics*	Sultan Chand and Sons	2014
2.	P. N. Tan, M. Steinbach, Vipin Kumar,	*Introduction to Data Mining*	Pearson Education,	2014
3.	Han, Kamber	*Data Mining Concepts and Techniques*	Morgan Kaufmann	3nd Edition,2012
4.	C. B. Gupta, Vijay Gupta	*An Introduction to Statistical Methods*	Sultan Chand and Sons	23rd Edition, 2004
5.	Michael Berry and Gordon Linoff	*Data Mining Techniques*	Wiley Publications	2nd Edition , 2011

- **Instructor needs to provide additional resources to students for in-depth understanding and practical applicability of the indicated topic/topics.**

Course Code	Course Title						
116U04E612	Vulnerability Analysis and Penetration Testing						
	TH		P	TUT	Total		
Teaching Scheme(Hrs.)	03		--	--	03		
Credits Assigned	03		--	--	03		
Examination Scheme	Marks						
	CA		ESE	TW	O	P	P&O	Total
	ISE	IA						
	30	20	50	--	--	--	--	100

Course prerequisites: **NIL**

Course Objectives:
This course will introduce concepts of vulnerability analysis and penetration testing. Objectives of course are to introduce vulnerability analysis and penetration testing and to use tools for implementing vulnerability analysis and penetration testing.

Course Outcomes:
At the end of successful completion of the course a student will be able to

CO 1: Realize that premise of vulnerability analysis and penetration testing (VAPT)
CO 2: Comprehend purpose of Anonymity and Footprinting
CO 3: Understand attack methodology

Module No.	Unit No.	Details	Hrs.	CO
1	**Introduction to VAPT premise**		12	CO 1
	1.1	Importance and Elements of Security, Phases of an Attack and Types of Hacker Attacks, Hacktivism and Ethical Hackers		
	1.2	Phases of Penetration Testing, Methodologies and Risk, Penetration Testing		
	1.3	Proper and Ethical Disclosure, ●OWASP Top Ten attack		
2	**Anonymity and Footprinting**		05	CO 2
	2.1	Anonymity and Censorship Circumvention		
	2.2	Introduction to Footprinting, ●Information-Gathering Methodology, vulnerability scanning , Whois Lookups, Dimitry		
	2.3	Port Scanning with Nmap, Nessus, Netcat, Maltego		
3.	**Attacking Authentication**		08	CO2
	3.1	Design Flaws in Authentication, Implementation Flaws in Authentication		
	3.2	Securing Authentication		
	3.3	Hydra, John the Ripper		
4	**Attacking Session Management**		10	CO2
	4.1	The Need for State		
	4.2	Weaknesses in Token Generation : Meaningful Tokens, Predictable Tokens, Encrypted Tokens: ECB		
	4.3	Weaknesses in Session Token Handling, Securing Session Management		
5	**Attacking Users and Data Store**		10	CO2
	5.1	Cross-Site Scripting basics, Anatomy of a XSS exploitation, Types of XSS, Finding XSS, XSS Exploitation, XSS, Browsers and same origin policy, Cookie stealing through XSS, Defacement, ●Advanced phishing attacks		
	5.2	SQL Injection Basics, Types of SQL Injection, SQL Injection Exploitation		
	5.3	Analyzing Network Traffic, performing Man-in-Middle Attack		
		Total	45	

Recommended Books:

Sr. No.	Name/s of Author/s	Title of Book	Name of Publisher with country	Edition and Year of Publication
1.	Dafydd Stuttard Marcus Pinto	*The Web Application Hacker's Handbook, Finding and Exploiting Security Flaws*	Wiley Publications, Inc	Second Edition, 2011
2.	Joseph Muniz Aamir Lakhani	*Web Penetration Testing with Kali Linux*	Packt Publishing	2013
3.	Thomas Wilhelm	*Professional Penetration Testing Creating and Operating a Formal Hacking Lab*	Elsevier Inc	2010

- **Instructors need to provide additional resources to students for in-depth understanding and practical applicability of the indicated topic/topics.**

