VIT®

Vellore Institute of Technology

(Deemed to be University under section 3 of UGC Act, 1956)

School of Computer Science and Engineering

CURRICULUM AND SYLLABI

(2020-2021)

B.Tech. Computer Science and Engineering with Spec. in Information Security

School of Computer Science and Engineering

B.Tech (CSE) - Specialization in Information Security

CURRICULUM AND SYLLABUS

(2020-21 Admitted Students)

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VISION STATEMENT OF VELLORE INSTITUTE OF TECHNOLOGY

Transforming life through excellence in education and research.

MISSION STATEMENT OF VELLORE INSTITUTE OF TECHNOLOGY

World class Education: Excellence in education, grounded in ethics and critical thinking, for improvement of life.

Cutting edge Research: An innovation ecosystem to extend knowledge and solve critical problems.

Impactful People: Happy, accountable, caring and effective workforce and students.

Rewarding Co-creations: Active collaboration with national & international industries & universities for productivity and economic development.

Service to Society: Service to the region and world through knowledge and compassion.

VISION STATEMENT OF THE SCHOOL OF COMPUTER SCIENCE AND ENGINEERING

To be a world-renowned centre of education, research and service in computing and allied domains.

MISSION STATEMENT OF THE SCHOOL OF COMPUTER SCIENCE AND ENGINEERING

- To offer computing education programs with the goal that the students become technically competent and develop lifelong learning skill.
- To undertake path-breaking research that creates new computing technologies and solutions for industry and society at large.
- To foster vibrant outreach programs for industry, research organizations, academia and society.

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School of Computer Science and Engineering

B.Tech-CSE (Spl. in Information Security)

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

1. Graduates will be engineering practitioners and leaders, who would helpsolve industry's technological problems.

2. Graduates will be engineering professionals, innovators or entrepreneurs engaged in technology development, technology deployment, or engineering system implementation in industry.

3. Graduates will function in their profession with social awareness and responsibility.

4. Graduates will interact with their peers in other disciplines in industry and society and contribute to the economic growth of the country.

5. Graduates will be successful in pursuing higher studies in engineering or management.

6. Graduates will pursue career paths in teaching or research.

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B.Tech-CSE (Spl. in Information Security)

PROGRAMME OUTCOMES (POs)

PO_01: Having an ability to apply mathematics and science in engineering applications.

PO_02: Having a clear understanding of the subject related concepts and of contemporary issues and apply them to identify, formulate and analyse complex engineering problems.

PO_03: Having an ability to design a component or a product applying all the relevant standards and with realistic constraints, including public health, safety, culture, society and environment

PO_04: Having an ability to design and conduct experiments, as well as toanalyse and interpret data, and synthesis of information

PO_05: Having an ability to use techniques, skills, resources and modern engineering and IT tools necessary for engineering practice

PO_06: Having problem solving ability- to assess social issues (societal, health, safety, legal and cultural) and engineering problems

PO_07: Having adaptive thinking and adaptability in relation to environmental context and sustainable development

PO_08: Having a clear understanding of professional and ethical responsibility

PO_09: Having cross cultural competency exhibited by working as a member or in teams

PO_10: Having a good working knowledge of communicating in English – communication with engineering community and society

PO_11: Having a good cognitive load management skills related to project management and finance

PO_12: Having interest and recognise the need for independent and lifelong learning

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B.Tech-CSE (Spl. in Information Security)

PROGRAMMEE SPECIFIC OUTCOMES (PSOs)

1. The ability to formulate mathematical models and problem solving skills through programming techniques for addressing real life problems using appropriate data structures and algorithms.

2. The ability to provide ethical solutions through the application of software engineering methodologies and database design principles with internet technologies for solving contemporary issues.

3. The ability to investigate and analyze using appropriate methodologies as well as security principles and apply security solutions to mitigate cyber security threats.

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B.Tech-CSE (Spl. in Information Security)

CREDIT STRUCTURE

Category-wise Credit distribution

CREDIT INFO		
S. No.	**Category**	**Credits**
1	Programme Core	**60**
2	Programme Elective	**35**
3	University Core	**53**
4	University Elective	**12**
5	Bridge Course	**0**
6	Non Credit Course	**5**
Total Credits		**165**

CREDIT INFO		
S.no	**Catagory**	**Credit**
1	Programme Core	60
2	Programme Elective	35
3	University Core	53
4	University Elective	12
5	Bridge Course	0
6	Non Credit Course	5
Total Credits		165

Programme Core									
sl.no	**Course Code**	**Course Title**	**Course Type**	**Version**	**L**	**T**	**P**	**J**	**Credit**
1	CSE1003	Digital Logic and Design	Embedded Theory and Lab	1.1	3	0	2	0	4.0
2	CSE1004	Network and Communication	Embedded Theory and Lab	1.1	3	0	2	0	4.0
3	CSE1007	Java Programming	Embedded Theory and Lab	1.0	3	0	2	0	4.0
4	CSE1011	Cryptography Fundamentals	Embedded Theory, Lab and Project	1.0	2	0	2	4	4.0
5	CSE2001	Computer Architecture and Organization	Theory Only	1.0	3	0	0	0	3.0
6	CSE2004	Database Management Systems	Embedded Theory and Lab	1.1	3	0	2	0	4.0
7	CSE2005	Operating Systems	Embedded Theory and Lab	1.1	3	0	2	0	4.0
8	CSE2008	Network Security	Embedded Theory and Project	1.0	3	0	0	4	4.0
9	CSE2010	Advanced C Programming	Embedded Theory and Lab	1.0	2	0	2	0	3.0
10	CSE2011	Data Structures and Algorithms	Embedded Theory and Lab	1.0	3	0	2	0	4.0
11	CSE2012	Design and Analysis of Algorithms	Embedded Theory and Lab	1.0	3	0	2	0	4.0
12	CSE2013	Theory of Computation	Theory Only	1.0	3	0	0	0	3.0
13	CSE3002	Internet and Web Programming	Embedded Theory and Lab	1.2	3	0	2	0	4.0
14	CSE4003	Cyber Security	Embedded Theory and Project	1.0	3	0	0	4	4.0
15	EEE1001	Basic Electrical and Electronics Engineering	Embedded Theory and Lab	1.0	2	0	2	0	3.0
16	MAT1014	Discrete Mathematics and Graph Theory	Theory Only	1.1	3	2	0	0	4.0

Programme Elective									
sl.no	Course Code	Course Title	Course Type	Version	L	T	P	J	Credit
1	BCI2001	Data Privacy	Embedded Theory and Project	1.0	3	0	0	4	4.0
2	BCI3001	Web Security	Embedded Theory, Lab and Project	1.0	2	0	2	4	4.0
3	BCI3002	Disaster Recovery and Business Continuity Management	Embedded Theory and Project	1.0	3	0	0	4	4.0
4	BCI3003	Android Security	Embedded Theory, Lab and Project	1.0	2	0	2	4	4.0
5	BCI3004	Security of E-Based Systems	Embedded Theory and Project	1.0	3	0	0	4	4.0
6	BCI3005	Digital Watermarking and Steganography	Embedded Theory and Project	1.0	3	0	0	4	4.0
7	BCI3006	Biometrics	Embedded Theory and Project	1.0	3	0	0	4	4.0
8	BCI4001	Cyber Forensics and Investigation	Embedded Theory and Lab	1.1	3	0	2	0	4.0
9	BCI4002	Vulnerability Analysis and Penetration Testing	Embedded Theory, Lab and Project	1.0	2	0	2	4	4.0
10	BCI4003	Malware Analysis	Embedded Theory, Lab and Project	1.0	2	0	2	4	4.0
11	CSE1006	Blockchain and Cryptocurrency Technologies	Theory Only	1.0	3	0	0	0	3.0
12	CSE2002	Theory of Computation and Compiler Design	Theory Only	1.1	4	0	0	0	4.0
13	CSE2006	Microprocessor and Interfacing	Embedded Theory, Lab and Project	1.1	2	0	2	4	4.0
14	CSE2014	Compiler Design	Embedded Theory and Lab	1.0	3	0	2	0	4.0
15	CSE3009	Internet of Things	Embedded Theory and Project	1.0	3	0	0	4	4.0
16	CSE3013	Artificial Intelligence	Embedded Theory and Project	1.0	3	0	0	4	4.0
17	CSE3501	Information Security Analysis and Audit	Embedded Theory, Lab and Project	1.0	2	0	2	4	4.0
18	CSE3502	Information Security Management	Embedded Theory, Lab and Project	1.0	2	0	2	4	4.0

Programme Elective									
19	CSE4001	Parallel and Distributed Computing	Embedded Theory, Lab and Project	1.0	2	0	2	4	4.0
20	CSE4019	Image Processing	Embedded Theory and Project	1.0	3	0	0	4	4.0
21	CSE4027	Mobile Programming	Embedded Theory, Lab and Project	1.0	2	0	2	4	4.0
22	MAT2002	Applications of Differential and Difference Equations	Embedded Theory and Lab	1.0	3	0	2	0	4.0
23	MAT3004	Applied Linear Algebra	Theory Only	1.1	3	2	0	0	4.0
24	MGT1004	Resource Management	Embedded Theory and Project	1.0	2	0	0	4	3.0
25	MGT1008	Impact of Information Systems on Society	Embedded Theory and Project	1.0	2	0	0	4	3.0
26	MGT1010	Total Quality Management	Theory Only	1.1	2	2	0	0	3.0
27	MGT1026	Information Assurance and Auditing	Embedded Theory and Project	1.0	2	0	0	4	3.0
28	MGT1028	Accounting and Financial Management	Embedded Theory and Project	1.0	2	2	0	4	4.0

University Core									
sl.no	**Course Code**	**Course Title**	**Course Type**	**Version**	**L**	**T**	**P**	**J**	**Credit**
1	CHY1701	Engineering Chemistry	Embedded Theory and Lab	1.0	3	0	2	0	4.0
2	CSE1001	Problem Solving and Programming	Lab Only	1.0	0	0	6	0	3.0
3	CSE1002	Problem Solving and Object Oriented Programming	Lab Only	1.0	0	0	6	0	3.0
4	CSE1901	Technical Answers for Real World Problems (TARP)	Embedded Theory and Project	1.0	1	0	0	4	2.0
5	CSE1902	Industrial Internship	Project	1.0	0	0	0	0	1.0
6	CSE1903	Comprehensive Examination	Project	1.0	0	0	0	0	1.0
7	CSE1904	Capstone Project	Project	1.0	0	0	0	0	12.0
8	ENG1901	Technical English - I	Lab Only	1.0	0	0	4	0	2.0
9	ENG1902	Technical English - II	Lab Only	1.0	0	0	4	0	2.0
10	ENG1903	Advanced Technical English	Embedded Lab and Project	1.0	0	0	2	4	2.0
11	FLC4097	Foreign Language Course Basket	Basket	1.0	0	0	0	0	2.0
12	HUM1021	Ethics and Values	Theory Only	1.2	2	0	0	0	2.0
13	MAT1011	Calculus for Engineers	Embedded Theory and Lab	1.0	3	0	2	0	4.0

University Core									
14	MAT2001	Statistics for Engineers	Embedded Theory and Lab	1.1	3	0	2	0	4.0
15	MGT1022	Lean Start-up Management	Embedded Theory and Project	1.0	1	0	0	4	2.0
16	PHY1701	Engineering Physics	Embedded Theory and Lab	1.0	3	0	2	0	4.0
17	PHY1901	Introduction to Innovative Projects	Theory Only	1.0	1	0	0	0	1.0
18	STS4097	Soft Skills B.Tech. / B.Des.	Basket	1.0	0	0	0	0	6.0

Bridge Course									
sl.no	Course Code	Course Title	Course Type	Version	L	T	P	J	Credit
1	ENG1000	Foundation English - I	Lab Only	1.0	0	0	4	0	2.0
2	ENG2000	Foundation English - II	Lab Only	1.0	0	0	4	0	2.0

Non Credit Course									
sl.no	Course Code	Course Title	Course Type	Version	L	T	P	J	Credit
1	CHY1002	Environmental Sciences	Theory Only	1.1	3	0	0	0	3.0
2	EXC4097	Co-Extra Curricular Basket	Basket	1.0	0	0	0	0	2.0

PROGRAMME CORE

CSE1003	DIGITAL LOGIC AND DESIGN	L	T	P	J	C
		3	0	2	0	4
Pre-requisite	**NIL**	**Syllabus version**				
		v1.0				

Course Objectives:

1. Introduce the concept of digital and binary systems.
2. Analyze and Design combinational and sequential logic circuits.
3. Reinforce theory and techniques taught in the classroom through experiments in the laboratory.

Expected Course Outcome:

1. Comprehend the different types of number system.
2. Evaluate and simplify logic functions using Boolean Algebra and K-map.
3. Design minimal combinational logic circuits.
4. Analyze the operation of medium complexity standard combinational circuits like the encoder, decoder, multiplexer, demultiplexer.
5. Analyze and Design the Basic Sequential Logic Circuits
6. Outline the construction of Basic Arithmetic and Logic Circuits
7. Acquire design thinking capability, ability to design a component with realistic constraints, to solve real world engineering problems and analyze the results.

Module:1	**INTRODUCTION**	**3 hours**
Number System - Base Conversion - Binary Codes - Complements(Binary and Decimal)		
Module:2	**BOOLEAN ALGEBRA**	**8 hours**
Boolean algebra - Properties of Boolean algebra - Boolean functions - Canonical and Standard forms - Logic gates - Universal gates – Karnaugh map - Don't care conditions - Tabulation Method		
Module:3	**COMBINATIONAL CIRCUIT - I**	**4 hours**
Adder - Subtractor - Code Converter - Analyzing a Combinational Circuit		
Module:4	**COMBINATIONAL CIRCUIT –II**	**6 hours**
Binary Parallel Adder- Look ahead carry - Magnitude Comparator - Decoders – Encoders - Multiplexers –Demultiplexers.		
Module:5	**SEQUENTIAL CIRCUITS – I**	**6 hours**
Flip Flops - Sequential Circuit: Design and Analysis - Finite State Machine: Moore and Mealy model - Sequence Detector.		
Module:6	**SEQUENTIAL CIRCUITS – II**	**7 hours**
Registers - Shift Registers - Counters - Ripple and Synchronous Counters - Modulo counters - Ring and Johnson counters		
Module:7	**ARITHMETIC LOGIC UNIT**	**9 hours**
Bus Organization - ALU - Design of ALU - Status Register - Design of Shifter - Processor Unit - Design of specific Arithmetic Circuits Accumulator - Design of Accumulator.		
Module:8	**Contemporary Issues: RECENT TRENDS**	**2 hours**
	Total Lecture hours:	**45 hours**

Text Book(s)			
1.	M. Morris Mano and Michael D.Ciletti– Digital Design: With an introduction to Verilog HDL, Pearson Education – 5th Edition- 2014. ISBN:9789332535763.		
Reference Books			
1.	Peterson, L.L. and Davie, B.S., 2007. Computer networks: a systems approach. Elsevier.		
2.	Thomas L Floyd. 2015. Digital Fundamentals. Pearson Education. ISBN: 9780132737968		
3.	Malvino, A.P. and Leach, D.P. and Goutam Saha. 2014. Digital Principles and Applications (SIE). Tata McGraw Hill. ISBN: 9789339203405.		
4.	Morris Mano, M. and Michael D.Ciletti. 2014. Digital Design: With an introduction to Verilog HDL. Pearson Education. ISBN:9789332535763		
Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar			
List of Challenging Experiments (Indicative)			
1.	Realization of Logic gates using discrete components, verication of truth table for logic gates, realization of basic gates using NAND and NOR gates		4.5 hours
	Implementation of Logic Circuits by verification of Boolean laws and verification of De Morgans law		3 hours
	Adder and Subtractor circuit realization by implementation of Half-Adder and Full-Adder, and by implementation of Half-Subtractor and Full-Subtractor		4.5 hours
	Combinational circuit design i. Design of Decoder and Encoder ii. Design of Multiplexer and De multiplexer iii. Design of Magnitude Comparator iv. Design of Code Converter		4.5 hours
	Sequential circuit design i. Design of Mealy and Moore circuit ii. Implementation of Shift registers iii. Design of 4-bit Counter iv. Design of Ring Counter		4.5 hours
	Implementation of different circuits to solve real world problems: A digitally controlled locker works based on a control switch and two keys which are entered by the user. Each key has a 2-bit binary representation. If the control switch is pressed, the locking system will pass the difference of two keys into the controller unit. Otherwise, the locking system will pass the sum of the two numbers to the controller unit. Design a circuit to determine the input to the controller unit.		4.5 hours
	Implementation of different circuits to solve real world problems: A bank queuing system has a capacity of 5 customers which serves on first come first served basis. A display unit is used to display the number of customers waiting in the queue. Whenever a customer leaves the queue, the count is reduced by one and the count is increased by one if a customer joins a queue. Two sensors (control signals) are used to sense customers leaving and joining the queue respectively. Design a circuit that displays the number of customers waiting in the queue in binary format using LEDs. Binary 1 is represented by LED glow and 0 otherwise.		4.5 hours
		Total Laboratory Hours	**30 hours**
Mode of assessment: Project/Activity			
Recommended by Board of Studies	28-02-2017		
Approved by Academic Council	No. 46	Date	24-08-2017

CSE1004	NETWORK AND COMMUNICATION	L	T	P	J	C
		3	0	2	0	4
Pre-requisite	**NIL**	**Syllabus version**				
		v1.0				

Course Objectives:

1. To build an understanding among students about the fundamental concepts of computer networking, protocols, architectures, and applications.
2. To help students to acquire knowledge in design, implement and analyze performance of OSI and TCP-IP based Architectures.
3. To implement new ideas in Networking through assignments.

Expected Course Outcome:

1. Interpret the different building blocks of Communication network and its architecture.
2. Contrast different types of switching networks and analyze the performance of network
3. Identify and analyze error and flow control mechanisms in data link layer
4. Design subnetting and analyze the performance of network layer
5. Construct and examine various routing protocols
6. Compare various congestion control mechanisms and identify appropriate Transport layer protocol for real time applications
7. Identify the suitable Application layer protocols for specific applications and its respective security mechanisms

Module:1	**Networking Principles and layered architecture**	**6 hours**

Data Communications and Networking: A Communications Model – Data Communications - Evolution of network, Requirements , Applications, Network Topology (Line configuration, Data Flow), Protocols and Standards, Network
Models (OSI, TCP/IP)

Module:2	**Circuit and Packet switching**	**7 hours**

Switched Communications Networks – Circuit Switching – Packet Switching – Comparison of Circuit Switching and Packet Switching – Implementing Network Software, Networking Parameters(Transmission Impairment, Data Rate and Performance)

Module:3	**Data Link Layer**	**10 hours**

Error Detection and Correction – Hamming Code , CRC, Checksum- Flow control mechanism – Sliding Window Protocol - GoBack - N - Selective Repeat - Multiple access Aloha - Slotted Aloha - CSMA, CSMA/CD – Multiple Access Networks (IEEE 802.3), Token Ring(IEEE 802.5) and Wireless Networks (IEEE 802.11, 802.15)

Module:4	**Network Layer**	**6 hours**

IPV4 Address Space – Notations – Classful Addressing – Classless Addressing – Network Address Translation – IPv6 Address Structure – IPv4 and IPv6 header format.

Module:5	**Routing Protocols**	**4 hours**

Routing-Link State and Distance Vector Routing Protocols- Implementation-Performance Analysis- Packet Tracer.

Module:6	**Transport Layer**	**7 hours**
TCP and UDP-Congestion Control-Effects of Congestion-Traffic Management-TCP Congestion Control-Congestion Avoidance Mechanisms-Queuing Mechanisms-QoS Parameters		
Module:7	**Application Layer**	**3 hours**
Application layer-Domain Name System-Case Study : FTP-HTTP-SMTP-SNMP		
Module:8	**Recent Trends in Network Security**	**2 hours**
	Total Lecture hours:	**45 hours**

Text Book(s)	
1.	Computer Networks: A Systems Approach, Larry Peterson and Bruce Davie, 5th Ed, The Morgan Kaufmann Series, Elsevier, 2011.
2.	Computer Networking: A Top-Down Approach Featuring the Internet, J.F. Kurose and K.W.Ross, 6th Ed., Pearson Education, 2012.
Reference Books	
1.	Data Communications and Networking, Behrouz A. Forouzan, McGraw Hill Education, 5th Ed., 2012.
2.	TCP/IP Protocol Suite, Behrouz A. Forouzan, McGraw-Hill Education, 4 Ed., 2009.
3.	Data and Computer Communications, William Stallings, Pearson Education, 10th Ed, 2013.

Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar

List of Challenging Experiments (Indicative)		
1	Demo session of all networking hardware and Functionalities	3 Hours
2	Network configuration commands using Linux	3 Hours
3	Error detection and correction mechanisms	3 Hours
4	Flow control mechanisms	3 Hours
5	IP addressing Classless addressing	3 Hours
6	Observing Packets across the network and Performance Analysis of Routing protocols	3 Hours
7	Socket programming(TCP and UDP) Multi client chatting	3 Hours
8	Simulation of unicast routing protocols	3 Hours
9	Simulation of Transport layer Protocols and analysis of congestion control techniques in network	3 Hours
10	Develop a DNS client server to resolve the given host name or IP address	3 Hours
	Total Laboratory Hours	**30 hours**

Mode of assessment: Project/Activity

Recommended by Board of Studies	28-02-2017		
Approved by Academic Council	No. 46	Date	24-08-2017

CSE1007	JAVA PROGRAMMING	L	T	P	J	C
		3	0	2	0	4
Pre-requisite	**NIL**	**Syllabus version**				
		v1.0				

Course Objectives:

1. To impart the core language features of Java and its Application Programming Interfaces (API).
2. To demonstrate the use of threads, exceptions, files and collection frameworks in Java.
3. To familiarize students with GUI based application development anddatabase connectivity.

Expected Course Outcome:

1. Comprehend Java Virtual Machine architecture and Java Programming Fundamentals.
2. Design applications involving Object Oriented Programming concepts such as inheritance, association, aggregation, composition, polymorphism, abstract classes and interfaces.
3. Design and build multi-threaded Java Applications.
4. Build software using concepts such as files, collection frameworks and containers.
5. Design and implement Java Applications for real world problems involving Database Connectivity.
6. Design Graphical User Interface using JavaFX.
7. Design, Develop and Deploy dynamic web applications using Servlets and JavaServer Pages.

Module:1	**Java Fundamentals**	**4 hours**

Java Basics: Java Design goal - Features of Java Language - JVM - Bytecode - Java source file structure basic programming constructs Arrays one dimensional and multi-dimensional enhanced for loop String package

Module:2	**Object Oriented Programming**	**5 hours**

Class Fundamentals - Object Object reference array of objects constructors methods over- loading this reference static block - nested class inner class garbage collection finalize() Wrapper classes Inheritance types - use of super - Polymorphism abstract class interfaces packages and sub packages.

Module:3	**Robustness and Concurrency**	**6 hours**

Exception Handling - Exceptions Errors - Types of Exception - Control Flow in Exceptions - Use of try, catch, finally, throw, throws in Exception Handling - user defined exceptions - Multithreading Thread creation sharing the workload among threads synchronization inter thread communication deadlock.

Module:4	**Files, Streams and Object serialization**	**7 hours**

Data structures: Java I/O streams Working with files Serialization and deserialization of objects Lambda expressions, Collection framework List, Map, Set Generics Annotations

Module:5	**GUI Programming and Database Connectivity**	**7 hours**

GUI programming using JavaFX, exploring events, controls and JavaFX menus Accessing databases using JDBC connectivity.

Module:6	**Servlet**	**7 hours**
Introduction to servlet - Servlet life cycle - Developing and Deploying Servlets - Exploring Deployment Descriptor (web.xml) - Handling Request and Response - Session Tracking Management.		
Module:7	**Java Server Pages**	**7 hours**
JSP Tags and Expressions - JSP Expression Language (EL) - Using Custom Tag - JSP with Java Bean.		
Module:8	**Latest Trends**	**2 hours**
Industry Expert talk		

	Total Lecture hours:	**45 hours**	

Text Book(s)	
1.	Herbert Schildt, The Complete Reference -Java, Tata McGraw-Hill Education, Tenth Edition, 2017.
2.	Paul J. Deitel, Harvey Deitel ,Java SE8 for Programmers (Deitel Developer Series) 3rd Edition, 2014
3.	Y. Daniel Liang, Introduction to Java programming-comprehensive version-Tenth Edition, Pearson ltd 2015
Reference Books	
1.	Paul Deitel Harvey Deitel ,Java, How to Program, Prentice Hall; 9th edition , 2011.
2.	Cay Horstmann BIG JAVA, 4th edition, John Wiley Sons,2009
3.	Nicholas S. Williams, Professional Java for Web Applications, Wrox Press, 2014.
Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar	

List of Challenging Experiments (Indicative)		
1.	Write a program to demonstrate the use of multidimensional arrays and looping constructs.	2 hours
2.	Write a program to demonstrate the application of String handling functions.	2 hours
3.	Write a program to demonstrate the use of Inheritance.	2 hours
4.	Write a program to demonstrate the application of user-defined packages and sub-packages.	2 hours
5.	Write a program to demonstrate the use of Java Exception handling methods.	2 hours
6.	Write a program to demonstrate the use of threads in Java.	2 hours
7.	Demonstrate with a program the use of File handling methods in Java.	2 hours
8.	Demonstrate the use of Java collection frameworks in reducing application development time.	2 hours
9.	Build a GUI application using JavaFX	2 hours
10.	Write a program to register students data using JDBC with MySQL Database.	2 hours
11.	Write a program that uses Servlets to perform basic banking tasks.	2 hours
12.	Write a web application using JSP and demonstrate the use of http request and response methods.	2 hours
13.	Write a JSP program for an order management system.	2 hours
14.	Write a JSP program that using JDBC and MySQL database to store the user data.	2 hours
15.	JSP with Java Bean	2 hours
	Total Laboratory Hours	30 hours
Mode of assessment: Project/Activity		

Recommended by Board of Studies	10-08-2018		
Approved by Academic Council	No. 52	Date	14-09-2018

CSE1011	CRYPTOGRAPHY FUNDAMENTALS	L	T	P	J	C
		2	0	2	4	4
Pre-requisite	**Nil**	**Syllabus version**				
		v. 1.0				

Course Objectives:

1. To learn the fundamental concepts of cryptography
2. To defend the security attacks on information systems with secure algorithms

Expected Course Outcome:

1. Learn to analyze the security of the in-built cryptosystems
2. Develop cryptographic algorithms for information security
3. Develop authentication schemes for identity and membership authorization

Module:1	INTRODUCTION TO SECURITY	4 hours

Information Security - Confidentiality, Integrity & Availability – Authentication, Authorization & Non-Repudiation – Introduction to Plain Text, Cipher Text, Encryption and Decryption Techniques, Secure Key, Hashing, Digital signature

Module:2	SYMMETRIC ENCRYPTION	4 hours

Block cipher, Stream cipher - Data Encryption Standard (DES) - Cipher Block Chaining (CBC) – Multiple Encryption DES - International Data Encryption Algorithm (IDEA) - Advanced Encryption Standard (AES)

Module:3	ASYMMETRIC ENCRYPTION	4 hours

Asymmetric key generation techniques – Applications of asymmetric encryption methods – RSA-Elliptic Curve Cryptography – Homomorphic encryption

Module:4	DIGITAL SIGNATURES	3 hours

Digital signature standards - Secure One-time Signatures - Application of Digital Signatures - Diffie-Hellman Key Exchange - Elliptic Curve Digital Signature algorithm

Module:5	HASHING AND MESSAGE DIGESTS	4 hours

Cryptographic Hash Functions- Applications- Simple hash functions and features for ensuring security – Hash functions based on Cipher Block Chaining- Secure Hash Algorithm (SHA) - Message Digest - MD5

Module:6	MESSAGE AUTHENTICATION	5 hours

Authentication Systems – Password and Address – Security Handshake Drawbacks - Authentication Standards – Kerberos- PKI Trust Models -Message Authentication Codes (MAC) – Security features- MAC based on Hash Functions - MAC based on Block Ciphers

Module:7	APPLICATIONS OF CRYPTOGRAPHIC ALGORITHMS	4 hours

Applying cryptography algorithms - Smart cards-Mobile phone security - Electronic passports and ID cards - SDA/DDA/CDA Bank Cards - Financial Cryptography – Secure Payment Systems - Crypto currencies - Bitcoin

Module:8	**Recent Trends**	**2 hours**
Industry Expert talk		
	Total Lecture hours:	**30 hours**

Text Book(s)	
1.	D. R. Stinson, Cryptography: Theory and Practice, 3rd Ed. Boca Raton, FL: Chapman & Hall/CRC, 2005. (ISBN No.: 978-1-58-488508-5).
2	W. Stallings, Cryptography and Network Security: Principles and Practice, 7th Ed. Pearson Publishers, 2017. (ISBN No.: 978-0-13-44446-11).
Reference Books	
1.	J. H. Silverman, A Friendly Introduction to Number Theory, 4th Ed. Boston: Pearson, 2012. (ISBN No.: 978-0-321-81619-1).
2.	C. Kaufman, R. Perlman, and M. Speciner, Network Security: Private Communication in a Public World, 2nd Ed. United States: Prentice Hall PTR, 2002. (ISBN No.: 978-0-13-046019-6)

Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar

List of Challenging Experiments (Indicative)		
1.	Demonstration of symmetric conventional cryptographic techniques.	3 hours
2.	Demonstration of symmetric classic cryptographic techniques	3 hours
3.	Demonstration of asymmetric cryptographic techniques	3 hours
4.	Demonstration of hashing and message digest techniques	3 hours
5.	Design and implementation of homomorphic encryption techniques	3 hours
6.	Demonstration and implementation of secure communication using standard crypto libraries	3 hours
7.	Implementation of smart card based server/client applications	3 hours
8.	Demonstration of authentication techniques	3 hours
9.	Developing cryptographic algorithms for industrial applications	3 hours
10.	Developing cryptographic algorithms for innovative applications	3 hours
	Total Laboratory Hours	**30 hours**

Mode of assessment: Project/Activity

Recommended by Board of Studies	25-02-2017		
Approved by Academic Council	No. 44	Date	16.03.2017

CSE2001	COMPUTER ARCHITECTURE AND ORGANIZATION	L	T	P	J	C
		3	0	2	0	4
Pre-requisite	CSE1003 Digital Logic Design	Syllabus version				
		v1.0				

Course Objectives:

1. To acquaint students with the basic concepts of fundamental component, architecture, register organization and performance metrics of a computer.
2. To impart the knowledge of data representation in binary and understand implementation of arithmetic algorithms in a typical computer.
3. To teach students how to describe machine capabilities and design an effective data path design for instruction execution. To introduce students to syntax and semantics of machine level programming.
4. To make students understand the importance of memory systems, IO interfacing techniques and external storage and their performance metrics for a typical computer. And explore various alternate techniques for improving the performance of a processor.

Expected Course Outcome:

1. Differentiate Von Neumann, Harvard, and CISC and RISC architectures. Analyze the performance of machines with different capabilities.
2. Illustrate binary format for numerical and characters. Validate efficient algorithm for arithmetic operations.
3. Construct machine level program for given expression on n-address machine. Analyze and calculate memory traffic for a program execution. Design an efficient data path for an instruction format for a given architecture.
4. Explain the importance of hierarchical memory organization. Able to construct larger memories. Analyze and suggest efficient cache mapping technique and replacement algorithms for given design requirements. Demonstrate hamming code for error detection and correction.
5. Understand the need for an interface. Compare and contrast memory mapping and IO mapping techniques. Describe and Differentiate different modes of data transfer. Appraise the synchronous and asynchronous bus for performance and arbitration.
6. Understand the structure and read write mechanisms for different storage systems. Illustrate and suggest appropriate use of RAID levels. Assess the performance of IO and external storage systems.
7. Classify parallel machine models. Illustrate typical 6-stage pipeline for overlapped execution. Analyze the hazards and solutions.

Module:1	Introduction and overview of computer architecture	3 hours

Introduction to computer systems - Overview of Organization and Architecture -Functional components of a computer -Registers and register files-Interconnection of components-Organization of the von Neumann machine and Harvard architecture-Performance of processor

Module:2	Data Representation And Computer Arithmetic	6 hours

Fixed point representation of numbers-algorithms for arithmetic operations: multiplication (Booths, Modified Booths) - division (restoring and non-restoring) - Floating point representation with IEEE standards and algorithms for common arithmetic operations- Representation of non-numeric data (character codes).

Module:3	**Fundamentals of Computer Architecture**	**11 hours**
Introduction to ISA (Instruction Set Architecture)-Instruction formats- Instruction types and addressing modes- Instruction execution (Phases of instruction cycle)- Assembly language programming-Subroutine call and return mechanisms-Single cycle Data path design-Introduction to multi cycle data path-Multi cycle Instruction execution.		
Module:4	**Memory System Organization and Architecture**	**9 hours**
Memory systems hierarchy-Main memory organization-Types of Main memory-memory interleaving and its characteristics and performance- Cache memories: address mapping-line size-replacement and policies- coherence- Virtual memory systems- TLB- Reliability of memory systems- error detecting and error correcting systems.		
Module:5	**Interfacing and Communication**	**7 hours**
I/O fundamentals: handshaking, buffering-I/O techniques: programmed I/O, interrupt-driven I/O, DMA- Interrupt structures: vectored and prioritized-interrupt overhead- Buses: Syn- chronous and asynchronous- Arbitration.		
Module:6	**Device Subsystems**	**4 hours**
External storage systems-organization and structure of disk drives: Electronic- magnetic and optical technologies- RAID Levels- I/O Performance		
Module:7	**Performance Enhancements**	**4 hours**
Classification of models - Flynns taxonomy of parallel machine models (SISD, SIMD, MISD, MIMD)- Introduction to Pipelining- Pipelined data path-Introduction to hazards		
Module:8	**Contemporary issues: Recent Trends**	**1 hour**
Multiprocessor architecture: Overview of Shared Memory architecture, Distributed architecture.		
	Total Lecture hours:	**45 hours**

Text Book(s)	
1.	David A. Patterson and John L. Hennessy Computer Organization and Design-The Hardware/Software Interface 5th edition, Morgan Kaufmann, 2013.
2.	Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Computer organization, Mc Graw Hill, Fifth edition, Reprint 2011.
Reference Books	
1.	W. Stallings, Computer organization and architecture, Prentice-Hall, 8th edition, 2013

Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar			
Recommended by Board of Studies	04-04-2014		
Approved by Academic Council	No. 37	Date	16-06-2015

CSE2004	DATABASE MANAGEMENT SYSTEM	L	T	P	J	C
		3	0	2	0	4
Pre-requisite	**NIL**	**Syllabus version**				
		v1.0				

Course Objectives:

1. To understand the concept of DBMS and ER Modeling.
2. To explain the normalization, Query optimization and relational algebra.
3. To apply the concurrency control, recovery, security and indexing for the real time data.

Expected Course Outcome:

1. Explain the basic concept and role of DBMS in an organization.
2. Illustrate the design principles for database design, ER model and normalization.
3. Demonstrate the basics of query evaluation and heuristic query optimization techniques.
4. Apply Concurrency control and recovery mechanisms for the desirable database problem.
5. Compare the basic database storage structure and access techniques including B Tree, B+ Tress and hashing.
6. Review the fundamental view on unstructured data and its management.
7. Design and implement the database system with the fundamental concepts of DBMS.

Module:1	**DATABASE SYSTEMS CONCEPTS AND ARCHITECTURE**	**5 hours**

History and motivation for database systems -characteristics of database approach - Actors on the scene - Workers behind the scene - Advantages of using DBMS approach– Data Models, Schemas, and Instances– Three-Schema Architecture and Data Independence– The Database System Environment– Centralized and Client/Server Architectures for DBMSs– Classification of database management systems.

Module:2	**DATA MODELING**	**4 hours**

Entity Relationship Model : Types of Attributes, Relationship, Structural Constraints - Relational Model, Relational model Constraints - Mapping ER model to a relational schema - Integrity constraints

Module:3	**SCHEMA REFINEMENT**	**6 hours**

Guidelines for Relational Schema – Functional dependency; Normalization, Boyce Codd Normal Form, Multi-valued dependency and Fourth Normal form; Join dependency and Fifth Normal form.

Module:4	**QUERY PROCESSING AND TRANSACTION PROCESSING**	**5 hours**

Translating SQL Queries into Relational Algebra - heuristic query optimization - Introduction to Transaction Processing - Transaction and System concepts – Desirable properties of Transactions - Characterizing schedules based on recoverability - Characterizing schedules based on serializability

Module:5	**CONCURRENCY CONTROL AND RECOVERY TECHNIQUES**	**4 hours**

Two-Phase Locking Techniques for Concurrency Control – Concurrency Control based on timestamp – Recovery Concepts – Recovery based on deferred update – Recovery techniques based on immediate update - Shadow Paging.

Module:6	**PHYSICAL DATABASE DESIGN**	**3 hours**

Indexing: Single level indexing, multi-level indexing, dynamic multilevel Indexing		
Module:7	**RECENT TRENDS - NOSQL DATABASE MANAGEMENT**	**3 hours**
Introduction, Need of NoSQL, CAP Theorem, different NoSQL data models: Key-value stores, Column families, Document databases, Graph databases		
	Total Lecture hours:	**30 hours**

Text Book(s)	
1.	R. Elmasri S. B. Navathe, Fundamentals of Database Systems, Addison Wesley, 2015
2.	Raghu Ramakrishnan,Database Management Systems,Mcgraw-Hill,4th edition,2015.
Reference Books	
1.	A. Silberschatz, H. F. Korth S. Sudershan, Database System Concepts, McGraw Hill, 6th Edition 2010.
2.	Thomas Connolly, Carolyn Begg, Database Systems: A Practical Approach to Design, Implementation and Management,6th Edition,2012.
3.	Pramod J. Sadalage and Marin Fowler, NoSQL Distilled: A brief guide to merging world of Polyglot persistence, Addison Wesley, 2012.
4.	Shashank Tiwari ,Professional NoSql,Wiley ,2011
Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar	

List of Challenging Experiments (Indicative)		
1.	DDL and DML	3 hours
2.	Single row and aggregate functions	3 hours
3.	Joins and Sub queries	3 hours
4.	Anonymous blocks and control structures	3 hours
5.	Iterations	3 hours
6.	Cursors	3 hours
7.	Functions and Procedures	3 hours
8.	Exception Handling and triggers	3 hours
9.	DBA Concepts	3 hours
10.	XML, DTD, XQuery Representations	3 hours
	Total Laboratory Hours	**30 hours**
Mode of assessment: Project/Activity		

Recommended by Board of Studies	04-04-2014		
Approved by Academic Council	No. 37	Date	16-06-2015

Course code	Course Title	L	T	P	J	C
CSE2005	OPERATING SYSTEMS	3	0	2	0	4
Pre-requisite	Nil	Syllabus version				
		v.x.x				

Course Objectives:

1. To introduce the operating system concepts, designs and provide skills required to implement the services.
2. To describe the trade-offs between conflicting objectives in large scale system design.
3. To develop the knowledge for application of the various design issues and services.

Expected Course Outcome:

1. Interpret the evolution of OS functionality, structures and layers.
2. Apply various types of system calls and to find the stages of various process states.
3. Design a model scheduling algorithm to compute various scheduling criteria.
4. Apply and analyze communication between inter process and synchronization techniques.
5. Implement page replacement algorithms, memory management problems and segmentation.
6. Differentiate the file systems for applying different allocation and access techniques.
7. Representing virtualization and demonstrating the various Operating system tasks and the principle algorithms for enumerating those tasks.

Module:1	Introduction	3 hours	CO:1

Introduction to OS: Functionality of OS - OS design issues - Structuring methods (monolithic, layered, modular, micro-kernel models) - Abstractions, processes, resources - Influence of security, networking, and multimedia.

Module:2	OS Principles	4 hours	CO:2

System calls, System/Application Call Interface – Protection: User/Kernel modes - Interrupts - Processes - Structures (Process Control Block, Ready List etc.), Process creation, management in Unix – Threads: User level, kernel level threads and thread models.