Course Code	Course Title						
116U04E613	Digital signal and Image Processing						
	TH		P	TUT	Total		
Teaching Scheme(Hrs.)	3		--	--	3		
Credits Assigned	3		--	--	3		
Examination Scheme	Marks						
	CA		ESE	TW	O	P	P&O	Total
	ISE	IA						
	30	20	50	--	--	--	--	100

Course prerequisites: NIL

Course Objectives:
This course provides the student with an intuitive and practical understanding of the fundamental concepts of discrete-time signal processing. This course covers all the fundamentals in 2-D digital image processing with emphasis on image processing techniques, image filtering design and applications. Through this course, students will get acquainted with the necessary background for taking advanced level courses in signal and image processing.

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

CO1: Understand the basic concepts of digital signal processing.
CO2: Apply Z transform and DFT on 1-D signals.
CO3: Illustrate the fundamental concepts of digital image processing.
CO4: Apply various Image Processing techniques like enhancement, object extraction, object representation & description on images.

Module No.	Unit No.	Details	Hrs.	CO
1	**Introduction to discrete time signals**		05	CO 1
	1.1	Analog, discrete, and digital signals, Conversion from analog to digital, Classification of signals.		
	1.2	Discrete time signals: Representation, classification & operations		
	1.3	Discrete-Time systems- Memoryless systems, Linear systems, Time-Invariant systems, Causality, Stability		
	1.4	LTI Systems, Properties of LTI systems, Convolution and Correlation- need, methods and examples 1-D Discrete Fourier Transform, properties		
2	**The z- Transform**		10	CO 2
	2.1	Introduction, z- Transform, Properties of the region of convergence for the z-Transform		
	2.2	Inverse z-Transform- Inspection method, Partial Fraction Expansion, Power Series Expansion		
	2.3	Properties of z-Transform		
3	**Discrete Fourier Transform**		05	CO 2
	3.1	1-D DFT		
	3.2	Properties		
	3.3	Radix-2 DIT-FFT and DIF-FFT Algorithms		
4	**Introduction to digital image processing**		13	CO 3
	4.1	Introduction: Definition of digital image, Generation of digital image, steps in digital image processing, 2-D sampling, spatial and tonal resolution, Pixel connectivity, elements of digital image processing systems		
	4.2	Image enhancement in Spatial domain- Point operations Histogram processing Spatial filtering: smoothing, sharpening, median, high boost		
	4.3	Image enhancement in Frequency Domain- Introduction to image in frequency domain, Concept of basis images, Two dimensional D.F.T. and its properties, Two dimensional F.F.T., Filtering in the frequency domain: smoothening,		

		sharpening and homomorphic filtering.		
5	**Image segmentation, representation, and description**		**12**	**CO 4**
	5.1	•Segmentation- Detection of discontinuities, Edge linking and boundary detection: Local Processing, Global Processing: Hough Transform, Graph Theoretic Technique, Segmentation based on Thresholding, Region based segmentation		
	5.2	Representation and description, Boundary descriptors: Run length code, Shape number, Fourier descriptor, Area Descriptors: Statistical moments, Morphological Operators, Fundamental Operations in Morphology: Dilation Erosion, Opening & Closing, Hit or Miss Transform, other basic Morphological Algorithms		
		Total	**45**	

Recommended Books:

Sr. No.	Name/s of Author/s	Title of Book	Name of Publisher with country	Edition and Year of Publication
1.	A.V.Oppenheim and R.W. Schafer	*Discrete Time Signal Processing*	Pearson Education, India	3rd Edition, 2014
2.	John G. Proakis Dimitris K Manolakis	*Digital Signal Processing- Principles, Algorithms and Applications*	Pearson Education, India	4th Edition, 2007
3.	Gonzalez & Woods,	*Digital Image Processing*	Pearson Education, India	4th Edition, 2018
4.	William K. Pratt	*Digital Image Processing*	Wiley Publication	4th Edition, 2007
5.	A.K.Jain	*Fundamentals of Image processing,*	Prentice-Hall of India Pvt.Ltd	1st Edition, 1995

- **Instructor needs to provide additional resources to students for in-depth understanding and practical applicability of the indicated topic/topics.**

<table>
<tr><th>Course Code</th><th colspan="8">Course Title</th></tr>
<tr><td>116U04E614</td><td colspan="8">Development Frameworks-1</td></tr>
<tr><td></td><td colspan="2">TH</td><td>P</td><td colspan="2">TUT</td><td colspan="3">Total</td></tr>
<tr><td>Teaching Scheme(Hrs.)</td><td colspan="2">03</td><td>--</td><td colspan="2">--</td><td colspan="3">03</td></tr>
<tr><td>Credits Assigned</td><td colspan="2">03</td><td>--</td><td colspan="2">--</td><td colspan="3">03</td></tr>
<tr><td rowspan="3">Examination Scheme</td><td colspan="8">Marks</td></tr>
<tr><td colspan="2">CA</td><td rowspan="2">ESE</td><td rowspan="2">TW</td><td rowspan="2">O</td><td rowspan="2">P</td><td rowspan="2">P&O</td><td rowspan="2">Total</td></tr>
<tr><td>ISE</td><td>IA</td></tr>
<tr><td>30</td><td>20</td><td>50</td><td>--</td><td>--</td><td>--</td><td>--</td><td>100</td></tr>
</table>

Course prerequisites: Basic knowledge of PHP and Java (PL-I Java course)

Course Objectives: The process of application development is carried out using framework for some specific technology. Frameworks provide a structural design for application development and speed up the process of development. In this course, PHP technology based framework Laravel and Java technology based framework Spring Boot is covered. Students will learn full-stack application development using Laravel and Spring Boot Frameworks. At the end of this course, students will be able to develop applications using Laravel and Spring Boot Framework

Course Outcomes:

At the end of successful completion of the course the student will be able to

CO1: Describe the architecture and working of Laravel/ Spring Boot Frameworks
CO2: Illustrate the use of different components in Laravel / Spring Boot Frameworks
CO3: Develop web applications using Laravel / Spring Boot Frameworks

Module No.	Unit No.	Details	Hrs.	CO
1	**Basics of Frameworks and Introduction to Laravel**		10	CO1
	1.1	Components of a Software, History of web frameworks, Understanding Web Framework and need for Frameworks		
	1.2	Laravel Features, Installation and Configuration		
	1.3	Architecture of Laravel and Components, Creating Laravel application		
	1.4	Configuration: Web Server, Directory		
2	**Laravel Fundamentals**		10	CO2, CO3
	2.1	MVC in Laravel:Model, Events, Views: Understanding Views, Passing Data to Views, Sharing Data with views, Blade Templates		
	2.2	Request and Response Handling, Cookie and Session		
	2.3	Middleware , Controllers, Front end: templates		
3	**Database Migration**		10	CO2, CO3
	3.1	Query Builder: Retrieving, Saving and Deleting Data		
	3.2	Migrations, Raw SQL Queries, Eloquent ORM		
	3.3	Redirections, Error Handling		
4	**Spring Boot Framework Fundamentals**		06	CO1
	4.1	Introduction to Servlet and JSP, Spring Boot basics and features, MVC fundamentals and workflow of Spring web MVC		
	4.2	Components of Spring Boot - Spring boot starter Parent POM, Spring Boot auto-configuration, Spring boot CLI, Spring Boot actuator		
	4.3	Installing Spring Boot CLI, Spring Initializer, Enabling Actuator, Analyzing actuator's endpoints, customizing endpoints		
5	**Developing Spring Boot Application using Spring Data JPA, Spring Boot Restful Web Services and Thymeleaf view**		09	CO2, CO3
	5.1	Build Spring Boot web application using Spring MVC with JSP, using CSS, javascript and images with Spring Boot web application		
	5.2	Spring Data JPA fundamentals, CRUD operations using Spring Data JPA		
	5.3	Build Spring Boot Restful Services API Application		
	5.4	• Thymeleaf View, Form Handling using Thymeleaf		
		Total	45	