Module:3	Scheduling	9 hours	CO:3

Processes Scheduling - CPU Scheduling: Pre-emptive, non-pre-emptive - Multiprocessor scheduling – Deadlocks - Resource allocation and management - Deadlock handling mechanisms: prevention, avoidance, detection, recovery.

Module:4	Concurrency	8 hours	CO:4

Inter-process communication, Synchronization - Implementing synchronization primitives (Peterson's solution, Bakery algorithm, synchronization hardware) - Semaphores – Classical

synchronization problems, Monitors: Solution to Dining Philosophers problem – IPC in Unix, Multiprocessors and Locking - Scalable Locks - Lock-free coordination.			
Module:5	**Memory Management**	**7 hours**	**CO:5**
Main memory management, Memory allocation strategies, Virtual memory: Hardware support for virtual memory (caching, TLB) – Paging - Segmentation - Demand Paging - Page Faults - Page Replacement -Thrashing - Working Set.			
Module:6	**Virtualization and File System Management**	**6 hours**	**CO:7**
Virtual Machines - Virtualization (Hardware/Software, Server, Service, Network - Hypervisors - Container virtualization - Cost of virtualization - File system interface (access methods, directory structures) - File system implementation (directory implementation, file allocation methods) - File system recovery - Journaling - Soft updates - Log-structured file system - Distributed file system.			
Module:7	**Storage Management, Protection and Security**	**6 hours**	**CO:6**
Disk structure and attachment – Disk scheduling algorithms (seek time, rotational latency based)- System threats and security – Policy vs mechanism - Access vs authentication - System protection: Access matrix – Capability based systems - OS: performance, scaling, future directions in mobile OS.			
Module:8	**Recent Trends**	**2 hours**	**CO:7**
	Total Lecture hours:	**45 hours**	

Text Book(s)		
1.	Abraham Silberschatz, Peter B. Galvin, Greg Gagne-Operating System Concepts, Wiley (2018).	
Reference Books		
1.	Ramez Elmasri, A.Gil Carrick, David Levine, Operating Systems, A Spiral Approach - McGrawHill Higher Education (2010).	
2.	Remzi H. Arpaci-Dusseau, Andrea C. Arpaci-Dusseau, Operating Systems, Three Easy Pieces, Arpaci-Dusseau Books, Inc (2015).	
3.	Andrew S. Tanenbaum, Modern Operating Systems, Pearson, 4th Edition (2016).	
4.	William Stallings, Operating Systems: Internals and Design Principles, Pearson, 9th Edition (2018).	
Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar		
List of Experiments		
1.	Design a boot loader - to load a particular OS say TinyOS/ KolibriOS image - code to access from BIOS to loading the OS - involves little assembly code may use QEMU/virtual machines for emulation of hardware.	3 hours

2.	Allocate/free memory to processes in whole pages, find max allocatable pages, incorporate address translation into the program.	3 hours
3.	Create an interrupt to handle a system call and continue the previously running process after servicing the interrupt.	3 hours
4.	Write a Disk driver for the SATA interface. Take care to check readiness of the controller, locked buffer cache, accept interrupts from OS during the period, interrupting the OS again once done and clearing buffers.	3 hours
5.	Demonstrate the use of locks in conjunction with the IDE driver.	3 hours
6.	Run an experiment to determine the context switch time from one process to another and one kernel thread to another. Compare the findings	3 hours
7.	Determine the latency of individual integer access times in main memory, L1 Cache and L2 Cache. Plot the results in log of memory accessed vs average latency.	3 hours
8.	Compare the overhead of a system call with a procedure call. What is the cost of a minimal system call?	3 hours
9.	Compare the task creation times. Execute a process and kernel thread, determine the time taken to create and run the threads.	3 hours
10.	Determine the file read time for sequential and random access based of varying sizes of the files. Take care not to read from cached data - used the raw device interface. Draw a graph log/log plot of size of file vs average per-block time.	3 hours
	Total Laboratory Hours	30 hours
Mode of evaluation: Project/Activity		
Recommended by Board of Studies	09-09-2020	
Approved by Academic Council	No. 59	Date 24-09-2020

CSE2008	NETWORK SECURITY	L	T	P	J	C
		3	0	0	4	4
Pre-requisite	**Nil**	**Syllabus version**				
		v. 1.0				

Course Objectives:

1. To develop a fundamental understanding of computer and network security proper practices, policies, technologies and standards
2. To impart familiarity with the security techniques that provide information and network security
3. To enable to evaluate the security of communication systems networks and protocols based on a multitude of security factors

Expected Course Outcome:

1. Describe computer and network security fundamental concepts and principles.
2. Identify and assess different types of threats, malware, spyware, viruses, vulnerabilities, and today's attacks such as social engineering, rootkit, and botnets
3. Describe the inner-workings of today's real time communication security, e-mail security and wireless security
4. Demonstrate the ability to select among available network security technology and protocols such as IDS, IPS, firewalls, honeynets, SSL, SSH, IPSec, TLS, VPNs, etc..

Module:1	**INTRODUCTION ON NETWORKING AND SECURITY**	**7 hours**

Access Control and Site Security- Virtual Local Area Network (VLAN), Demilitarized zone (DMZ) ATTACKS, SERVICES MECHANISMS Attack Methods – TCP/IP Internetworking, Security problems in TCP/IP protocol suite, BGP security attacks, DNS Cache poisoning, Denial of Service (DoS) attacks, Distributed Denial of Service (DDoS) attacks, IP Trace back attacks

Module:2	**REAL-TIME COMMUNICATION SECURITY**	**8 hours**

Introduction to TCP/IP protocol stack -Implementation layers for security protocols and implications - IPsec: AH and ESP- IPsec: IKE- SSL/TLS- Distribution lists-Establishing keys-Privacy, Source Authentication, Message Integrity, Non-Repudiation, Proof of Submission, Proof of Delivery, Message Flow Confidentiality, Anonymity – Packet filters-Application level gateways.

Module:3	**INTERNET CONTROL MESSAGE PROTOCOL (ICMP)**	**5 hours**

ICMP Messages - Attacks Using ICMP Messages - Reconnaissance Scanning - ICMP Sweep- Traceroute - Firewalk - Inverse Mapping - OS Fingerprinting - Exploiting Systems - ICMP Route Redirect - ICMP informational messages - ICMP Router Discovery Messages - ICMP Floods - Smurf - Keeping Access Covering The Tracks

Module:4	**ELECTRONIC MAIL SECURITY**	**5 hours**

Pretty Good Privacy – PGP services – Transmission and Reception of PGP Messages – PGP Message Generation – PGP Message Reception

Module:5	**Web Security**	**4 hours**

Threats on the web – Secure Socket Layer and Transport Layer Security:SSL architecture – SSL record protocol – Handshake protocols

Module:6	**Wireless Security**	**7 hours**
SSID vulnerabilities, Hotspot vulnerabilities, Privacy and security issues in WiFi, WPA, Wireless Intrusion Prevention System (WIPS), - Audit records - Viruses and related threats –Security of data oriented and voice oriented wireless networks (GSM UMTS, other models) IOT SECURITY Introduction –Application Space – IoT Security Issues – Hardware, Software and Network Security Solutions – Security Analysis		
Module:7	**Network Defense Solutions**	**7 hours**
Firewall, VPNs, Intrusion Detection and Prevention filters, Covert channels and counter measures in communication protocols, Techniques for shielding applications from an untrusted environment, Client and Server Security tools and applications		
Module:8	**Recent Trends**	**2 hours**
Industry Expert talk		
	Total Lecture hours:	**45 hours**

Text Book(s)	
1.	W. Stallings, Cryptography and Network Security: Principles and Practice, 5th Ed. Boston: Prentice Hall, 2010. (ISBN No.: 978-0-13-609704-4).
2	A. Das and C. VeniMadhavan, Public-key Cryptography: Theory and Practice. New Delhi, India: Pearson Education India, 2009. (ISBN No. : 978-8-13-170832-3).
Reference Books	
1.	D. R. Stinson, Cryptography: Theory and Practice, 3rd Ed. Boca Raton, FL: Chapman Hall/CRC, 2005. (ISBN No.: 978-1-58-488508-5).
2.	M. Rhodes-Ousley, Network security the complete reference (complete reference), 2nd ed. New York, USA: McGraw-Hill Professional Publishing, 2013. (ISBN No. : 978-1-59749-535-6)
3.	C. Kaufman, R. Perlman, and M. Speciner, Network Security: Private Communication in a Public World, 2nd Ed. United States: Prentice Hall PTR, 2002. (ISBN No.: 978-0-13-046019-6).
4.	A. Kahate, Cryptography and Network Security, 3rd Ed. New Delhi: Tata McGraw-Hill Education, 2003.(ISBN No. : 978-0-07-049483-1)
5.	A. Basta and M. Zgola, Database Security, 1st Ed. Boston, MA: Delmar Cengage Learning, 2012. (ISBN No.: 978 - 1 – 4354 – 5390 – 6)

Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar			
Mode of assessment: Project/Activity			
Recommended by Board of Studies	28-02-2017		
Approved by Academic Council	No. 41	Date	16-03-2017

Course code	Advanced C Programming	L	T	P	J	C
CSE2010		2	0	2	0	3
Pre-requisite	CSE1001	Syllabus version				
Anti-requisite	CSE1008	v. xx.xx				

Course Objectives:

1. In depth understanding of storage classes, memory allocation and pointer manipulation.
2. High level and low level organization of files.
3. Explore the power of macros and preprocessor directives.

Expected Course Outcome:

At the end of this course students will be able to:

1. Learn various control structures and derived data types for solving real world problems using user defined functions.
2. Explore dynamic memory allocations strategies and user defined data types.
3. Realize the features of various Input and Output methods including files.
4. Idealize the power of preprocessor directives and recognize programming methods
5. Able to modularize the programming using various input, output, mathematical and utility functions in C and unix system interfaces.
6. Able to design the software in c using features of graphics, embedded programming concepts.
7. Apply the learned concepts and design algorithmic solutions for the real world problems.

Module:1	Control Structures, Functions and Pointer	3 hours	CO: 1

Review of C fundamentals : Data types, Operators and Expressions, Control structures, Arrays, Functions, String, Pointers and Structures.

Module:2	Memory Allocation	5 hours	CO: 2

The memory layout in c programming, dynamic memory allocation: malloc(), calloc(), realloc(), free(), core dump, memory leak, dangling pointer. Pointers and array: Pointer and one dimensional arrays, Array of pointers, Pointers and two dimensional arrays, Subscripting pointer to an array, Dynamic 1D and 2D array.

Module:3	User defined data types	5 hours	CO: 2

Structures, array of structures, passing structure to functions, function pointers : Passing and returning values using pointers, Array as function argument, Using Pointers as Arguments, Functions returning address, Function returning pointers, Pointer to a function, Calling a function through function pointer, Functions with varying number of arguments. arrays and structures within structures, Unions, Bit fields, enumerations, typedef.

Module:4	Input/Output Manipulation and Files	5 hours	CO: 3

I/O Manipulation: Standard I/O, Formatted Output - printf, Formated Input - scanf, Variable length argument list, file access including FILE structure, fopen, stdin, sdtout and stderr, Error Handling including exit, perror and error.h, Line I/O, related miscellaneous functions. Files manipulations: File Descriptors, File pointer, Working with text files, working with binary files, Character I/O, EOF, Sequential and random access.

Module:5	**Preprocessor Directives and programming method**	**4 hours**	**CO: 4**
Preprocessor Directives: #include statements, #define statements, #error, Conditional compilation, #undef, The # and ## preprocessor operators, Predefined macro names, Nested macros, Multiline macros, Macros pitfalls, Macros Vs enums, Inline functions, Macros vs inline functions, Inline recursive functions, Command line arguments, Environment Variables in C Programs, Type qualifiers. Programming Method: Debugging, User Defined Header, User Defined Library Function, makefile utility.			
Module:6	**Standard Library functions and Unix system Interface**	**3 hours**	**CO: 5**
Standard Library functions: I/O functions, string and character functions, mathematical functions, time, date and localization functions, utility functions, wide-character functions. Unix system Interface: File Descriptor, Low level I/O - read and write, Open, create, close and unlink, Random access - Iseek, Discussions on Listing Directory, Storage allocator.			
Module:7	**Graphics, embedded C and Software development using C**	**3 hours**	**CO: 6**
Graphics: writing a text graphics program, writing a pixel graphics program, two dimensional graphics. Embedded C programming : Basics, Data types, keywords, programming structure, basic embedded c programming. Software development using c: Building a windows 2000 skeleton, software engineering using c, efficiency, porting programming.			
Module:8	**Contemporary issues**	**2hours**	**CO: 7**
	Total Lecture hours:	**30 hours**	

Text Book(s)

1.	**Byron Gottfried and Jitender Chhabra , "Programming with C (Schaum's Outlines Series)", Third Edition. McGraw Hill Education. ISBN: 978-0070145900, July 2017.**
2.	**Herbert Schildt., "C: The Complete Reference", Fourth Edition. McGraw Hill Education. 978-0070411838. July 2017.**
3.	Brian W. Kernighan and Dennis Ritchie, "The C Programming Language", Pearson Education India; 2nd Edition. ISBN: 978-9332549449. 2015.
4.	Peter Prinz and Tony Crawford, "C in a Nutshell: The Definitive Reference". O'Reilly Media. Inc., Second Edition. ISBN: 978-1491904756. December 2015.
5.	K R. Venugopal, Sudeep. R Prasad, "Mastering C", McGraw Hill Publishers, Second Edition. ISBN: 9789332901278. May 2015.

Reference Books

1.	**Jeff Szuhay, "Learn C Programming: A beginner's guide to learning C programming the easy and disciplined way", Packt Publishing Limited, First Edition, ISBN: 978-1789349917. June 2020.**

2.	**Zed A Shaw, "Learn C the Hard Way: Practical Exercises on the Computational Subjects You Keep Avoiding (Like C)", First Edition. Addison Wesley. ISBN: 978-0-321-88492-3. September 2015.**			
3.	Richard M. Reeses, "Understanding and Using C Pointers", First Edition. O'Reilly Publishers, ISBN: 9781449344184. January 2013.			
4.	A.R. Bradley, "Programming for Engineers", Springer, Berlin, Heidelberg. First Edition. ISBN: 978-3-642-23303-6, 2011.			
5.	A. Forouzan and Richard F. Gilberg, "Computer Science: A Structured Programming Approach Using C", CENGAGE LEARNING (RS), Third Edition.ISBN: 978-8131503638, 2007.			
Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar				
List of Challenging Experiments (Indicative)			**CO: 7**	
1.	Programs to demonstrate the use of various data types and storage classes.			2 hours
2.	Programs to understand various control structures.			2 hours
3.	Programs for Manipulating Arrays (One dimensional and Two dimensional)			4 hours
4.	Programs to understand memory allocations using pointers (simple and arrays)			2 hours
5.	Programs using pointers to arrays including strings (One dimensional and two dimensional)			6 hours
6.	Programs to explore different kinds of macros.			2 hours
7.	Programs to manipulate different records (employee, students, HR) using structures (with and without pointers)			6 hours
8.	Programs to manipulate different files (sequential and random)			6 hours
			Total Laboratory Hours	30 hours
Mode of evaluation:				
Recommended by Board of Studies	09-09-2020			
Approved by Academic Council	No. 59	Date	24-09-2020	

Course code	Data Structures and Algorithms	L	T	P	J	C
CSE2011		3	0	2	0	4
Pre-requisite	Nil	Syllabus version				
		v. xx.xx				

Course Objectives:

1. To understand the basic concepts of data structures and algorithms.
2. To differentiate linear and non-linear data structures and the operations upon them.
3. Ability to perform sorting and searchingin a given set ofdata items.
4. To comprehend the necessity of time complexity in algorithms.

Expected Course Outcome:

1. Understanding the fundamental analysis and time complexity for a given problem.
2. Articulate linear data structures and legal operations permitted on them.
3. Articulate non-linear data structures and legal operations permitted on them.
4. Applyinga suitable algorithm for searching and sorting.
5. Understanding graph algorithms, operations, and applications.
6. Understanding the importance of hashing.
7. Applying the basic data structures to understand advanced data structure operations and applications.
8. Application ofappropriate data structures to find solutions to practical problems.

Module:1	Introduction to Algorithms and Analysis	6 hours	CO:1

Overview and importance of algorithms and data structures. Fundamentals of algorithm analysis, Space and time complexity of an algorithm, Types of asymptotic notations and orders of growth, Algorithm efficiency – best case, worst case, average case, Analysis of non-recursive and recursive algorithms, Asymptotic analysis for recurrence relation – Recursive Tree Method.

Module:2	Linear Data Structures	8 hours	CO: 2,8

Array- 1D and 2D array , Stack - Applications of stack: Expression Evaluation - Conversion of Infix to postfix and prefix expression, Tower of Hanoi.

Queue - Types of Queue: Circular Queue, Double Ended Queue (deQueue), Applications – Priority Queue using Arrays - List - Singly linked lists – Doubly linked lists - Circular linked lists, Applications -Polynomial Manipulation - Josephus problem(permutation)

Module:3	Sorting and Search Techniques	8 hours	CO:4,8

Searching - Linear Search and binary search, Applications - Finding square root of ‘n’-Longest Common Prefix

Sorting – Insertion sort - Selection sort – Bubble sort – (Counting Sort) - Quick sort- Merge sort , Analysis, Applications - Finding the ‘n’ closest pair’s

Module:4	**Non-linear Data Structures - Trees**	**6 hours**	**CO:5,8**
Tree - Terminology, Binary Tree – Terminology and Properties, Tree Traversals, Expression Trees – Binary Search Trees – operations in BST – insertion, deletion, finding min and max, Finding the kth minimum element in a BST, Applications – Dictionary			
Module:5	**Non-linear Data Structures - Graphs**	**6 hours**	**CO:3,8**
Graph – basic definition and Terminology – Representation of Graph – Graph Traversal: Breadth First Search (BFS), Depth First Search (DFS) - Minimum Spanning Tree: Prim's, Kruskal's- Single Source Shortest Path: Dijkstra's Algorithm.			
Module:6	**Hashing**	**4 hours**	**CO:6,8**
Hash functions, open hashing-separate chaining, closed hashing - linear probing, quadratic probing, double hashing, random probing, rehashing, extendible hashing, Applications – Dictionary-Telephone directory			
Module:7	**Heaps and Balanced Binary Search Trees**	**5 hours**	**CO:7,8**
Heaps - Heap sort, Applications -Priority Queue using Heaps AVL trees – Terminology - basic operations(rotation, insertion and deletion			
Module:8	**Recent Trends**	**2 hours**	**CO:8**
Recent trends in algorithms and data structures			
	Total Lecture hours:	**45 hours**	

Text Book(s)	
1.	Thomas H. Cormen, C.E. Leiserson, R L.Rivest and C. Stein, Introduction to Algorithms , Third edition, MIT Press, 2009.
2	Mark A. Weiss,Data Structures & Algorithm Analysis in C++, 3rd edition, 2008, PEARSON.
Reference Books	
1.	Kurt Mehlhorn, and Peter Sanders – Algorithms and Data Sturctures The Basic Toolbox, Springer-Verlag Berlin Heidelberg, 2008.
2.	Horowitz, Sahni, and S. Anderson-Freed , Fundamentals of Data Structures in C UNIVERSITIES PRESS,Second Edition,2008.

Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar

List of Experiments (Indicative)		**CO:3,4,5**
1.	Implementation of Stack and its applications	4 hours
2.	Implementation of queue and its applications	4 hours

3.	Linked List	4 hours
4.	Searching algorithm	2 hours
5.	Sorting algorithm – insertion, bubble, selection etc.	2 hours
6.	Randomized Quick sort and merge sort	2 hours
7.	Binary Tree traversals	2 hours
8.	Binary search tree	2 hours
9.	DFS, BFS	3 hours
10.	Minimum Spanning Tree – Prim's and Kruskal's	3hours
11.	Single source shortest path algorithm – Connected Components and finding a cycle in a graph	2 hours
	Total Laboratory Hours	30 hours

Mode of evaluation:			
Recommended by Board of Studies	09-09-2020		
Approved by Academic Council	No. 59	Date	24-09-2020

Course code	Design and Analysis of Algorithms	L	T	P	J	C
CSE2012		3	0	2	0	4
Pre-requisite	CSE2011 – Data Structures and Algorithms	Syllabus version				
		v. xx.xx				

Course Objectives:

1. To provide a mathematical foundation for analyzing and proving the efficiency of an algorithm.
2. To focus on the design of algorithms in various domains of computer engineering.
3. To provide familiarity with main thrusts of work in algorithms sufficient to give some context for formulating and seeking known solutions to an algorithmic problem.

Expected Course Outcome:

On completion of this course, student should be able to

1. Ability to use mathematical tools to analyze and derive the running time of algorithms and prove the correctness.
2. Explain and apply the major algorithm design paradigms.
3. Explain the major graph algorithms and their analyses.
4. Explain the major String Matching algorithms and their analysis.
5. Explain the major Computational Geometry algorithms and their analysis.
6. Provide algorithmic solutions to real-world problem from various domains.
7. Explain the hardness of real world problems with respect to algorithmic efficiency and learning to cope with it.

Module:1	Algorithm Development	4 hours	CO: 1

Stages of algorithm development for solving a problem: Describing the problem, Identifying a suitable technique, Design of an algorithm, Proof of Correctness of the algorithm.

Module:2	Algorithm Design Techniques	10 hours	CO: 2

Brute force techniques – Travelling Salesman Problem, Divide and Conquer - Finding a maximum and minimum in a given array -Matrix multiplication: Strassen's algorithm, Greedy techniques Huffman Codes and Data Compression -Fractional Knapsack problem, Dynamic programming - O/1 Knapsack problem-Matrix chain multiplication, LCS, Travelling Salesman Problem, Backtracking-N-Queens Problem, Knights Tour on Chess Board.

Module:3	String Matching Algorithms	5 hours	CO:1,4

Naïve String matching Algorithms, KMP algorithm, Rabin-Karp Algorithm

Module:4	Computational Geometry Algorithms	5 hours	CO:1,5

Line Segments – properties, intersection; Convex Hull finding algorithms- Graham's Scan, Jarvis's March Algorithm.

Module:5	Graph Algorithms	6 hours	CO:1,3

All pair shortest path – Floyd-Warshall Algorithm. Network Flows - Flow Networks, Maximum Flows – Ford-Fulkerson Algorithm, Push Re-label Algorithm, Minimum Cost Flows – Cycle Cancelling Algorithm.

Module:6	**Complexity Classes**	**7 hours**	**CO:1,6**
The Class P, The Class NP, Reducibility and NP-completeness – SAT (without proof), 3-SAT, Vertex Cover, Independent Set, Maximum Clique.			
Module:7	**Approximation and Randomized Algorithms**	**6 hours**	**CO:7**
Approximation Algorithms - The set-covering problem – Vertex cover, K-center clustering. Randomized Algorithms - The hiring problem, Finding the global Minimum Cut			
Module:8	**Recent Trends**	**2 hours**	**CO:7**
	Total Lecture hours:	**45 hours**	

Text Book(s)

1.	Thomas H. Cormen, C.E. Leiserson, R L.Rivest and C. Stein, Introduction to Algorithms , Third edition, MIT Press, 2009.

Reference Books

1. Jon Kleinberg, ÉvaTardos ,Algorithm Design, Pearson education, 2014
2. Ravindra K. Ahuja, Thomas L. Magnanti, and James B. Orlin, "Network Flows: Theory, Algorithms, and Applications", Pearson Education, 2014.

Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar

Assignment: Exploring Finite Automata and String Matching

List of Experiments (Indicative)	**Total Hours: 30**
1. Design and implement an algorithm that multiplies two 'n' digit numbers faster than O(n3). 2. Design and implement an algorithm that will find the top and the least scores of students from an online Quiz. Note: The scores are stored in an array. 3. Design a solution for an Airline Customer on what to leave behind and what to carry based on cabin baggage weight limits. The Customer has to pack as many items as the limit allows while maximizing the total worth. The data can be shared in a CSV File.	

4. Assume you have an unparenthesized arithmetic expression with only + and - operators. You can change the value ofexpression by parenthesizing at different positions. To keep it simple, assume that parenthesis occur only before or immediately after operands and not operators. Design an algorithm that can take a maximum possible value theexpression can take in after adding the parenthesis. 5. About 14 historic sites in Tamilnadu is shown in https://www.google.com/maps/search/historic+sites+in+tamilnadu/@10.7929896,78.2883573,7z/data=!3m1!4b1 Design a solution that identifies the shortest possible routes for a traveler to visit these sites. 6. Design a solution to see if a content C = PGGA is plagiarizedin Text T = SAQSPAPGPGGAS. 7. You can find the schematics of Delhi Art Gallery (GroundFloor) in: https://www.archdaily.com/156154/delhi-art-gallery-re-design- vertex-design/50151feb28ba0d02f0000302-delhi-art-gallery-re- design-vertex-design-first-floor-plan Design a model to install fewest possible Closed CircuitCameras covering all hallways and turns. 8. A maze has to be created and path has to be displayed whichwill be taken by the rat by using backtracking concept. 9. Consider x=aabab and y=babb. Each insertion and deletionhas a unit 1) cost where as a change costs 2 units. Find a minimum cost edit sequence that transforms x into y by usingsuitable algorithm design technique. 10. Implement N-Queens problem and analyse its timecomplexity using backtracking. 11. Write a program to find all the Hamiltonian cycles in aconnected undirected graph G(V,E) using backtracking 12. Design and implement a solution to find a subset of a givenset S = {Sl, S2,. ,Sn} of n positive integers whose SUM is equal to a given positive integer d. For example, if S ={1, 2, 5,6, 8} and d= 9,there are two solutions {1,2,6}and {1,8}. Display a suitable message, if the given problem instance doesn't have a solution.	

Mode of evaluation:			
Recommended by Board of Studies	09-09-2020		
Approved by Academic Council	No. 59	Date	24-09-2020

Course code	Theory of Computation	L	T	P	J	C
CSE2013		3	0	0	0	3
Pre-requisite		Syllabus version				
		v. xx.xx				

Course Objectives:

The objectives of this course are to learn

1. Types of grammars and models of automata.
2. Limitation of computation: What can be and what cannot be computed.
3. Establishing connections among grammars, automata and formal languages.

Expected Course Outcome:

After successfully completing the course the student should be able to

1.Compare and analyze different computational models

2. Apply rigorously formal mathematical methods to prove properties of languages, grammars and automata.

3. Identify limitations of some computational models and possible methods of proving them.

Module:1	Introduction to Languages and Grammars	4 hours	CO: 1

Recall on Proof techniques in Mathematics -Overview of a Computational Models - Languages and Grammars - Alphabets - Strings - Operations on Languages, Overview on Automata

Module:2	Finite State Automata	8 hours	CO: 2

Finite Automata (FA) - Deterministic Finite Automata (DFA) - Non-deterministic Finite Automata (NFA) - NFA with epsilon transitions – NFA without epsilon transition, conversion of NFA to DFA, Equivalence of NFA and DFA – minimization of DFA

Module:3	Regular Expressions and Languages	7 hours	CO: 2

Regular Expression - FA and Regular Expressions: FA to regular expression and regular expression to FA- - Pattern matching and regular expressions - Regular grammar and FA- Pumping lemma for regular languages - Closure properties of regular languages.

Module:4	Context Free Grammars	7 hours	CO: 3

Context-Free Grammar (CFG) – Derivations- Parse Trees - Ambiguity in CFG - CYK algorithm – Simplification of CFG – Elimination of Useless symbols, Unit productions, Null productions - Normal forms for CFG: CNF and GNF - Pumping Lemma for CFL - Closure Properties of CFL

Module:5	Pushdown Automata	5 hours	CO: 2

Definition of the Pushdown automata - Languages of a Pushdown automata – Power of Non-Deterministic Pushdown Automata and Deterministic pushdown automata

Module:6	**Turing Machine**	**6 hours**	**CO: 3**
Turing Machines as acceptor and transducer - Multi head and Multi tape Turing Machines – Universal Turing Machine - The Halting problem - Turing-Church thesis			
Module:7	**Recursive and Recursively Enumerable Languages**	**6 hours**	**CO: 3**
Recursive and Recursively Enumerable Languages, Language that is not Recursively Enumerable (RE) – computable functions – Chomsky Hierarchy – Undecidable problems - Post's Correspondence Problem			
Module:8	**Recent Trends**	**2 hours**	**CO: 3**
	Total Lecture hours:	**45 hours**	

Text Book(s)

1. J.E. Hopcroft, R. Motwani and J.D. Ullman, "Introduction to Automata Theory, Languages and Computation", Third Edition, Pearson Education, India 2008. ISBN: 978-8131720479
2. Peter Linz, "An Introduction to Formal Languages and Automata", Sixth Edition, Jones & Bartlett, 2016. ISBN**:** 978-9384323219

Reference Books

1. K. Krithivasan and R. Rama, "Introduction to Formal Languages, Automata and Computation", Pearson Education, 2009. ISBN: 978-8131723562
2. Michael Sipser, Introduction of the Theory and Computation, Cengage; 3rd edition, 2014, ISBN: 978-8131525296
3. Dexter C. Kozen, "Automata and Computability", Springer; Softcover reprint of the original 1st ed. 1997 edition. 2012
4. John C Martin, "Introduction to Languages and the Theory of Computation", McGraw Hill Publishing Company, Fourth Edition, 2011.

Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar

Mode of assessment:

Recommended by Board of Studies	09-09-2020		
Approved by Academic Council	No. 59	Date	24-09-2020

CSE3002	INTERNET AND WEB PROGRAMMING	L	T	P	J	C
		3	0	2	0	4
Pre-requisite	**CSE2004-Database Management System**	**Syllabus version**				
		v1.0				

Course Objectives:

1. To comprehend and analyze the basic concepts of web programming and internet protocols.
2. To describe how the client-server model of Internet programming works.
3. To demonstrates the uses of scripting languages and their limitations.

Expected Course Outcome:

After successfully completing the course the student should be able to

1. Differentiate web protocols and web architecture.
2. Apply JavaScript, HTML and CSS effectively to create interactive and dynamic websites.
3. Implement client side scripting using JavaScript.
4. Develop applications using Java.
5. Implement server side script using PHP, JSP and Servlets.
6. Develop XML based web applications.
7. Develop application using recent environment like Node JS, Angular JS, JSON and AJAX.

Module:1	**INTRODUCTION TO INTERNET**	**2 hours**

Internet Overview- Networks - Web Protocols — Web Organization and Addressing - Web Browsers and Web Servers -Security and Vulnerability-Web System Architecture – URL - Domain Name – Client-side and server-side scripting.

Module:2	**WEB DESIGNING**	**4 hours**

HTML5 – Form elements, Input types and Media elements, CSS3 - Selectors, Box Model, Backgrounds and Borders, Text Effects, Animations, Multiple Column Layout, User Interface.

Module:3	**CLIENT-SIDE PROCESSING AND SCRIPTING**	**7 hours**

JavaScript Introduction –Functions – Arrays – DOM, Built-in Objects, Regular Expression, Exceptions, Event handling, Validation- AJAX - JQuery.

Module:4	**SERVER SIDE PROCESSING AND SCRIPTING - PHP**	**5 hours**

Introduction to PHP – Operators – Conditionals – Looping – Functions – Arrays- Date and Time Functions – String functions - File Handling - File Uploading – Email Basics - Email with attachments.

Module:5	**PHP SESSION MANAGEMENT and DATABASE CONNECTIVITY**	**3 hours**

Sessions-Cookies-MySQL Basics – Querying single and multiple MySQL Databases with PHP – PHP Data Objects.

Module:6	**XML**	**4 hours**

XML Basics – XSL, XSLT, XML Schema-JSON.

Module:7	**APPLICATION DEVELOPMENT USING NODE JS**	**4 hours**
Introduction to Node.js- Installing Node.js - Using Events, Listeners, Timers, and Callbacks in Node.js – Introduction to Mongo DB- Accessing MongoDB from Node.js.		
Module:8	**Industry Expert Talk**	**1 hour**
	Total Lecture hours:	**30 hours**

Text Book(s)

1.	Paul Deitel, Harvey Deitel, Abbey Deitel, Internet & World Wide Web - How to Program, 5th edition, Pearson Education, 2012.
2.	Kogent Learning Solutions Inc, Web Technologies Black Book, Dream Tech press, 2013.
3.	Brad Dayley, Brendan Dayley, and Caleb Dayley , Node.js, MongoDB and Angular Web Development: The definitive guide to using the MEAN stack to build web applications, 2nd Edition, Pearson Education, 2018

Reference Books

1.	Lindsay Bassett, Introduction to JavaScript Object Notation, 1st Edition, O'Reilly Media, 2015
2.	Fritz Schneider, Thomas Powell , JavaScript – The Complete Reference, 3rd Edition, Mc-Graw Hill, 2017
3.	Steven Holzener , PHP – The Complete Reference, 1st Edition, Mc-Graw Hill, 2017
4.	Sandeep Kumar Patel, Developing Responsive Web Applications with AJAX and JQuery, Packt Publications, 2014

Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar

List of Challenging Experiments (Indicative)

1.	HTML basic tags, HTML forms, table, list, HTML frames and CSS internal, external and inline	4 hours
2.	JavaScript validation, DOM and Ajax	6 hours
3.	Java, Servlet and JSP	8 hours
4.	PHP : Forms and File handling, Session Management and Cookies, Databases	8 hours
5.	XML	4 hours
	Total Laboratory Hours	30 hours

Mode of assessment: Project/Activity

Recommended by Board of Studies	19-11-2018		
Approved by Academic Council	No. 53	Date	13-12-2018

CSE4003	CYBER SECURITY	L	T	P	J	C
		3	0	0	4	4
Pre-requisite	**Nil**	**Syllabus version**				
		v. 1.0				

Course Objectives:

1 To learn the concepts of number theory, cryptographic techniques.
2.To understand integrity and authentication process.
3.To familiarize various cyber threats, attacks, vulnerabilities, defensive mechanisms, security policies and practices.

Expected Course Outcome:

1 Know the fundamental mathematical concepts related to security.
2.Implement the cryptographic techniques to real time applications.
3.Comprehend the authenticated process and integrity, and its implementation
4.Know fundamentals of cybercrimes and the cyber offenses.
5.Realize the cyber threats, attacks, vulnerabilities and its defensive mechanism.
6.Design suitable security policies for the given requirements.
7.Exploring the industry practices and tools to be on par with the recent trends

Module:1	**Introduction to Number Theory**	**6 hours**

Finite Fields and Number Theory: Modular arithmetic, Euclidian Algorithm, Primality Testing: Fermats and Eulers theorem, Chinese Reminder theorem, Discrete Logarithms

Module:2	**Cryptographic Techniques**	**9 hours**

Symmetric key cryptographic techniques: Introduction to Stream cipher, Block cipher: DES, AES,IDEA Asymmetric key cryptographic techniques: principles,RSA,ElGamal,Elliptic Curve cryptography, Key distribution and Key exchange protocols.

Module:3	**Integrity and Authentication**	**5 hours**

Hash functions,Secure Hash Algorithm (SHA)Message Authentication, Message Authentica- tion Code (MAC), Digital Signature Algorithm : RSA ElGamal based

Module:4	**Cybercrimes and cyber offenses**	**7 hours**

Classification of cybercrimes, planning of attacks, social engineering:Human based, Computer based: Cyberstalking, Cybercafe and Cybercrimes

Module:5	**Cyber Threats, Attacks and Prevention**	**9 hours**

Phishing, Password cracking, Keyloggers and Spywares, DoS and DDoS attacks, SQL Injection Identity Theft (ID) : Types of identity theft, Techniques of ID theft

Module:6	**Cybersecurity Policies and Practices**	**7 hours**

What security policies are: determining the policy needs, writing security policies, Internet and email security policies, Compliance and Enforcement of policies, Review

Module:7	**Recent Trends**	**2 hours**

Industry Expert talk

	Total Lecture hours:		**45 hours**
Text Book(s)			
1.	Cryptography and Network security, William Stallings, Pearson Education, 7th Edition, 2016		
2	Cyber Security, Understanding cyber crimes, computer forensics and legal perspectives, Nina Godbole,Sunit Belapure, Wiley Publications, Reprint 2016		
3	Writing Information Security Policies, Scott Barman, New Riders Publications, 2002		
Reference Books			
1.	Cybersecurity for Dummies, Brian Underdahl, Wiley, 2011		
2.	Cryptography and Network security, Behrouz A. Forouzan , Debdeep Mukhopadhyay, Mcgraw Hill Education, 2 nd Edition, 2011		
Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar			
Recommended by Board of Studies	04-04-2014		
Approved by Academic Council	No. 37	Date	16-06-2015

EEE1001	Basic Electrical and Electronics Engineering	L	T	P	J	C
		2	0	2	0	3
Pre-requisite	**NIL**	**Syllabus version**				
		v. 1.0				

Course Objectives:

1. To understand the various laws and theorems applied to solve electric circuits and networks
2. To provide the students with an overview of the most important concepts in Electrical and Electronics Engineering which is the basic need for every engineer

Expected Course Outcome:

1. Solve basic electrical circuit problems using various laws and theorems
2. Analyze AC power circuits and networks, its measurement and safety concerns
3. Classify and compare various types of electrical machines
4. Design and implement various digital circuits
5. Analyze the characteristics of semiconductor devices and comprehend the various modulation techniques in communication engineering
6. Design and conduct experiments to analyze and interpret data

Module:1	**DC circuits**	**5 hours**

Basic circuit elements and sources, Ohms law, Kirchhoff's laws, series and parallel connection of circuit elements, Node voltage analysis, Mesh current analysis, Thevenin's and Maximum power transfer theorem

Module:2	**AC circuits**	**6 hours**

Alternating voltages and currents, AC values, Single Phase RL, RC, RLC Series circuits, Power in AC circuits-Power Factor- Three Phase Systems – Star and Delta Connection- Three Phase Power Measurement – Electrical Safety –Fuses and Earthing, Residential wiring

Module:3	**Electrical Machines**	**7 hours**

Construction, Working Principle and applications of DC Machines, Transformers, Single phase and Three-phase Induction motors, Special Machines-Stepper motor, Servo Motor and BLDC motor

Module:4	**Digital Systems**	**5 hours**

Basic logic circuit concepts, Representation of Numerical Data in Binary Form- Combinational logic circuits, Synthesis of logic circuits

Module:5	**Semiconductor devices and Circuits**	**7 hours**

Conduction in Semiconductor materials, PN junction diodes, Zener diodes, BJTs, MOSFETs, Rectifiers, Feedback Amplifiers using transistors. Communication Engineering: Modulation and Demodulation - Amplitude and Frequency Modulation

	Total Lecture hours:	**30 hours**	

Text Book(s)

1. 1. John Bird, 'Electrical circuit theory and technology ', Newnes publications, 4 t h Edition, 2010.