Recommended Books:

Sr. No.	Name/s of Author/s	Title of Book	Name of Publisher with country	Edition and Year of Publication
1.	Martin Bean	*Laravel 5 Essentials*	Packt Publishing	First Edition,2015
2.	Matt Stauffer	*Laravel: Up and Running: A Framework for Building Modern PHP Apps*	OReilly Publication	Second Edition, 2019
3.	Dinesh Rajput	*Mastering Spring Boot 2.0*	Packt Publishing	First Edition,2018
4.	Mohamed Shazin Sadakath	*Spring Boot 2.0 Projects*	Packt Publishing	First Edition,2018
5.	Craig Walls Foreword by Andrew Glover	*Spring Boot in Action*	Manning Publication	First Edition,2015

- **Instructor needs to provide additional resources to students for in-depth understanding and practical applicability of the indicated topic/topics.**

Course Code	Course Title							
116U04E615	Internet of Things							
	TH		P		TUT		Total	
Teaching Scheme(Hrs.)	3		--		--		03	
Credits Assigned	3		--		--		03	
Examination Scheme	Marks							
	CA		ESE	TW	O	P	P&O	Total
	ISE	IA						
	30	20	50	--	--	--	--	100

Course prerequisites: **Nil**

Course Objectives:

This course introduces basic concepts of Internet of Things (IoT). The course offers context of move from machine to Machine (M2M) towards IoT. The course covers different application domain verticals ranging agriculture, healthcare, manufacturing, construction, water, which are presently accommodating requirements to support IoT.

Course Outcomes:

At the end of successful completion of the course the student will be able to

CO1: Understand journey of IoT from M2M communication and its perceived applications

CO2: Comprehend IoT architecture, enabling technologies and protocols

CO3: Realize design process of IoT applications and IoT challenges

Module No.	Unit No.	Details	Hrs.	CO
1	**Introduction to the Internet of Things (IoT)**		**10**	**CO1**
	1.1	From M2M to IoT, M2M towards IoT-the global context, A use case example, Differing Characteristics, M2M and IoT value chains		
	1.2	M2M and IoT Technology fundamentals		
	1.3	•Domain Specific IoT applications- Home Automation, Industry Automation , Energy, Cities, Environment, Retail, Agriculture		
2	**IoT Architectures**		**8**	**CO2**
	2.1	IoT Architecture – State of the Art		
	2.2	IoT Reference model		
	2.3	IoT Reference Architecture - Functional view, Information view, Deployment and operational view, Other relevant architectural views		
3	**Enabling Technologies and Protocols**		**10**	**CO2**
	3.1	RFID – Introduction, Role in IoT Environment		
	3.2	Wireless Sensor Network - Introduction, Role in IoT Environment		
	3.3	Cloud Computing - Introduction, Role in IoT Environment		
	3.4	Embedded Systems - Introduction, Role in IoT Environment		
	3.5	•IoT Protocols at Link, Network, Transport and Application Layer		
4	**Design of IoT application**		**10**	**CO3**
	4.1	Logical Design of IoT- IoT Functional Blocks, IoT Communication Models, IoT Communication API		
	4.2	IoT levels and Deployment Templates		
	4.3	IoT Design Methodologies		
	4.4	Real-world design constraints		
	4.5	•Case study on IoT system		
5	**IoT Challenges**		**07**	**CO3**
	5.1	Problem of Interoperability		
	5.2	Problem of Standardization - Importance		
	5.3	Security, Privacy, Trust		
		Total	**45**	

Recommended Books:

Sr. No.	Name/s of Author/s	Title of Book	Name of Publisher with country	Edition and Year of Publication
01	Jan Holler, Vlasios Tsiatsis, Catherine Mulligan	*From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence*	Academic Press, Elsevier	2014
02	Vijay Madisetti and Arshdeep Bahga	*Internet of Things (A Hands-on-Approach)*	VPT	1st Edition, 2014
03	Cuno Pfister	*Getting Started with the Internet of Things*	OReilly Media	2011