Reference Books

1. Allan R. Hambley, 'Electrical Engineering -Principles & Applications' Pearson Education, First Impression, 6/e, 2013

2.	Simon Haykin, 'Communication Systems', John Wiley & Sons, 5 t h Edition, 2009.			
3.	Charles K Alexander, Mathew N O Sadiku, 'Fundamentals of Electric Circuits', Tata McGraw Hill, 2012.			
4.	Batarseh, 'Power Electronics Circuits', Wiley, 2003			
5.	H. Hayt, J.E. Kemmerly and S. M. Durbin, 'Engineering Circuit Analysis', 6/e, Tata McGraw Hill, New Delhi, 2011.			
7.	Fitzgerald, Higgabogan, Grabel, 'Basic Electrical Engineering', 5t h edn, McGraw Hill, 2009.			
8.	S.L.Uppal, 'Electrical Wiring Estimating and Costing ', Khanna publishers, NewDelhi, 2008.			
Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar				
List of Challenging Experiments (Indicative)				
1.	Thevenin's and Maximum Power Transfer Theorems – Impedance matching of source and load			3 hours
2.	Sinusoidal steady state Response of RLC circuits			3 hours
3.	Three phase power measurement for ac loads			3 hours
4.	Staircase wiring circuit layout for multi storey building			3 hours
5.	Fabricate and test a PCB layout for a rectifier circuit			3 hours
6.	Half and full adder circuits.			3 hours
7.	Full wave Rectifier circuits used in DC power supplies. Study the characteristics of the semiconductor device used			3 hours
8.	Regulated power supply using zener diode. Study the characteristics of the Zener diode used			3 hours
9.	Lamp dimmer circuit (Darlington pair circuit using transistors) used in cars. Study the characteristics of the transistor used			3 hours
10.	Characteristics of MOSFET			3 hours
			Total Laboratory Hours	**30 hours**
Mode of assessment: CAT / Assignment / Quiz / FAT / Project / Seminar				
Recommended by Board of Studies	**29/05/2015**			
Approved by Academic Council	**37th AC**	Date	**16/06/2015**	

MAT1014	Discrete Mathematics and Graph Theory	L	T	P	J	C
		3	2	0	0	4
Pre-requisite	Nil	Syllabus Version				
		1.0				

Course Objectives:

1. To address the challenge of the relevance of lattice theory, coding theory and algebraic structures to computer science and engineering problems.
2. To use number theory, in particular congruence theory to cryptography and computer science problems.
3. To understand the concepts of graph theory and related algorithm concepts.

Expected Course Outcome:

At the end of this course, students are expected to

1. form truth tables, proving results by truth tables, finding normal forms,
2. learn proof techniques and concepts of inference theory
3. understand the concepts of groups and application of group codes, use Boolean algebra for minimizing Boolean expressions.
4. learn basic concepts of graph theory, shortest path algorithms, concepts of trees and minimum spanning tree and graph colouring, chromatic number of a graph.
5. Solve Science and Engineering problems using Graph theory.

Module:1	Mathematical Logic and Statement Calculus	6 hours

Introduction-Statements and Notation-Connectives–Tautologies–Two State Devices and Statement logic -Equivalence - Implications–Normal forms - The Theory of Inference for the Statement Calculus.

Module:2	Predicate Calculus	4 hours

The Predicate Calculus - Inference Theory of the Predicate Calculus.

Module:3	Algebraic Structures	5 hours

Semigroups and Monoids - Groups – Subgroups – Lagrange's Theorem Homomorphism – Properties-Group Codes.

Module:4	Lattices	5 hours

Partially Ordered Relations -Lattices as Posets – Hasse Digram – Properties of Lattices.

Module:5	Boolean algebra	5 hours

Boolean algebra - Boolean Functions-Representation and Minimization of Boolean Functions – Karnaugh map – McCluskey algorithm.

Module:6	Fundamentals of Graphs	6 hours

Basic Concepts of Graph Theory – Planar and Complete graph - Matrix representation of Graphs – Graph Isomorphism – Connectivity–Cut sets-Euler and Hamilton Paths–Shortest Path algorithms.

Module:7	Trees, Fundamental circuits , Cut sets,	12 hours

	Graph colouring, covering, Partitioning	
Trees – properties of trees – distance and centres in tree –Spanning trees – Spanning tree algorithms- Tree traversals- Fundamental circuits and cut-sets. Bipartite graphs - Chromatic number – Chromatic partitioning – Chromatic polynomial - matching – Covering– Four Colour problem.		
Module:8	**Contemporary Issues**	**2 hours**
Industry Expert Lecture		
	Total Lecture hours:	**45 hours**
Tutorial	• A minimum of 10 problems to be worked out by students in every Tutorial class. • Another 5 problems per Tutorial Class to be given as home work.	**15 hours**

Mode of Evaluation

Individual Exercises, Team Exercises, Online Quizzes, Online, Discussion Forums

Text Book(s)

1. Discrete Mathematical Structures with Applications to Computer Science, J .P. Trembley and R. Manohar, Tata McGraw Hill-35th reprint, 2017.
2. Graph theory with application to Engineering and Computer Science, Narasing Deo, Prentice Hall India 2016.

Reference Books

1. Discrete Mathematics and its applications, Kenneth H. Rosen, 8th Edition, Tata McGraw Hill, 2019.
2. Discrete Mathematical Structures, Kolman, R.C.Busby and S.C.Ross, 6th Edition, PHI, 2018.
3. Discrete Mathematics, Richard Johnsonbaugh, 8th Edition, Prentice Hall, 2017.
4. Discrete Mathematics, S. Lipschutz and M. Lipson, McGraw Hill Education (India) 2017.
5. Elements of Discrete Mathematics–A Computer Oriented Approach, C.L.Liu, Tata McGraw Hill, Special Indian Edition, 2017.
6. Introduction to Graph Theory, D. B. West, 3rd Edition, Prentice-Hall, Englewood Cliffs, NJ, 2015.

Mode of Evaluation

Digital Assignments, Quiz, Continuous Assessments, Final Assessment Test

Recommended by Board of Studies	03-06-2019		
Approved by Academic Council	No.55	Date	13-06-2019

PROGRAMME ELECTIVE

BCI2001	DATA PRIVACY	L	T	P	J	C
		3	0	0	4	4
Pre-requisite	**NIL**	**Syllabus version**				
		v1.0				

Course Objectives:

1. To recognize the need of data privacy.
2. To categorize the statistical and computational techniques needed to share data, with a primary focus on the social, behavioural and health sciences.
3. To formulate architectural, algorithmic and technological foundations for the maintenance of the privacy of individuals, the confidentiality of organizations, and the protection of sensitive information, despite the requirement that information be released publicly or semi-publicly

Expected Course Outcome:

1.Characterize basic rules and principles for protecting privacy and personal information.
2.Design enhanced privacy protection methods by envisioning the basic attacks to happen.
3.Formulate data that supports useful statistical inference while minimizing the disclosure of sensitive information

Module:1	**Data Privacy and its Importance**	**4 hours**

Need for Sharing Data, Methods of Protecting Data, Importance of Balancing Data Privacy and Utility, Disclosure, Tabular Data, Micro data, Approaches to Statistical disclosure control, Ethics, principles, guidelines and regulations

Module:2	**Microdata**	**7 hours**

Disclosure, Disclosure risk, Estimating re-identification risk, Non-perturbative microdata masking, Perturbative microdata masking, Information loss in microdata

Module:3	**Static Data Anonymization on Multidimensional Data**	**8 hours**

Privacy Preserving Methods, Classification of Data in a Multidimensional Data Set, Group- Based Anonymization, k- Anonymity, l-Diversity, t-closeness

Module:4	**Static Data Anonymization on Complex Data Structures**	**8 hours**

Privacy Preserving Graph Data, Privacy Preserving Time Series Data, Time Series Data Pro- tection Methods, Privacy Preservation of Longitudinal Data, Privacy Preservation of Trans- action Data.

Module:5	**Data Anonymization Threats**	**8 hours**

Threats to Anonymized Data, Threats to Data Structures, Threats by Anonymization Techniques, Randomization, k- Anonymization, l-Diversity, t-Closeness. Dynamic Data Protection: Tokenization, Understanding Tokenization, Use Cases for Dynamic Data Protection, Benefits of Tokenization Compared to Other Methods, Components for Tokenization.

Module:6	**Privacy Preserving Data Mining**	**4 hours**

Key Functional Areas of Multidimensional Data for privacy preservation , Association Rule Mining, Clustering algorithms for privacy preservation

Module:7	**Privacy Preserving Test Data Generation**	**7 hours**
Test Data Fundamentals, Utility of Test Data: Test Coverage, Privacy Preservation of Test Data, Quality of Test Data, Anonymization Design for PPTDG, Insufficiencies of Anonymized Test Data.		
Module:8	**Contemporary Issues: RECENT TRENDS**	**2 hours**
Very large Scale Integrated circuits (VLSI), Field Programmable Gate Arrays(FPGA).		
	Total Lecture hours:	**45 hours**

Text Book(s)	
1.	1. Nataraj Venkataramanan, AshwinShriram, Data Privacy: Principles and Practice, Taylor Fran- cis, 2016. (ISBN No.: 978-1-49-872104-2).
2.	Anco Hundepool, Josep Domingo-Ferrer, Luisa Franconi, Sarah Giessing, Eric Schulte Nordholt, Keith Spicer, Peter-Paul de Wolf, Statistical Disclosure Control, Wiley, 2012. (ISBN No.: 978- 1-11-997815-2)
Reference Books	
1.	George T. Duncan. Mark Elliot, Juan-Jose Salazar-GonZalez, Statistical Confidentiality: Principle and Practice. Springer, 2011. (ISBN No.: 978-1-44-197801-1).
2.	Aggarwal, Charu C., Yu, Philip S., Privacy-Preserving Data Mining : Models and Algorithms, Springer, 2010. (ISBN No.: 978-0-38-770991-8).
Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar	
Mode of assessment: Project/Activity	

Recommended by Board of Studies	28-02-2017		
Approved by Academic Council	No. 44	Date	16-03-2017

BCI3001	WEB SECURITY	L	T	P	J	C
		2	0	2	4	4
Pre-requisite	**NIL**	**Syllabus version**				
		v1.0				

Course Objectives:

1. To study and practice fundamental techniques in developing secure web based applications
2. To identify and find the vulnerabilities of web based applications and to protect those applications from attacks

Expected Course Outcome:

1.To understand security-related issues in Web-based systems and applications.
2.To understand the fundamental mechanisms of securing a Web-based system.
3.To be able to implement security mechanisms to secure a Web-based application.
4.To be able to evaluate a Web-based system with respect to its security requirements

Module:1	**Introduction**	**3 hours**

Introduction - Evolution of Web Applications - Web Application Security - Core Defence Mechanisms - Handling User Access - Handling User Input- Handling Attackers - Managing the Application - The OWASP Top Ten List

Module:2	**WEB APPLICATION TECHNOLOGIES**	**4 hours**

Web Functionality Encoding Schemes Mapping the Application - Enumerating the Content and Functionality Analysing the Application Bypassing Client Side Controls : Transmitting Data Via the Client Capturing User Data Handling Client Side Data Securely - Input Validation, Blacklist Validation - Whitelist Validation - The Defence-in-Depth Approach - Attack Surface Reduction Rules of Thumb

Module:3	**WEB APPLICATION AUTHENTICATION**	**4 hours**

Authentication Fundamentals- Two Factor and Three Factor Authentication - Password Based, Built-in HTTP, Single Sign-on Custom Authentication- Secured Password Based Authentication: Attacks against Password, Importance of Password Complexity - Design Flaws in Authentication Mechanisms - Implementation Flaws in Authentication Mechanisms - Securing Authentication

Module:4	**SESSION MANAGEMENT**	**3 hours**

Need for Session Management Weaknesses in Session Token Generation Weaknesses in Session Token Handling Securing Session Management; Access Control : Access Control Overview, Common Vulnerabilities Attacking Access Controls Securing Access Control.

Module:5	**WEB SECURITY PRINCIPLES**	**3 hours**

Origin Policy, Exceptions Cross Site Scripting, Cross Site Forgery Scripting; File Security Principles: Source Code Security, Forceful Browsing, Directory Traversals- Classifying and Prioritizing Threats Origin Policy.

Module:6	**WEB APPLICATION VULNERABILITY**	**6 hours**

Understanding Vulnerabilities in Traditional Client Server Application and Web Applications, Client State Manipulation, Cookie based Attacks, SQL Injection, Cross Domain Attack (XSS/ XSRF/ XSSI), HTTP Header Injection, SSL Vulnerabilities And Testing - Proper Encryption use in Web Application - Session Vulnerabilities and Testing - Cross-Site Request Forgery			
Module:7	**EXPLOITING SYSTEMS**		**5 hours**
Path Traversal - Finding and Exploiting Path Traversal Vulnerability Preventing Path Traversal Vulnerability Information Disclosure - Exploiting Error Messages Securing Compiled Applica- tions Buffer Overflow Vulnerability Integer Vulnerability Format String Vulnerability.			
Module:8	**Contemporary Issues: RECENT TRENDS**		**2 hours**
Very large Scale Integrated circuits (VLSI), Field Programmable Gate Arrays(FPGA).			
	Total Lecture hours:		**30 hours**

Text Book(s)	
1.	B. Sullivan, V. Liu, and M. Howard, Web Application Security, A B Guide. New York: McGraw-Hill Education, 2011. (ISBN No.: 978-0-07-177616-5).
2.	D. Stuttard and M. Pinto, , 2nd ed. Indianapolis, IN: Wiley, John Sons, 2011. (ISBN No. : 978-1-118-02647-2)
Reference Books	
1.	Hanqing and L. Zhao, Web Security: A Whitehat Perspective. United Kingdom: Auerbach Publishers, 2015.(ISBN No.: 978-1-46-659261-2).
2.	M. Shema and J. B. Alcover, Hacking Web Apps: Detecting and Preventing Web Application Security Problems. Washington, DC, United States: Syngress Publishing, 2014.(ISBN No. 978-1-59-749951-4)

Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar

List of Challenging Experiments (Indicative)		
1	Reconnaissance on any popular websites	3 hours
2	Crawling a website	3 hours
3	Vulnerability scanning	3 hours
4	Cookie Stealing with cross site scripting	3 hours
5	Commit identity theft	3 hours
6	Website Security implementation Apache hardening, MySQL hardening, PHP hardening	3 hours
7	XSS and SQL injections	3 hours
8	Password security	3 hours
9	Browser security	3 hours
10	Web application security assessment	3 hours
	Total Laboratory Hours	**30 hours**

Mode of assessment: Project/Activity

Recommended by Board of Studies	28-02-2017		
Approved by Academic Council	No. 44	Date	16-03-2017

BCI3002	DISASTER RECOVERY AND BUSINESS CONTINUITY MANAGEMENT	L	T	P	J	C
		3	0	0	4	4
Pre-requisite	**NIL**	**Syllabus version**				
		v1.0				

Course Objectives:

1. To develop an understanding of concepts of risk management
2. To examine aspects of incident response and contingency planning consisting of incident response plans, disaster recovery plans, and business continuity plans.
3. To develop and execute plans to deal with contingency, incident response, disaster recovery and business continuity

Expected Course Outcome:

1. Describe concepts of risk management
2. Define and differentiate contingency planning components
3. Define and be able to discuss incident response options
4. Design an incident response plan for sustained organizational operations
5. Discuss and recommend contingency strategies including data backup and recovery and alternate site selection for business resumption planning
6. Describe the escalation process from incident to disaster
7. Design a disaster recovery plan, business continuity plan for sustained organizational operations

Module:1	DISASTER RECOVERY AND BUSINESS CONTINUITY INTRODUCTION	5 hours

Disaster Different source of disaster and types of disasters. Disaster Recovery Operational cycle of disaster recovery, disaster recovery cost, incidents that requires disaster recovery plans, evaluating disaster recovery - methods, team, phases, objectives, checklist. Best practises for disaster recovery - Business continuity - Business continuity vs. disaster recovery

Module:2	DISASTER RECOVERY PLANNING AND IMPLEMENTATION	6 hours

Introduction - Aspects of security - Application security - Database security - Distributed system security - Firmware security - Industrial security. Profiles Operational profile, Appli- cation profiles, Inventory profile, Disaster recovery plan - Business impact analysis - Disaster recovery roles and responsibilities - Disaster recovery planning steps - Disaster preparedness - Notification and activation procedures

Module:3	BUSINESS CONTINUITY MANAGEMENT	6 hours

Introduction - Elements of business continuity management. Business continuity plan - Business continuity planning and strategies - BCP standards and guidelines - BCP Project Organization - Crisis communication plan - Emergency response plan - Contingency planning

Module:4	MANAGING, ASSESSING AND EVALUATING RISKS	6 hours

Introduction - Importance of risk management - Risk management methodology - Attack methods and Countermeasures - Cost benefits analysis of risk management - Risk assessment responsibilities - Responsibilities of security professional - Information system auditing and monitoring - Verification

tools and techniques.		
Module:5	**RISK CONTROL POLICIES AND COUNTER MEASURES**	**7 hours**
Introduction - Counter measures - Risk control policy development factors Development of information assurance principles and practices - Laws and procedures in information assurance policy implementation, Security test and evaluation, Automated security tools, Cost benefit analysis, Developing a risk assessment methodology, Security requirements, Information categorization, Risk management methodologies to develop life cycle management policies and procedures, Education, training and awareness. Policy development Information security pol- icy, change control policies, system acquisition policies and procedures, Risk analysis policies and General risk control policies.		
Module:6	**STORAGE DISASTER RECOVERY SERVICES TOOLS**	**7 hours**
Introduction - Importance of data backup - Preventing data loss - Developing an effective data backup strategy - Backup techniques Disk mirroring, Snapshot, Continuous data protection, and Parity protection. Backup schedules - Removable backup media - Potential risks - Challenges in backup and recovery - Backup and recovery checklist - Data backup and recovery tools - Offsite data backup methods and strategies - Enterprise backup tools		
Module:7	**BUSINESS RECOVERY**	**6 hours**
Business recovery planning process mobilizing business recovery team, Assessing extent of damage and business impact, Preparing specific recovery plans, Assess damaged property and documents, Backup recovery site, Monitoring progress, Keeping stockholders informed, Handling business operation back to regular management. Planning recovery activities Communication systems, Human resources, Corporate proprietary information and documentation, IT systems Software architecture recovery.		
Module:8	**Contemporary Issues: RECENT TRENDS**	**2 hours**
	Total Lecture hours:	**45 hours**

Text Book(s)	
1.	John W. Rittinghouse and James F. Ransome, Business Continuity and Disaster Recovery for Info Sec Managers. Elsevier: Elsevier Digital Press, 2005. (ISBN: 978-0-52-119019-0)
2.	EC Council Press. Disaster Recovery, 1st Ed. Course Technology, 2011. (ISBN: 978-1-55558-339-2)
Reference Books	
1.	ISO 27001:2013 A specification for an information security management system
2.	David Alexander, Amanda Finch, David Sutton, Andy Taylor. Information Security Management Principles, 2nd Ed. BCS Shop, 2013. (ISBN: 9781780171753)
3	ISO Guide 73:2009 Definitions of generic terms related to Risk Management
4	ISO Guide 27005:2011 Guidelines for information security risk management
5	ISO 31010:2010 Risk Management Risk Assessment Techniques
6	Mark Talabis, Jason Martin. Information Security Risk Assessment Toolkit Practical Assessments through Data Collection and Data Analysis. Syngress Imprint, 2013. (ISBN: 978-1-59-749735-0).

Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar			
Recommended by Board of Studies	28-02-2017		
Approved by Academic Council	No. 44	Date	16-03-2017

BCI3003	ANDROID SECURITY	L	T	P	J	C
		2	0	2	4	4
Pre-requisite	**NIL**					**Syllabus version**
						v1.0

Course Objectives:

1.To learn basic of the Android operating system and security aspects.
2.To practice the android malware analysis techniques.
3.To appraise the malwares analysis of real world applications.

Expected Course Outcome:

1.Identify various malwares and understand the behavior of malwares in real world applications.
2.Implement different malware analysis techniques.
3.Understand the malware behavior in android.
4.Understand the purpose of malware analysis.
5.Identify the various tools for malware analysis.

Module:1	**INTRODUCTION TO ANDROID OPERATING SYSTEMS**	**3 hours**

Introduction to Android, Android API, DVM, APK File Structure Basic Analysis of an APK, Dex structure, Dex Structure Parsing, APK install process, Android Root.

Module:2	**APPLICATION SECURITY**	**5 hours**

Inspecting the AndroidManifest.xml file - Introduction to Android Debugging Tools and Their Usage, Interacting with the Activity Manager via ADB - Extracting Application Resources via ADB, Inspecting Application Certificates and Signatures - Verifying Application Signatures - Signing Android Applications. Mobile Security - IOS vs Android vs Windows

Module:3	**PERMISSIONS**	**4 hours**

Nature of Permissions, Permission Management, Permission Assignment, Permission Enforcement

Module:4	**ANDROID MALWARE VULNERABILITY**	**4 hours**

Master Key Vulnerability - File Name Length Vulnerability Introduction to Obfuscation - DEX Code Obfuscation

Module:5	**ENTERPRISE LEVEL SECURITY FOR MOBILE DEVICES**	**4 hours**

Security enhancement for Android, Device administration, Customizable secure boot, Knox security, Knox container, TIMA Trust Zone-based Integrity Measurement Architecture.

Module:6	**REVERSE ENGINEERING APPLICATIONS**	**4 hours**

Introduction Decompiling DEX Files to Java Interpreting the Dalvik Bytecode Decompiling the

applications native libraries, Debugging Android process, CFF explorer, dex2Jar, Hex Editor, JD-GUI		
Module:7	**DEVICE ADMINISTRATION POLICIES**	**4 hours**
Introduction - Using Cryptography Libraries - Screen Security - Secure USB Debugging		
Module:8	**Contemporary Issues: RECENT TRENDS**	**2 hours**
	Total Lecture hours:	**30 hours**

Text /Reference Book(s)		
1.	Nikolay Elenkov, Android Security Internals - An InDepth Guide to Android Security Architecture , No Starch Press, 2015. (ISBN : 978-1-59-327581-5)	
2.	Keith Makan, Scott Alexander-Bown, Android Security Cookbook, Packt Publishers, 2013. (ISBN: 978 -1-78- 216716-7)	
3.	Erik Hellman, Android Programming Pushing the Limits, Wiley Publishers, 2014.(ISBN : 978-1-118-71737-0)	
Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar		
List of Challenging Experiments (Indicative)		
1	Inspect details of AndroidManifest.xml	3 Hours
2	Installation of APK and identify the application	3 Hours
3	Analysis of various Malware types and behavior	4 Hours
4	Android malware analysis	4 Hours
5	Data encoding and malware countermeasures	4 Hours
6	Comparative study of various malware analysis tools	4 Hours
7	Tools available in Antivirus Application	4 Hours
8	Packet sniffing with Wire shark	4 Hours
	Total Laboratory Hours	30 Hours

Recommended by Board of Studies		28-02-2017		
Approved by Academic Council		No. 44	Date	16-03-2017

BCI3004	SECURITY OF E-BASED SYSTEMS	L	T	P	J	C
		3	0	0	4	4
Pre-requisite	**NIL**	**Syllabus version**				
		v1.0				

Course Objectives:

1. To discuss the basic security principles, as well as the issues, policy and standards particular to e-based applications.
2. To introduce the technology, concepts, issues and principles for the design and implementation of secure e-based system.
3. To enable to evaluate and critique the security and performance of security algorithms and protocols, and e - commerce systems.
4. To describe remedies for various existing security breaches in e-based systems and to show the methodologies required to make future systems less prone to security failures and outside attack.

Expected Course Outcome:

1. Describe security features needed for an e- based system.
2. Identify and assess different types of security breaches and possible solutions for a robust e-based system
3. Describe the inner-workings of payment protocols, file transfer protocols, and related algorithms
4. Demonstrate the ability to select and design among available security solutions based on different domains of e-based system

Module:1	E-Based System, E-Commerce Security	4 hours

Evolution Of Commerce -Payment Modes And Methods - Distributed Computing Environ- ment Cloud Security- Mobile Commerce M Vs. E- Commerce- Web Commerce Security Requirements - E-Commerce Security -Risk Driven Security- Scalable Security Securing The Transactions.

Module:2	Security Model For E-Commerce/M-Commerce	5 hours

Architectural Framework - Cryptography Access Control- System Hardening Authentication - Authorization - Non-Repudiation Privacy Layered Security Architecture

Module:3	Electronic and Online Payments	7 hours

Electronic Payments: Overview, SET Protocol, Payment Gateway, Certificates, Digital Token, Smart Cards, Credit Cards, Magnetic Strip Cards, EChecks, Credit/ Debit Card EPS, Dash. Online Payments: Mobile Payments, Online Banking, Emerging Financial Instruments - Appli- cation in Business, E-Commerce Laws, Forms of Agreement, Government Policies and Agenda, Secured Online Shopping and Payment - Threats and Attacks Certification and Accreditation Process for Web Commerce Applications

Module:4	E-Healthcare Security	5 hours

Introduction - Nature and Trends Significance and Challenges Frameworks and Approaches Securing E-Healthcare - Information Breaches of Privacy and Confidentiality in E-Healthcare Utilisation Challenge - Legal Protection Challenge

Module:5	Privacy And Confidentiality	5 hours

Anonymization and Pseudo-Anonymization Secure E-Healthcare Information Systems Elements Security and Privacy Provisions Electronic Personal Health Care Records Clinical Decision Support Systems.		
Module:6	**E-Governance Security**	**7 hours**
Introduction - Secure and Interoperable e-Government Services- Trust Models Dos Attacks on E-Government Services- Certificate Management -Interoperability- Privacy Enabled Identity Management- E-Government Architecture- Anonymous and Accurate EPolling- Secure Multiparty/Multi Candidate Electronic Elections		
Module:7	**E-Learning Security**	**10 hours**
Introduction Security Attacks in E-Learning Modeling Security Services Real E-Learning Scenarios Secure Learning Management Systems Security in Collaborative Learning, Mobile Learning, Massive Open Online Courses (MOOC) - Trustworthiness for Secure Collaborative Learning Model Factors And Rules - Time Factor and Trustworthiness Sequences Knowledge Management for E-Learning Data - Trustworthiness-Based Security for P2P E-Assessment Security in EAssessment, P2P E-Assessment Case Study		
Module:8	**Contemporary Issues: RECENT TRENDS**	**2 hours**
	Total Lecture hours:	**45 hours**

Text Book(s)	
1.	H. Nahari and R. L. Krutz, Web Commerce Security: Design and Development. Indianapolis: Wiley, John Sons, 2011. (ISBN No. : 978-0-470-62446-3)
2.	C. A. Shoniregun, K. Dube, and F. Mtenzi, Electronic Healthcare Information Security. New York: Seacaucs, New Jersey, U.S.A.: Springer-Verlag New York, 2010. (ISBN No. : 978-0-387-84817-4)
3.	A. Mitrakas, P. Hengeveld, and D. Polemi, Eds., Secure e-Government Web Services. United States: IGI Global, United States, 2006. (ISBN No. : 978-1-59-904138-4)
4.	M. Jorge, S. Caballe, and F. Xhafa, Intelligent Data Analysis for e-Learning: Enhancing Security and Trustworthiness in Online Learning Systems. United States: Morgan Kaufmann Publishers In, 2016. (ISBN No. : 978-0-12-804535-0)
Reference Book(s)	
1.	M. S. Obaidat and N. A. Boudriga, Security of E-Systems and Computer Networks. Cambridge: Cambridge University Press, 2007. (ISBN No.: 978-3-66-244787-1)
2.	K. Stanoevska-Slabeva, Towards the e-Society: e-Commerce, e-Business, and e-Government. Kluwer Academic Publishers, 2001. (ISBN No. : 978-0-306-47009-7)

Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar			
Recommended by Board of Studies	28-02-2017		
Approved by Academic Council	No. 44	Date	16-03-2017

BCI3005	DIGITAL WATERMARKING AND STEGANOGRAPHY	L	T	P	J	C
		3	0	0	4	4
Pre-requisite	**NIL**					**Syllabus version**
						v1.0

Course Objectives:

1. To develop an understanding of digital watermarking and steganography basics, various approaches, characteristics and application domains.
2. To apply digital watermarking as an authentication tool for distribution of content over the Internet and steganography techniques for covert communication.
3. To understand the basics of the counter measures like steganalysis for assessing the data hiding methods.
4. To enable to evaluate and choose appropriate data hiding technique based on a multitude of security factors.

Expected Course Outcome:

1 Describe watermarking and steganography fundamental concepts and principles.
2. Identify and assess different types of data hiding techniques in various image formats like GIF, BMP etc., and various data hiding methods like LSB, EzStego, OutGuess, and F5.
3. Describe the block codes and its usage for covert communication.
4. Demonstrate the use of watermarking for copyright protection and steganography for secret communication in various digital media.
5. Design and implement efficient data hiding methods.
6. Assess the strength of any data hiding algorithm against steganalysis techniques.

Module:1	DATA HIDING	5 hours

Relationship between Watermarking and Steganography. Digital Watermarking Basics: Mod- els of Watermarking, Basic Message Coding, Error Coding. Digital Watermarking Theoretic Aspects: Mutual Information and Channel Capacity, Designing a Good Digital Mark, Theoretical Analysis of Digital Watermarking Types of Watermarking Fragile, Semi-Fragile.

Module:2	SPREAD SPECTRUM WATERMARKING	5 hours

Transform Domain Watermarking, Quantization Watermarking. Protocols: Buyer Seller Watermarking Protocols, Efficient and Anonymous Buyer-Seller Watermarking Protocol

Module:3	STEGANOGRAPHY	8 hours

Introduction - Text Steganography Image Steganography: Data Hiding in Raw (BMP) Images - LSB (Least Significant Bit) Embedding - Data Hiding by Mimicking Device Noise (Stochastic Modulation). Data Hiding in Palette (GIF) Images - Palette Formats (GIF) - Hiding by Decreasing Colour Depth, Gifshuffle, - Optimal Palette Parity Assignment. Data Hiding in JPEG Images - JPEG Format - J-Steg Data Hiding Algorithm Hiding in Spatial Domain Hiding in Transform Domain Image Quality Metrics

Module:4	AUDIO STEGANOGRAPHY	6 hours

Temporal Domain Techniques - Low-Bit Encoding - Echo Hiding - Hiding in Silence Intervals. Transform Domain Hiding Techniques - Magnitude Spectrum - Tone Insertion - Phase Coding

- Amplitude Coding - Cepstral Domain Codecs Domain: Codebook Modification Bit stream Hiding Audio Quality Metrics		
Module:5	**VIDEO STEGANOGRAPHY**	**6 hours**
Introduction Video Streams - Substitution- Based Techniques - Transform Domain Techniques - Adaptive Techniques - Format-Based Techniques - Cover Generation Techniques Video Quality Metrics - Perceptual Transparency Analysis - Robustness against Compression - Robustness against Manipulation.		
Module:6	**WET PAPER CODES**	**6 hours**
Random Linear Codes - LT Codes - Perturbed Quantization, Matrix Embedding - Matrix Embedding Theorem - Binary Hamming Codes, Q-Ary Case Random Linear Codes for Large Payloads		
Module:7	**STEGANALYSIS**	**7 hours**
Principles, Approaches, ROC Analysis - Sample Pairs Analysis - Attacks using Histogram Characteristic Function - Spatial Domain Steganalysis using Higher Order Statistics - Steganalysis using Resampling Calibration - Feature Selection - Calibration by Recompression		
Module:8	**Contemporary Issues: RECENT TRENDS**	**2 hours**
	Total Lecture hours:	**45 hours**

Text Book(s)	
1.	I. J. Cox, M. L. Miller, J. A. Bloom, T. Kalker, and J. Fridrich, Digital Watermarking and Steganography, 2nd Ed. Amsterdam: Morgan Kaufmann Publishers In, 2007. (ISBN No. : 978-0-12-372585-1)
2.	J. Fridrich, Steganography in Digital Media: Principles, Algorithms, and Applications. Cambridge: Cambridge University Press, 2009. (ISBN No.: 978-0-52-119019-0)
Reference Book(s)	
1.	R. C. Gonzalez, R. E. Woods, D. J. Czitrom, and S. Armitage, Digital Image Processing, 3rd Ed. United States: Prentice Hall, 2007. (ISBN No.: 978-0-13-168728-8)
2.	P. Wayner, Disappearing Cryptography: Information hiding: Steganography and Watermarking , 3rd ed. Amsterdam: Morgan Kaufmann Publishers In, 2008 . (ISBN No. : 978-0-08-092270-6)
3	M. Arnold, M. Schmucker, and S. D. Wolthusen, Techniques and applications of digital Watermarking and content protection, 2nd Ed. Boston, MA: Artech House Publishers, 2003. (ISBN No.: 978-1-58-053664-6)

Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar			
Recommended by Board of Studies	28-02-2017		
Approved by Academic Council	No. 44	Date	16-03-2017

BCI3006	BIOMETRICS	L	T	P	J	C
		3	0	0	4	4
Pre-requisite	**NIL**					**Syllabus version**
						v1.0

Course Objectives:

1. The design and working of a generic biometric security system.
2. The features used to represent and match individual biometric traits.
3. The performance metrics used to evaluate a biometric system.
4. The socio-legal implications of biometrics.

Expected Course Outcome:

1. Demonstrate knowledge of the basic physical and biological science and engineering principles underlying biometric systems.
2. Understand and analyse biometric systems at the component level and be able to analyse and design basic biometric system applications.
3. Identify the sociological and acceptance issues associated with the design and implementation of biometric systems.
4. Understand various Biometric security issues.

Module:1	**INTRODUCTION**	**7 hours**

Introduction of Biometric Traits and its Aim, Biometric Standards and Biometric Databases, Biometric Modalities - Principles of Biometrics: Behaviour and Physiology, Data Acquisition, Liveness Detection, Active Biometric Traits- Voice Biometrics, Handwriting Biometrics , Gait Biometrics, Other Active Traits, Passive Biometric Traits- Fingerprint Biometrics, Iris Biometrics, Face Biometrics, ECG Biometrics, Other Passive Traits, Multimodal Biometrics -Taxonomy of Multimodal Biometrics, Fusion Levels.

Module:2	**IMAGE PROCES SING AND BASIC IMAGE OPERATIONS**	**7 hours**

Pattern Recognition/ Statistics, Error Types. What is Image, Acquisition, Type, Point Operations, Geometric Transformations. Linear Interpolation, Brightness Correction, Histogram, Convolution, Linear/ Non -Linear Filtering, Gaussian, Median, Min, Gray Level Reduction. Special Filters, Enhancement Filter, Edge Detection, Derivatives, Laplacian, Unsharp Masking, High Boot Filtering, Sharpening Special Filtering, Edge Detection, Canny Edge Detection, Fourier Series, DFT , Inverse Of DFT

Module:3	**OPERATIONS OF A BIOMETRIC SYSTEM**	**4 hours**

Verification and Identification, Performance of a Biometric System, FAR, FRR, GAR, ERR, DET and ROC Curve, Failure to Acquire (FTA), Failure To Enroll (FTE), Applications of Bio- metrics in Government, Forensics and Commercial, Characteristics of Biometrics, Commonly used Biometrics

Module:4	**FACE RECOGNITION**	**7 hours**

Eigen faces (PCA), Linear Discriminant Analysis (LDA) and Fisher faces, Independent Com- ponent Analysis (ICA), Neural Networks (NN) And Support Vector Machines (SVM), Kernel Methods, FERET Database

Module:5	**FINGERPRINT RECOGNITION**	**7 hours**
Sensing, Feature Extraction, Enhancement and Binarization, Minutiae Extraction, Matching Correlation Based Methods, Minutiae Based Methods, Ridge Feature Based Methods, Performance Evaluation, Synthetic Fingerprint Generation.		
Module:6	**IRIS RECOGNITION SYSTEM**	**7 hours**
Active Contours, Flexible Generalized Embedded Coordinates, Fourier-based Trigonometry and Correction for Off - Axis Gaze, Detecting and Excluding Eyelashes by Statistical Inference, Alternative Score Normalization Rules		
Module:7	**BIOMETRIC SECURITY**	**4 hours**
Vulnerabilities in Biometric Systems, Biometric Template Security, Encoded Biometric Schemes. Attacks to User Authentication Systems, Unauthorized Access: Thread Analysis Tree, Denial of Service: Thread Analysis Tree, Actions: Possession, Knowledge and Biometrics		
Module:8	**Contemporary Issues: RECENT TRENDS**	**2 hours**
	Total Lecture hours:	**45 hours**

Text Book(s)	
1.	Digital Image Processing using MATLAB, By: Rafael C. Gonzalez, Richard Eugene Woods, 2nd Edition, Tata McGraw-Hill Education 2010
2.	Guide to Biometrics, By: Ruud M. Bolle, Sharath Pankanti, Nalini K. Ratha, Andrew W. Senior, Jonatha n H. Connell, Springer 2009
3.	Pattern Classification, By: Richard O. Duda, David G.Stork, Peter E. Hart, Wiley 2007.
4.	Jain, Anil, Patrick Flynn, and Arun A. Ross, eds. Handbook of biometrics. Springer Science Business Media, 2007.
5.	Vielhauer, Claus. Biometric user authentication for IT security: from fundamentals to handwriting. Vol. 18. Springer Science Business Media, 2005.

Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar			
Recommended by Board of Studies	28-02-2017		
Approved by Academic Council	No. 44	Date	16-03-2017

BCI4001	CYBER FORENSICS AND INVESTIGATION	L	T	P	J	C
		3	0	2	0	4
Pre-requisite	**Nil**	**Syllabus version**				
		v. 1.0				

Course Objectives:

1. To present the students with a comprehensive understanding of digital forensic principles and the collection, preservation, and analysis of digital evidence
2. To enlighten the importance of forensic principles and procedures, legal considerations, digital evidence controls, and the documentation of forensic analysis
3. To develop an understanding of the different applications and methods for conducting network and digital forensic acquisition and analysis

Expected Course Outcome:

1. Explain the responsibilities and liabilities of a computer forensic investigator
2. Plan and prepare for an incident requiring computer forensic skills
3. Seize a computer from a crime scene without damaging it or risking it becoming inadmissible in a court of law
4. Identify potential sources of electronic evidence.
5. Understand the importance of maintaining the integrity of digital evidence.
6. Demonstrate the ability to perform basic forensic data acquisition and analysis using computer and network based applications and utilities.
7. Demonstrate the ability to accurately document forensic procedures and results

Module:1	UNDERSTANDING CYBER FORENSICS AND LEGAL ASPECTS	7 hours

Forensics Fundamentals ; Computer Forensics and Law Enforcement- Indian Cyber Forensic - Forensics Services, Professional Forensics Methodology- Types of Forensics Technology Forensics system and Services : Forensics on - Internet Usage – Intrusion - Firewall and Storage Area Network; Occurrence of Cyber-crimes- Cyber Detectives- Fighting Cyber Crimes- Forensic Process

Module:2	COMPUTER FORENSICS	6 hours

Data Backup and Recovery - Test Disk Suite, Data-Recovery Solution, Hiding and Recovering Hidden data, Evidence Collection and Data Seizure.

Module:3	DIGITAL FORENSICS AND PRESERVATION	6 hours

Digital Repositories - Evidence Collection – Data Preservation Approaches – Meta Data and Historic records – Legal aspects

Module:4	FORENSIC DATA ANALYSIS	6 hours

Basic Steps of Forensic Analysis in Windows and Linux – Forensic Scenario – Email Analysis – File Signature Analysis – Hash Analysis – Forensic Examination of log files

Module:5	MOBILE DEVICE SECURITY AND FORENSICS	6 hours
Introduction to Mobile Forensic – Android Device – Analysis- Android Malware – iOS Forensic Analysis – SIM Forensic Analysis – Case study		
Module:6	**CLOUD FORENSICS**	**5 hours**
Working with the cloud vendor, obtaining evidence, reviewing logs and APIs		
Module:7	**CURRENT COMPUTER FORENSIC TOOLS**	**7 hours**
Overview of different software packages – Encase-Autopsy-Magnet – Wireshark - Mobile Forensic Tools – SQLite Case study Report Preparation A real Forensic case study – Processing a complete Forensic case – Preparing Forensic Report		
Module:8	**Recent Trends**	**2 hours**
Industry Expert talk		
	Total Lecture hours:	**45 hours**

Text Book(s)	
1.	J. R. Vacca, Computer forensics: Computer Crime Scene investigation, 2nd Ed. Hanover, NH, United States: Charles River Media, 2002.(ISBN No.: 978-1-58-450389-7).
2	C. Altheide, H. Carvey, and R. Davidson, Digital Forensics with Open Source Tools: Using Open Source Platform Tools for Performing Computer Forensics on Target Systems: Windows, Mac, Linux, Unix, etc, 1st Ed. United States: Syngress Media,U.S., 2011.(ISBN No. : 978-1-59-749586-8).
3	S. Bommisetty, R. Tamma, and H. Mahalik, Practical Mobile Forensics: Dive into Mobile Forensics on IOS, Android, windows, and blackBerry devices with this action-packed, practical guide. United Kingdom: Packt Publishing, 2014. (ISBN No. : 978-1783288311).
4	G. Gogolin, Digital Forensics Explained, 1st Ed. Boca Raton, FL: CRC Taylor Francis, 2013. (ISBN No. : 978-1-43-987495-0)
5	M. Dawson and M. Omar, Eds., New Threats and Countermeasures in Digital Crime and Cyber Terrorism. Boca Raton, FL, United States: Idea Group,U.S., 2015. (ISBN No.: 978-1-46-668345-7)
Reference Books	
1.	A. Hoog and J. McCash, Android forensics: Investigation, Analysis, and Mobile Security for Google Android. Waltham, MA: Syngress Media,U.S., 2011. (ISBN No.: 1597496510).
2.	B. Nelson, A. Phillips, F. Enfinger, and C. Steuart, Guide to Computer Forensics and Investigations, Second edition, 2nd Ed. Boston: Thomson Course Technology, 2009. (ISBN No. : 0-619-21706-5)

Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar			
Mode of assessment: Project/Activity			
Recommended by Board of Studies	28-02-2017		
Approved by Academic Council	No. 44	Date	16-03-2017

BCI4002	VULNERABILITY ANALYSIS A ND PENETRATION TESTING	L	T	P	J	C
		2	0	2	4	4
Pre-requisite	**Nil**	**Syllabus version**				
		v. 1.0				

Course Objectives:

1. To learn the tools that can be used to perform information gathering
2. To identify various attacks in various domains of cyber space.
3. To learn about exploits in various operating systems and Wireless environment
4. To learn how vulnerability assessment can be carried out by means of automatic tools or manual investigation
5. To learn the vulnerabilities associated with various network applications and database system.