- **Instructors need to provide additional resources to students for in-depth understanding and practical applicability of the indicated topic/topics.**

<table>
<tr><th>Course Code</th><th colspan="8">Course Title</th></tr>
<tr><td>116U04E616</td><td colspan="8">Development Frameworks-2</td></tr>
<tr><td></td><td colspan="2">TH</td><td colspan="2">P</td><td colspan="2">TUT</td><td colspan="2">Total</td></tr>
<tr><td>Teaching Scheme(Hrs.)</td><td colspan="2">03</td><td colspan="2">--</td><td colspan="2">--</td><td colspan="2">03</td></tr>
<tr><td>Credits Assigned</td><td colspan="2">03</td><td colspan="2">--</td><td colspan="2">--</td><td colspan="2">03</td></tr>
<tr><td rowspan="3">Examination Scheme</td><td colspan="8">Marks</td></tr>
<tr><td colspan="2">CA</td><td rowspan="2">ESE</td><td rowspan="2">TW</td><td rowspan="2">O</td><td rowspan="2">P</td><td rowspan="2">P&O</td><td rowspan="2">Total</td></tr>
<tr><td>ISE</td><td>IA</td></tr>
<tr><td></td><td>30</td><td>20</td><td>50</td><td>--</td><td>--</td><td>--</td><td>--</td><td>100</td></tr>
</table>

Course prerequisites: Basic knowledge of PHP and Python (PL-I Python course)

Course Objectives: The process of application development is carried out using a framework for some specific technology. Frameworks provide a structural design for application development and speed up the process of development. In this course, PHP technology based framework Laravel and Python based framework Django are covered. Students will learn full-stack application development using Laravel and Django Frameworks. At the end of this course, students will be able to develop applications using Laravel and Django Framework

Course Outcomes:

At the end of successful completion of the course the student will be able to

CO1: Describe the architecture and working of Laravel/ Django Frameworks
CO2: Illustrate the use of different components in Laravel / Django Frameworks
CO3: Develop web applications using Laravel / Django Frameworks

Module No.	Unit No.	Details	Hrs.	CO
1	**Basics of Frameworks and Introduction to Laravel**		10	CO1
	1.1	Components of a Software, History of web frameworks, Understanding Web Framework and need for frameworks		
	1.2	Laravel Features, Installation and Configuration		
	1.3	Architecture of Laravel and Components, Creating Laravel application		
	1.4	Configuration: Web Server, Directory		
2	**Laravel Fundamentals**		10	CO2,CO3
	2.1	MVC in Laravel: Model, Events, Views: Understanding Views, Passing Data to Views, Sharing Data with views, Blade Templates		
	2.2	Request and Response Handling, Cookie and Session		
	2.3	Middleware , Controllers, Front end: templates		
3	**Database Migration**		10	CO2,CO3
	3.1	Query Builder: Retrieving, Saving and Deleting Data		
	3.2	Migrations, Raw SQL Queries, Eloquent ORM		
	3.3	Redirections, Error Handling		
4	**Introduction to Django**		10	CO1
	4.1	MVT Design Pattern, Understanding Django Folder, Files and Configurations, Installation of Django, Setting up Development Environment		
	4.2	Running Development Server, Creating and registering Application		
	4.3	Setting up database with Django, Database Migration		
5	**Views, Templates and Models in Django**		5	CO2,CO3
	5.1	Views and URL Confs: Processing request in Django, Dynamic URL's		
	5.2	Templates: Template System Basics, Creating Template Objects,ContextObjects,Tags,Filters,Using Templates in Views, Template Loading		
	5.3	Model: Installing Model, Basic data Access, Model String		

		Representation, Inserting and Updating data, Selecting Objects		
	5.4	Namespace,Validation, Session framework, Django admin Site: contrib packages, Forms, Adding models to admin site		
	5.5	• Session Framework, Email Handling, Django with Rest API Framework		
		Total	**45**	

Recommended Books:

Sr. No.	Name/s of Author/s	Title of Book	Name of Publisher with country	Edition and Year of Publication
1.	Adrian Holovaty, Jacob Kaplan-Moss	*The Definitive Guide to Django: Web Development Done Right*	Apress	Second Edition, 2014
2.	Martin Bean	*Laravel 5 Essentials*	Packt Publishing	First Edition,2015
3.	Matt Stauffer	*Laravel: Up & Running: A Framework for Building Modern PHP Apps*	OReilly Publication	Second Edition, 2019

- **Instructor needs to provide additional resources to students for in-depth understanding and practical applicability of the indicated topic/topics.**

Course Code	Course Title							
116U04L601	Object Oriented Software Engineering Laboratory							
	TH		P		TUT		Total	
Teaching Scheme(Hrs.)	--		02		--		02	
Credits Assigned	--		01		--		01	
Examination Scheme	Marks							
	CA		ESE	TW	O	P	P&O	Total
	ISE	IA						
	--	--	--	25	--	--	25	50

- **Term-Work will consist of practical covering entire syllabus of "Object Oriented Software Engineering" (116U04C601). Students will be graded based on continuous assessment of their term work.**
- **Practical and Oral Examination will be based on laboratory work and entire theory syllabus of "Object Oriented Software Engineering" (116U04C601).**

Course Code	Course Title							
116U04L602	Simulation and Modeling Laboratory							
	TH		P		TUT		Total	
Teaching Scheme(Hrs.)	--		02		--		02	
Credits Assigned	--		01		--		01	
Examination Scheme	Marks							
	CA		ESE	TW	O	P	P&O	Total
	ISE	IA						
	--	--	--	25	25	--	--	50

- **Term-Work will consist of practical covering entire syllabus of "Simulation and Modeling" (116U04C602). Students will be graded based on continuous assessment of their term work.**
- **Oral Examination will be based on laboratory work and entire theory syllabus of "Simulation and Modeling" (116U04C602).**

Course Code	Course Title							
116U04L603	Cloud Computing Laboratory							
	TH		P		TUT		Total	
Teaching Scheme(Hrs.)	--		02		--		02	
Credits Assigned	--		01		--		01	
Examination Scheme	Marks							
	CA		ESE	TW	O	P	P&O	Total
	ISE	IA						
	--	--	--	25	--	--	50	75

- **Term-Work will consist of practical covering entire syllabus of "Cloud Computing" (116U04C603). Students will be graded based on continuous assessment of their term work.**
- **Practical and Oral Examination will be based on laboratory work and entire theory syllabus of "Cloud Computing" (116U04C603).**

Course Code	Course Title							
116U04L611	Exploratory Data Analytics Laboratory							
	TH		P		TUT		Total	
Teaching Scheme(Hrs.)	--		02		--		02	
Credits Assigned	--		01		--		01	
Examination Scheme	Marks							
	CA		ESE	TW	O	P	P&O	Total
	ISE	IA						
	--	--	--	25	25	--	--	50

- **Term-Work will consist of practical covering entire syllabus of "Exploratory Data Analytics" (116U04E611). Students will be graded based on continuous assessment of their term work.**
- **Oral Examination will be based on laboratory work and entire theory syllabus of "Exploratory Data Analytics" (116U04E611).**

Course Code	Course Title							
116U04L612	Vulnerability Analysis and Penetration Testing Laboratory							
	TH		P			TUT		Total
Teaching Scheme(Hrs.)	--		02			--		02
Credits Assigned	--		01			--		01
Examination Scheme	Marks							
	CA		ESE	TW	O	P	P&O	Total
	ISE	IA						
	--	--	--	25	25	--	--	50

- **Term-Work will consist of practical covering entire syllabus of "Vulnerability Analysis and Penetration Testing" (116U04E612). Students will be graded based on continuous assessment of their term work.**
- **Oral Examination will be based on laboratory work and entire theory syllabus of "Vulnerability Analysis and Penetration Testing" (116U04E612).**

Course Code	Course Title							
116U04L613	Digital signal and Image Processing Laboratory							
	TH		P		TUT		Total	
Teaching Scheme(Hrs.)	--		02		--		02	
Credits Assigned	--		01		--		01	
Examination Scheme	Marks							
	CA		ESE	TW	O	P	P&O	Total
	ISE	IA						
	--	--	--	25	25	--	--	50

- **Term-Work will consist of practical covering entire syllabus of "Digital signal and Image Processing" (116U04E613). Students will be graded based on continuous assessment of their term work.**
- **Oral Examination will be based on laboratory work and entire theory syllabus of "Digital signal and Image Processing" (116U04E613).**

Course Code	Course Title							
116U04L614	Development framework 1 Laboratory							
	TH		P		TUT		Total	
Teaching Scheme(Hrs.)	--		02		--		02	
Credits Assigned	--		01		--		01	
Examination Scheme	Marks							
	CA		ESE	TW	O	P	P&O	Total
	ISE	IA						
	--	--	--	25	25	--	--	50

- **Term-Work will consist of practical covering entire syllabus of "Development framework 1" (116U04E614). Students will be graded based on continuous assessment of their term work.**
- **Oral Examination will be based on laboratory work and entire theory syllabus of "Development framework 1"(116U04E614).**

Course Code	Course Title							
116U04L615	Internet of Things Laboratory							
	TH			P		TUT		Total
Teaching Scheme(Hrs.)	--			02		--		02
Credits Assigned	--			01		--		01
Examination Scheme	Marks							
	CA		ESE	TW	O	P	P&O	Total
	ISE	IA						
	--	--	--	25	25	--	--	50

- **Term-Work will consist of practical covering entire syllabus of "Internet of Things" (116U04E615). Students will be graded based on continuous assessment of their term work.**
- **Oral Examination will be based on laboratory work and entire theory syllabus of "Internet of Things" (116U04E615).**

Course Code	Course Title							
116U04L616	Development framework 2 Laboratory							
	TH		P		TUT		Total	
Teaching Scheme(Hrs.)	--		02		--		02	
Credits Assigned	--		01		--		01	
Examination Scheme	Marks							
	CA		ESE	TW	O	P	P&O	Total
	ISE	IA						
	--	--	--	25	25	--	--	50

- **Term-Work will consist of practical covering entire syllabus of "Development framework 2" (116U04E616). Students will be graded based on continuous assessment of their term work.**
- **Oral Examination will be based on laboratory work and entire theory syllabus of "Development framework 2" (116U04E616).**

Course Code	Course Title							
116U04P601	Mini Project							
	TH		P	TUT	Total			
Teaching Scheme(Hrs.)	--		02	--	02			
Credits Assigned	--		01	--	01			
Examination Scheme	Marks							
	CA		ESE	TW	O	P	P&O	Total
	ISE	IA						
	--	--	--	25	25	--	--	50

Course Objectives

The objective of Mini Project is to identify the real world challenges and try to provide the feasible solution to these problems considering different aspects such as requirements analysis, design, development, and deployment etc. of the application to solve the problem. This will enable students to apply the knowledge acquired in earlier semesters and also demonstrate the self-learning ability by exploring new required skills/ technology due to interdisciplinary nature of the mini project. It will empower student to follow the professional ethics and time management which will be highly beneficial during their professional life.

Course Outcomes

At the end of successful completion of the course the student will be able to

CO1: Identify the problem statement and scope of the problem

CO2: Analyze and design the solution considering hardware/software requirement.

CO3: Development and deployment of the solution

CO4: Communicate effectively using technical report and power point presentation

Term Work and Oral:

The mini project is a group project. Interdisciplinary projects are also permitted. Each project will be assigned with a faculty member as a supervisor. There will be continuous assessment and progress report of the project needs to be maintained by student(s).

The project will be evaluated based on the continuous assessment, technical report, project demonstration and presentation.