Expected Course Outcome:

1 Ability to determine the security threats and vulnerabilities in computer networks using penetration testing techniques
2. Set up of a hacking lab environment to study and document vulnerabilities within the network
3. Realize and respect ethical boundaries to demonstrate and understand what is necessary and appropriate when conducting penetration tests

Module:1	**Information Gathering and Detecting Vulnerabilities**	**5 hours**

Open Source Intelligence Gathering - Port Scanning - Nessus Policies - Web Application Scanning Manual Analysis- Traffic Capturing

Module:2	**Attacks**	**4 hours**

Password Attacks Client side Exploitation Social Engineering- Bypassing Antivirus Applications.

Module:3	**Exploits**	**4 hours**

Metasploit Payloads Open phpMyAdmin -Buffer overflow: Windows and Linux,Web scanning exploits, port scanning exploits, SQL exploits

Module:4	**Wireless Security**	**5 hours**

Wired vs. wireless Privacy Protocols - Wireless Frame Generation Encryption Cracking Tools- Wireless DoS Attacks

Module:5	**Common Vulnerability Analysis of Application Protocols**	**4 hours**

Simple Mail Transfer Protocol- File Transfer Protocol- Trivial File Transfer Protocol-Hyper Text Transmission Protocol-ICMP SMURF- UDP-DNS-PING-SYN

Module:6	**Network Vulnerability Analysis**	**4 hours**

Domain Name Server and Dynamic Host Configuration Protocol -Light Weight Directory Access Protocol-Simple Network Management Protocol-Remote Procedural Call

Module:7	**Penetration Tools and Database Security**	**3 hours**

Traceroutes, Neotrace, Whatweb. Database Security : Access control in database systems - Inference control - Multilevel database security		
Module:8	**Recent Trends**	**1 hour**
Industry Expert talk		
	Total Lecture hours:	**30 hours**

Text Book(s)	
1.	Georgia Weidman, "Penetration Testing: A Hands On Introduction to Hacking", No Startch Press, First Edition 2014. ISBN-13: 978-1593275648 ISBN-10: 1593275641.
2	B.Singh, H.Joseph and Abhishek Singh,"Vulnerability Analysis and Defense for the Internet, Springer, 2008 Edition. ISBN-10: 0387743898 ISBN-13: 978-0387743899.
Reference Books	
1.	Rafay Baloch, "Ethical Hacking and Penetration Testing Guide",CRC Press, 2015,ISBN :78-1-4822-3161-8.
2.	Dr.Patrick Engebretson, "The Basics of Hacking and Penetration Testing",Syngress Publications Elseveir, 2013, ISBN : 978-0-12-411644-3
3.	Prakhar Prasad, Mastering Modern Web Penetration Testing (Kindle Edition),2016 , Packt Publishing, ISBN:978-1-78528-458-8.
4	Gilberto Najera Gutierrez, Kali Linux Web Penetration Testing Cookbook ,2016, ISBN13 9781784392918
5	Robert Svensson, From Hacking to Report Writing: An Introduction to Security and Penetration Testing 2016, ISBN 978-1-4842-2282-9

Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar		
List of Challenging Experiments (Indicative)		
1.	Set up of Kali Linux in a Virtual machine and setup with DNS info and collection of local network.	2 hours
2.	Scan the network for Windows XP and Windows 7 Target machines in local network and virtual network.	2 hours
3.	Identify the open ports and firewall rules setup.	2 hours
4.	Use password guessing tools to guess a password. Use password strengthening tools to strengthen the password. Try guessing the password and tabulate the enhanced difficulty due to length of password and addition of special characters	2 hours
5.	Extract password hashes from Windows XP/ NT machine. Use a password extraction tool, using word list, single crack or external mode to recover the password. Increase the complexity of the password and determine the point at which the cracking tool fails	2 hours
6.	Experiments on SQL injections.	2 hours
7.	Analysis of WEP flaws.	2 hours
8.	Experiments on Wireless DoS Attacks.	2 hours
9.	Buffer Overflow Prevention	2 hours
10.	Prevention against Cross Site Scripting Attacks.	2 hours
11.	Experiments on Metasploit Framework.	2 hours
12.	Cross Site Scripting.	2 hours
13.	Cross Site Request Forgery.	2 hours
14	File upload vulnerability on Social engineering.	2 hours
15	Cracking Linux passwords	2 hours
	Total Laboratory Hours	**30 hours**
Mode of assessment: Project/Activity		

Recommended by Board of Studies	28-02-2017		
Approved by Academic Council	No. 44	Date	16-03-2017

BCI4003	MALWARE ANALYSIS	L	T	P	J	C
		2	0	2	4	4
Pre-requisite	**Nil**	**Syllabus version**				
		v. 1.0				

Course Objectives:

1. To introduce the fundamentals of malware, types and its effects
2. To enable to identify and analyse various malware types by static, dynamic analysis and reverse engineering
3. To deal with detection, analysis, understanding, controlling, and eradication of malware

Expected Course Outcome:

1 Possess the skills necessary to carry out independent analysis of modern malware samples using both static and dynamic analysis techniques.
2. Have an intimate understanding of executable formats, Windows internals and API s, and malware analysis techniques.
3. Extract investigative leads from host and network-based indicators associated with a malicious program.
4. Apply techniques and concepts to unpack, extract, decrypt, or bypass new anti-analysis techniques in future malware samples.
5. Achieve proficiency with industry standard tools including ProcMon, CFF Explorer, ProcExplore, BinText, FileAlyzer, OllyDbg etc

Module:1	**INTRODUCTION TO MALWARE ANALYSIS**	**4 hours**

Malware taxonomy - Malware threats - Malware analysis methodologies - Legal considerations - Identifying and protecting against malware - Malware hiding places - Collecting malware from live system - Identifying malware in dead system Malware Analysis Environment : Virtual machine - Real systems - Malware analysis tools ProcMon, CFF Explorer, ProcExplore, BinText, FileAlyzer, OllyDbg

Module:2	**STATIC ANALYSIS**	**4 hours**

Detailed file analysis -Database of file hashes. Identifying file compile date Identifying packing/ obfuscation methods - Strings analysis - File signature analysis - Local and online malware scanning -Identifying file dependencies.

Module:3	**Dynamic Analysis**	**4 hours**

System baselining - Host integrity - Monitor - Installation monitor - Process monitor - File monitor - Registry analysis/ monitoring - Network traffic monitoring/ ana lysis - Port monitor - DNS monitoring/ resolution -Simulating internet services

Module:4	**CODE ANALYSIS**	**4 hours**

Reverse engineering malicious code - Identifying malware passwords - Bypassing authentication - Assembly level computing Standard x86 instructions, Introduction to IDA, Olly Dbg, Advanced malware analysis Virus, Trojan. Parsing Basic analysis of an APK

Module:5	MALICIOUS DOCUMENT ANALYSIS	4 hours
PDF and Microsoft Office document structures - PDF and office document vulnerabilities - Malware extraction and analysis tools - Analysis of malicious documents		
Module:6	**MALWARE CHALLENGES**	**3 hours**
Virtual environment - Live internet connection - Real, fake, and virtual services -Anti-debug and anti-forensic malware		
Module:7	**MOBILE MALWARE ANALYSIS**	**5 hours**
Need for mobile application penetration testing testing methodology Android and iOS Vulnerabilities - Exploit Prevention - Handheld Exploitation- Android Root Spreading and Distribution Android Debugging		
Module:8	**Recent Trends**	**2 hours**
Industry Expert talk		
	Total Lecture hours:	**30 hours**

Text Book(s)	
1.	M. Sikorski and A. Honig, Practical Malware Analysis: The Hands-on Guide to Dissecting Malicious Software. San Francisco: No Starch Press San Francisco, CA, 2012. (ISBN No.: 978-1-59-327290-6)
2	M. H. Ligh, S. Adair, and B. Hartstein, Cookbook and DVD: Tools and Techniques for Fighting Malicious Code. Indianapolis, IN: Wiley, John Sons, 2010. (ISBN No. : 978-0-470-61303-0).
3	K. Dunham and S. Abu-Nimeh, Mobile Malware Attacks and Defense. Washington, DC, United States: Syngress Media,U.S., 2008. (ISBN No. : 978-1-59-749298-0).
Reference Books	
1.	C. H. Malin, J. M. Aquilina, and E. Casey, Malware Forensics Field Guide for Windows Systems: Digital Forensics Field Guides, R. Maxwell, Ed. Waltham, MA: Syngress Media,U.S., 2012. (ISBN No.: 978-1-59-749472-4).
2.	B. Dang, A. Gazet, E. Bachaalany, and S. Josse, Practical Reverse Engineering: X86, X64, arm, Windows Kernel, Reversing Tools, and Obfuscation. United States: Wiley, 2014. (ISBN No. : 978-1-118-78731-1)
3.	C. Eagle, The IDAPro Book: The Unofficial Guide to the worlds most popular Disassembler , 2nd Ed. San Francisco: No Starch Press San Francisco, CA, 2011. (ISBN No. : 978-1-59327-289-0).
Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar	

List of Challenging Experiments (Indicative)		
1	Sandboxing malware and gathering information from runtime analysis	2 hours
2	Basic malware analysis finding file compilation date, imports/ exports, suspicious strings , run-time effect, procmon filter, hist -based signatures revealing files, registry keys, processes, services, network based signatures revealing URLs, packet contents, intention, checksum, and evidence	2 hours
3	Advanced static malware analysis finding address of main, code constructs, suspicious strings, imported functions, their tasks, intention of the malware, impact of the malware via hexcode	2 hours
4	Basic analysis of Windows programs for imports, msdn based purposes, changes, suspicious strings, persistence mechanism, COM interface, COM functions, host-based signature, checksum, VirusTotal Report for that malware.	2 hours
5	Advacned analysis of Windows programs for processes, interactive remote shell, uploaded file, address of the subroutine, return value, Windows APIs, functionalities of the malware	2 hours
6	Malware behaviour analysis finding the source of malware, how it reached	2 hours

	the system, persistence mechanism, multiple instances replication mechanism, hiding strategies, API calls for key logging, constants involved, post-infection actions of the malware, mutex, SendMessage API structure, what is done with the collected data	
7	Anti-disassembly and anti-debugging technique used in the binary by patching the PE, set a breakpoint in the malicious subroutine and let the program execute until the breakpoint	3 hours
8	Packing and unpacking malware finding the packers name, indicator, unpacking script, removing the nagging screen, resolving any PE header corruption, fixing the import table	3 hours
9	Disassembling Portable Executable (PE32) File Format following all imports, exports, functions, main address, malicious string locations, x86 assembly language	3 hours
10	Reversing basics: branches, loops, switches, differences between code and data, cross-references, imports & exports, searching, defining arrays, structures , and ,functions, standard library functions and FLIRT, IDA scripts and plugins	3 hours
11	Malware self - defense, compression, and obfuscation techniques packing, unpacking, identifying malicious code section, recognizing and defeating data encryption and encoding techniques etc	3 hours
12	Analyzing malicious Microsoft Office and Adobe PDF documents to locate potentially malicious embedded code such as shellcode, VBA macros or JavaScript, extract suspicious code from the file, disassemble and/ or debug shellcode, understand all the steps in the infection chain	3 hours
	Total Laboratory Hours	**30 hours**

Mode of assessment: Project/Activity			
Recommended by Board of Studies	28-02-2017		
Approved by Academic Council	No. 44	Date	16-03-2017

CSE1006	BLOCKCHAIN AND CRYPTOCURRENCY TECHNOLOGIES	L	T	P	J	C
		3	0	0	0	3
Pre-requisite	**NIL**	**Syllabus version**				
		v1.0				

Course Objectives:

1. To understand the mechanism of Blockchain and Cryptocurrency.
2. To understand the functionality of current implementation of blockchain technology.
3. To understand the required cryptographic background.
4. To explore the applications of Blockchain to cryptocurrencies and understanding limitations of current Blockchain.
5. An exposure towards recent research.

Expected Course Outcome:

1. To Understand and apply the fundamentals of Cryptography in Cryptocurrency
2. To gain knowledge about various operations associated with the life cycle of Blockchain and Cryptocurrency
3. To deal with the methods for verification and validation of Bitcoin transactions
4. To demonstrate the general ecosystem of several Cryptocurrency
5. To educate the principles, practices and policies associated Bitcoin business

Module:1	**Introduction to Cryptography and Cryptocurrencies**	**5 hours**

Cryptographic Hash Functions, Hash Pointers and Data Structures, Digital Signatures, Public Keys as Identities, A Simple Cryptocurrency.

Module:2	**How Blockchain Achieves and How to Store and Use**	**7 hours**

Decentralization-Centralization vs. Decentralization-Distributed consensus, Consensus with- out identity using a blockchain, Incentives and proof of work. Simple Local Storage, Hot and Cold Storage, Splitting and Sharing Keys, Online Wallets and Exchanges, Payment Services, Transaction Fees, Currency Exchange Markets.

Module:3	**Mechanics of Bitcoin**	**5 hours**

Bitcoin transactions, Bitcoin Scripts, Applications of Bitcoin scripts, Bitcoin blocks, The Bit- coin network, Limitations and improvements.

Module:4	**Bitcoin Mining**	**5 hours**

The task of Bitcoin miners, Mining Hardware, Energy consumption and ecology, Mining pools, Mining incentives and strategies

Module:5	**Bitcoin and Anonymity**	**5 hours**

Anonymity Basics, How to De-anonymize Bitcoin, Mixing, Decentralized Mixing, Zerocoin and Zerocash.

Module:6	**Community, Politics, and Regulation**	**9 hours**

Consensus in Bitcoin, Bitcoin Core Software, Stakeholders: Who's in Charge, Roots of Bitcoin, Governments Notice on Bitcoin, Anti Money Laundering Regulation, New York's Bit License Proposal. Bitcoin as a Platform: Bitcoin as an Append only Log, Bitcoins as Smart Property, Secure Multi Party Lotteries in Bitcoin, Bitcoin as Public Randomness, Source-Prediction Markets, and

Real World Data Feeds.			
Module:7	**Altcoins and the Cryptocurrency Ecosystem**		**7 hours**
Altcoins: History and Motivation, A Few Altcoins in Detail, Relationship Between Bitcoin and Altcoins, Merge Mining-Atomic Crosschain Swaps-6 BitcoinBacked Altcoins, Side Chains, Ethereum and Smart Contracts.			
Module:8	**Recent Trends and applications**		**2 hours**
	Total Lecture hours:	**45 hours**	

Text Book(s)	
1.	Narayanan, A., Bonneau, J., Felten, E., Miller, A., and Goldfeder, S. (2016). Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University Press.
Reference Books	
1.	Antonopoulos, A. M. (2014). Mastering Bitcoin: unlocking digital cryptocurrencies. OReilly Media, Inc.”.
2.	Franco, P. (2014). Understanding Bitcoin: Cryptography, engineering and economics. John Wiley and Sons.

Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar			
Recommended by Board of Studies	10-08-2018		
Approved by Academic Council	No. 52	Date	14-09-2018

CSE2002	THEORY OF COMPUTATION AND COMPILER DESIGN	L	T	P	J	C
		4	0	0	0	4
Pre-requisite	**NIL**	**Syllabus version**				
		v1.0				

Course Objectives:

1. Provides required theoretical foundation for a computational model and compiler design
2. Discuss Turing machines as a abstract computational model
3. Compiler algorithms focus more on low level system aspects.

Expected Course Outcome:

On successful completion of the course, the student should be able to:

1. Design computational models for formal languages
2. Design scanners and parsers using top-down as well as bottom-up paradigms
3. Design symbol tables and use them for type checking and other semantic checks
4. Implement a language translator
5. Use tools such as lex, YACC to automate parts of implementation process

Module:1	**Introduction To Languages and Grammers**	**3 hours**

Overview of a computational model - Languages and grammars – alphabets – Strings - Operations on languages, Introduction to Compilers - Analysis of the Source Program - Phases of a Compiler

Module:2	**Regular Expressions and Finite Automata**	**9 hours**

Finite automata – DFA – NFA – Equivalence of NFA and DFA (With Proof) - Regular expressions – Conversion between RE and FA (With Proof) Lexical Analysis - Recognition of Tokens - Designing a Lexical Analyzer using finite automata

Module:3	**Myhill-Nerode Theorem**	**4 hours**

Myhill-Nerode Theorem - Minimization of FA – Decision properties of regular languages – Pumping lemma for Regular languages (With Proof)

Module:4	**CFG, PDAs and Turing Machines**	**15 hours**

CFG – Chomsky Normal Forms - NPDA – DPDA - Membership algorithm for CFG. Syntax Analysis - Top-Down Parsing - Bottom-Up Parsing - Operator-Precedence Parsing - LR Parsers

Module:5	**Turing Machines**	**5 hours**

Turing Machines – Recursive and recursively enumerable languages – Linear bounded automata - Chomsky's hierarchy – Halting problem

Module:6	**Intermediate Code Generation**	**10 hours**

Intermediate Code Generation - Intermediate Languages – Declarations - Assignment Statements - Boolean Expressions - Case Statements – Backpatching - Procedure Calls.

Module:7	**Code Optimization**	**7 hours**

Code Optimization - Basic Blocks and Flow Graphs – The DAG Representation of Basic Blocks - The Principal Sources of Optimization - Optimization of Basic Blocks - Loops in Flow Graphs - Peephole Optimization - Introduction to Global Data-Flow Analysis

Module:8	Code Generation	7 hour
Code Generation – Issues in the Design of a Code Generator - The Target Machine - Run-Time Storage Management - Next-Use Information - Register Allocation and Assignment - A Simple Code Generator - Generating Code from DAG Recent Trends – Just-in-time compilation with adaptive optimization for dynamic languages - Parallelizing Compilers Total Lecture Hours		
	Total Lecture hours:	**60 hours**

Text Book(s)	
1.	Introduction to Automata Theory, Languages, and Computation (3rd Edition), John E Hopcroft, Rajeev Motwani, Jeffery D. Ullman, Pearson education, 2013.
2.	Principles of Compiler Design, Alferd V. Aho and Jeffery D. Ullman, Addison Wesley, 2006
Reference Books	
1.	Introduction to Languages and the Theory of Computation, John Martin, McGraw-Hill Higher Education,2010
2.	Modern Compiler Implementation in Java, 2nd ed., Andrew W. Appel Cambrdige University Press, 2012.

Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar			
Recommended by Board of Studies	19-11-2018		
Approved by Academic Council	No. 53	Date	13-12-2018

CSE2006	MICROPROCESSOR AND INTERFACING	L	T	P	J	C
		2	0	2	4	4
Pre-requisite	**CSE1003-Digital Logic Design, CSE2001-Computer Architecture and Organization**	**Syllabus version**				
		v1.0				

Course Objectives:

1. Students will gain knowledge on architecture, accessing data and instruction from memory for processing.
2. Ability to do programs with instruction set and control the external devices through I/O interface
3. Generate a system model for real world problems with data acquisition, processing and decision making with aid of micro controllers and advanced processors.

Expected Course Outcome:

1. Recall the basics of processor, its ways of addressing data for operation by instruction set.
2. Execute basic and advanced assembly language programs.
3. Learn the ways to interface I/O devices with processor for task sharing.
4. Recall the basics of co-processor and its ways to handle float values by its instruction set.
5. Recognize the functionality of micro controller, latest version processors and its applications.
6. Acquire design thinking capability, ability to design a component with realistic constraints, to solve real world engineering problems and analyze the results.

Module:1	**INTRODUCTION TO 8086 MICROPROCESSOR**	**6 hours**

Introduction to 8086, Pin diagram, Architecture, addressing mode and Instruction set

Module:2	**INTRODUCTION TO ALP**	**5 hours**

Tools- Assembler Directives, Editor, assembler, debugger, simulator and emulator. E.g., ALP Programs-Arithmetic Operations and Number System Conversions, Programs using Loops, If then else, for loop structures

Module:3	**Advanced ALP**	**2 hours**

Interrupt programming using DOS BIOS function calls, File Management

Module:4	**Introduction to Peripheral Interfacing-I**	**5 hours**

PPI 8255, Timer 8253,Interrupt controller-8259

Module:5	**Introduction to Peripheral Interfacing-II**	**4 hours**

IC 8251 UART, Data converters (A/D and D/A Converter), seven segment display and key- board interfacing

Module:6	**Co-Processor**	**4 hours**

Introduction to 8087, Architecture, Instruction set and ALP Programming

Module:7	**Introduction to Arduino Boards**	**2 hours**

Introduction to Microcontroller- Quark SOC processor, programming, Arduino Boards using GPIO (LED, LCD, Keypad, Motor control and sensor), System design application and case study.

Module:8	Contemporary issues	2 hours
Architecture of one of the advanced processors such as Multicore, Snapdragon, ARM processor in iPad		
	Total Lecture hours:	**30 hours**

Text Book(s)	
1.	A.K. Ray and K.M. Bhurchandi Advanced Microprocessors and Peripherals, third Edition, Tata McGraw Hill, 2012.
2.	Barry B Bray , The Intel Microprocessor 8086/8088, 80186,80286, 80386 and 80486 Arcitecture, programming and interfacing, PHI, 8th Edition, 2009.

Reference Books	
1.	Douglas V. Hall, SSSP Rao Microprocessors and Interfacing Programming and Hardware. Tata McGraw Hill, Third edition, 2012.
2.	Mohamed Rafiquazzaman, Microprocessor and Microcomputer based system design, Universal Book stall, New Delhi, Second edition, 1995
3.	K Uday Kumar, B S Umashankar, Advanced Micro processors IBM-PC Assembly Language Programming, Tata McGraw Hill, 2002.
4.	Massimo Banzi,Getting Started with Arduino , First Edition, pub. O'Reilly, 2008.
5.	John Uffenbeck and 8088 Family. 1997. The 80x86 Family: Design, Programming, and Interfacing (2nd ed.). Prentice Hall PTR, Upper Saddle River, NJ, USA.

Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar

List of Challenging Experiments (Indicative)		
1.	Arithmetic operations 8/16 bit using different addressing modes.	2.5 hours
2.	Finding the factorial of an 8 /16 bit number.	2.5 hours
3.	(a) Solving nCr and nPr (b) Compute nCr and nPr using recursive procedure. Assume that n and r are non-negative integers	2.5 hours
4.	Assembly language program to display Fibonacci series	2.5 hours
5.	Sorting in ascending and descending order	2.5 hours
6.	(a) Search a given number or a word in an array of given numbers. (b) Search a key element in a list of n 16-bit numbers using the Binary search algorithm.	2.5 hours
7.	To find the smallest and biggest numbers in a given array.	2.5 hours
8.	ALP for number system conversions.	2.5 hours
9.	(a) String operations(String length, reverse, comparison, concatenation, palindrome)	2.5 hours
10.	ALP for Password checking	2.5 hours
11.	Convert a 16-bit binary value (assumed to be an unsigned integer) to BCD and display it from left to right and right to left for specified number of times	2.5 hours
12.	ALP to interface Stepper motor using 8086/ Intel Galileo Board	2.5 hours
	Total Laboratory Hours	30 hours

Mode of assessment: Project/Activity

Recommended by Board of Studies	04-04-2014		
Approved by Academic Council	No. 37	Date	16-06-2015

Course code	Course Title	L	T	P	J	C
CSE2014	Compiler Design	3	0	2	0	4
Pre-requisite	CSE2013 - Theory of Computation	Syllabus version				

Course Objectives:

1. To provide foundation for study of high performance compiler design.
2. To make students familiar with lexical analysis and parsing techniques.
3. To understand the various actions carried out in semantic analysis.
4. To make the students to get familiar how the intermediate code is generated.
5. To understand the principles of code optimization techniques.
6. To provide fundamental knowledge of various language translators.

Expected Course Outcome:

1. Demonstrate the functioning of a Compiler and to develop a firm and enlightened grasp of concepts such as higher level programming, assemblers, automata theory, and formal languages, language specifications.
2. Develop language specifications using context free grammars (CFG).
3. Apply the ideas, the techniques, and the knowledge acquired for the purpose of developing software systems.
4. Constructing symbol tables and generating intermediate code.
5. Obtain insights on compiler optimization.
6. Apply the skills on devising, selecting and using tools and techniques towards compiler design

Module:1	INTRODUCTION TO COMPILATION AND LEXCIAL ANALYSIS	7 hours

Introduction to programming language translators-Structure and Phases of a Compiler-Design Issues-Patterns-Lexemes-Tokens-Attributes-Specification of Tokens-Extended Regular Expression- Regular expression to Deterministic Finite Automata (Direct method).

Module:2	SYNTAX ANALYSIS –TOP DOWN	5 hours

Role of Parser- Parse Tree - Elimination of Ambiguity - Top Down Parsing - Recursive Descent Parsing - Non Recursive Descent Parsing - Predictive Parsing - LL(1) Grammars.

Module:3	SYNTAX ANALYSIS –BOTTOM UP	7 hours

Shift Reduce Parsers- Operator Precedence Parsing -LR Parsers,Construction of SLR Parser Tables and Parsing, CLR Parsing, LALR Parsing

Module:4	SEMANTICS ANALYSIS	6 hours

Syntax Directed Definition – Evaluation Order - Applications of Syntax Directed Translation - Syntax Directed Translation Schemes - Implementation of L attributed Syntax Directed Definition.		
Module:5	**INTERMEDIATE CODE GENERATION**	**6 hours**
Variants of Syntax trees - Three Address Code- Types – Declarations - Procedures - Assignment Statements - Translation of Expressions - Control Flow - Back Patching- Switch Case Statements.		
Module:6	**CODE OPTIMIZATION**	**6 hours**
Loop optimizations- Principal Sources of Optimization -Introduction to Data Flow Analysis - Basic Blocks - Optimization of Basic Blocks - Peephole Optimization- The DAG Representation of Basic Blocks -Loops in Flow Graphs.		
Module:7	**CODE GENERATION**	**6 hours**
Issues in the design of a code generator- Target Machine- Next-Use Information - Register Allocation and Assignment, Runtime Organization, Activation Records.		
Module:8	**RECENT TRENDS**	**2 hours**
	Total Lecture hours:	**45 hours**

Text Book(s)	
1.	A. V. Aho, Monica S. Lam, Ravi Sethi and Jeffrey D. Ullman, Compilers: Principles, techniques, & tools, Second Edition, Pearson Education, 2007.
2.	K. D. Cooper and L. Torczon, Engineering a compiler, Morgan Kaufmann, 2nd edition, 2011.
3.	Steven S.Muchnick "Advanced Compiler design implementation", Elsevier Science India, 2003.
Reference Books	
1.	Andrew A.Appel , Modern Compiler Implementation in Java, Cambridge University Press; 2nd edition, 2002.
2.	Allen Holub, Compiler Design in C, Prentice Hall, 1990
3.	Torbengidius Mogensen, Basics of Compiler Design, Springer, 2011.
4.	Charles N, Ron K Cytron, Richard J LeBlanc Jr., Crafting a Complier, Pearson Education, 2010.

Mode of Evaluation:CAT/ Digital Assignment/Quiz/FAT/ Project.

List of Experiments		**CO: 3**
1.	Write a LEX program to recognize valid arithmetic expression. Identifiers in the expression could be only integers and operators could be + and *. Count the identifiers & operators present and print them separately.	3 hours
2.	Write a LEX program to eliminate comment lines in a C program and copy the resulting program into a separate file	3 hours
3.	Write YACC program to recognize all strings for which starts with n number of „a" followed by n number of „b".	3 hours
4.	Write YACC program to recognize valid identifier, operators and keywords in the given text (C program) file.	3 hours
5.	Implementation of calculator using lex and yacc.	3 hours

6.	Convert the bnf rules into yacc form and write code to generate abstract syntax tree	3 hours
7.	SCHEME EXPRESSION Write a scheme expression that evaluates the polynomial Write 5 *(4.5 - 8.5) + 77 as a scheme expression, and find its value. Define a function middle that takes five numbers as argument and returns the middle of the five	3 hours
8.	Intro to Flex and Bison Modify the scanner and parser so that terminating a statement with ";b" instead of ";" results in the output being printed in binary.	3 hours
9.	Write a recursive descent parser for the CFG language and implement it using LLVM	3 hours
10.	Write a LR parser for the CFG language and implement it in the using LLVM	3 hours
	Total Laboratory Hours	**30 hours**

Mode of assessment:Assessment Examination, FAT Lab Examination			
Recommended by Board of Studies	09-09-2020		
Approved by Academic Council	No. 59	Date	24-09-2020

CSE3009	INTERNET OF THINGS	L	T	P	J	C
		3	0	0	4	4
Pre-requisite	**NIL**	**Syllabus version**				
		v1.0				

Course Objectives:

1. To apprise students with basic knowledge of IoT that paves a platform to understand physical, logical design and business models
2. To teach a student how to analyze requirements of various communication models and protocols for cost-effective design of IoT applications on different IoT platforms.
3. To explain the students how to code for an IoT application and deploy for real-time scenario.

Expected Course Outcome:

1. Describe various layers of IoT protocol stack and describe protocol functionalities.
2. Evaluate efficiency trade-offs among alternative communication models for an efficient IoT application design.
3. Comprehend advanced IoT applications and technologies from the basics of IoT.
4. Understand working principles of various sensor for different IoT platforms.
5. Estimate the cost of hardware and software for low cost design IoT applications.
6. Compare various application business models of different domains.
7. Solve real-time problems and demonstrate IoT applications in various domains using prototype models.

Module:1	**Introduction To Internet of Things**	**5 hours**

Definition & Characteristics of IoT - Challenges and Issues - Physical Design of IoT, Logical Design of IoT - IoT Functional Blocks, Security.

Module:2	**Components In Internet of Things**	**7 hours**

Control Units Communication modules Bluetooth Zigbee Wifi GPS- IOT Protocols (IPv6, 6LoWPAN, RPL, CoAP etc), MQTT, Wired Communication, Power Sources.

Module:3	**Technologies Behind IoT**	**7 hours**

Four pillars of IOT paradigm, - RFID, Wireless Sensor Networks, SCADA (Supervisory Con- trol and Data Acquisition), M2M - IOT Enabling Technologies - BigData Analytics, Cloud Computing, Embedded Systems.

Module:4	**Programming The Microcontroller For IoT**	**8 hours**

Working principles of sensors IOT deployment for Raspberry Pi /Arduino /Equivalent plat- formReading from Sensors, Communication: Connecting microcontroller with mobile devices, communication through Bluetooth, wifi and USB - Contiki OS- Cooja Simulator.

Module:5	**Resource Management in IoT**	**4 hours**

Clustering, Clustering for Scalability, Clustering Protocols for IOT.

Module:6	**From The Internet Of Things To The Web Of Things**	**6 hours**

The Future Web of Things Set up cloud environment Cloud access from sensors Data Analytics for IOT- Case studies- Open Source e-Health sensor platform Be Close Elderly monitoring Other recent

projects.		
Module:7	**IoT Applications**	**6 hours**
Business models for the internet of things, Smart city, smart mobility and transport, smart buildings and infrastructure, smart health, environment monitoring and surveillance.		
Module:8	**Recent Trends**	**2 hours**
	Total Lecture hours:	**45 hours**

Text Book(s)	
1.	Dieter Uckelmann et.al, Architecting the Internet of Things, Springer, 2011
2.	Arshdeep Bahga and Vijay Madisetti, Internet of Things A Hand-on Approach, Universities press, 2015
Reference Books	
1.	Charalampos Doukas , Building Internet of Things with the Arduino, Create space, April 2002
2.	Dr. Ovidiu Vermesan and Dr. Peter Friess, Internet of Things: From research and innovation to market deployment, River Publishers 2014.

Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar			
Recommended by Board of Studies	04-04-2014		
Approved by Academic Council	No. 37	Date	16-06-2015

CSE3013	ARTIFICIAL INTELLIGENCE	L	T	P	J	C
		3	0	0	4	4
Pre-requisite	**NIL**	**Syllabus version**				
		v1.0				

Course Objectives:

1. To impart artificial intelligence principles, techniques and its history
2. To assess the applicability, strengths, and weaknesses of the basic knowledge representation, problem solving, and learning methods in solving engineering problems
3. To develop intelligent systems by assembling solutions to concrete computational problems

Expected Course Outcome:

1. Evaluate Artificial Intelligence (AI) methods and describe their foundations.
2. Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation and learning.
3. Demonstrate knowledge of reasoning and knowledge representation for solving real world problems
4. Analyze and illustrate how search algorithms play vital role in problem solving
5. Illustrate the construction of learning and expert system
6. Discuss current scope and limitations of AI and societal implications.

Module:1	**Artificial Intelligence and its Issues**	**9 hours**

Definitions - Importance of AI, Evolution of AI - Applications of AI, Classification of AI systems with respect to environment, Knowledge Inferring systems and Planning, Uncertainty and towards Learning Systems.

Module:2	**Overview to Problem Solving**	**5 hours**

Problem solving by Search, Problem space - State space, Blind Search - Types, Performance measurement.

Module:3	**Heuristic Search**	**4 hours**

Types, Game playing mini-max algorithm, Alpha-Beta Pruning

Module:4	**Knowledge Representation and Reasoning**	**7 hours**

Logical systems Knowledge Based systems, Propositional Logic Constraints, Predicate Logic First Order Logic, Inference in First Order Logic, Ontological Representations and applications

Module:5	**Uncertainty and knowledge Reasoning**	**7 hours**

Overview Definition of uncertainty, Bayes Rule Inference, Belief Network, Utility Based System, Decision Network

Module:6	**Learning Systems**	**4 hours**

Forms of Learning Types - Supervised, Unsupervised, Reinforcement Learning, Learning Decision Trees

Module:7	**Expert Systems**	**7 hours**

Expert Systems - Stages in the development of an Expert System - Probability based Expert Systems

- Expert System Tools - Difficulties in Developing Expert Systems - Applications of Expert Systems			
Module:8	**Recent Trends**		**2 hours**
	Total Lecture hours:	**45 hours**	

Text Book(s)	
1.	Russell, S. and Norvig, P. 2015. Artificial Intelligence - A Modern Approach, 3rd edition, Prentice Hall.
2.	Poole, D. and Mackworth, A. 2010. Artificial Intelligence: Foundations of Computational Agents, Cambridge University Press.
Reference Books	
1.	Ric, E., Knight, K and Shankar, B. 2009. Artificial Intelligence, 3rd edition, Tata McGraw Hill.
2.	Luger, G.F. 2008. Artificial Intelligence -Structures and Strategies for Complex Problem Solving, 6th edition, Pearson.
3.	Brachman, R. and Levesque, H. 2004. Knowledge Representation and Reasoning, Morgan Kaufmann.
4.	Alpaydin, E. 2010. Introduction to Machine Learning. 2nd edition, MIT Press.
5.	Sutton R.S. and Barto, A.G. 1998. Reinforcement Learning: An Introduction, MIT Press.
6.	Padhy, N.P. 2009. Artificial Intelligence and Intelligent Systems, Oxford University Press.

Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar			
Recommended by Board of Studies	04-04-2014		
Approved by Academic Council	No. 37	Date	16-06-2015

CSE3501	Information Security Analysis and Audit	L	T	P	J	C
	Job Role: SSC/Q0901	2	0	2	4	4
Pre-requisite	Computer Networks	Syllabus version				
		v.1.0				

Objective of the course

1. Explore system security related incidents and gain insight on potential defenses and counter measures against common threat/vulnerabilities.
2. Install, configure and troubleshoot information security devices
3. Gain experience using tools and common processes in information security audits and analysis of compromised systems.

Expected Outcome

After successfully completing the course the student should be able to

- Contribute to managing information security
- Co-ordinate responses to information security incidents
- Install and configure information security devices
- Contribute to information security audits
- Support teams to prepare for and undergo information security audits
- Manage their work to meet requirements
- Work effectively with colleagues
- Maintain a healthy, safe and secure working environment
- Provide data/information in standard formats
- Develop their knowledge, skills and competence

1	**Information Security Fundamentals**	7 hours
Definitions & challenges of security, Attacks & services, Security policies, Security Controls, Access control structures, Cryptography, Deception, Ethical Hacking, Firewalls, Identify and Access Management (IdAM).		
2	**System Security**	6 hours
System Vulnerabilities, Network Security Systems, System Security, System Security Tools, Web Security, Application Security, Intrusion Detection Systems.		
3	**Information Security Management**	3 hours
Monitor systems and apply controls, security assessment using automated tools, backups of security devices, Performance Analysis, Root cause analysis and Resolution, Information Security Policies, Procedures, Standards and Guidelines		
4	**Incident Management**	5 hours
Security requirements, Risk Management, Risk Assessment, Security incident management, third party security management, Incident Components, Roles.		
5	**Incident Response**	4 hours
Incident Response Lifecycle, Record, classify and prioritize information security incidents using standard templates and tools, Responses to information security incidents, Vulnerability Assessment, Incident Analysis.		
6	**Conducting Security Audits**	3 hours

Common issues in audit tasks and how to deal with these, Different systems and structures that may need information security audits and how they operate, including: servers and storage devices, infrastructure and networks , application hosting and content management, communication routes such as messaging, Features, configuration and specifications of information security systems and devices and associated processes and architecture, Common audit techniques, Record and report audit tasks, Methods and techniques for testing compliance.		
7	**Information Security Audit Preparation**	2 hours
Establish the nature and scope of information security audits, Roles and responsibilities, Identify the procedures/guidelines/checklists, Identify the requirements of information security, audits and prepare for audits in advance, Liaise with appropriate people to gather data/information required for information security audits.		
8	**Self and Work Management**	2 hours
Establish and agree work requirements with appropriate people, Keep the immediate work area clean and tidy, utilize time effectively, Use resources correctly and efficiently, Treat confidential information correctly, Work in line with organization's policies and procedures, Work within the limits of their job role.		
	Total Lecture hours:	**30 hours**

Text Book(s)

1.	William Stallings, Lawrie Brown, Computer Security: Principles and Practice, 3rd edition, 2014.
2.	Nina Godbole, Information Systems Security: Security Management, Metrics, Frameworks and Best Practices, Wiley, 2017
3.	Nina Godbole, Sunit Belapure, Cyber Security- Understanding cyber-crimes, computer forensics and legal perspectives, Wiley Publications, 2016
4.	Andrew Vladimirov Michajlowski, Konstantin, Andrew A. Vladimirov, Konstantin V. Gavrilenko, Assessing Information Security: Strategies, Tactics, Logic and Framework, IT Governance Ltd, O'Reilly, 2010

Reference Books

1.	Charles P. Pfleeger, Security in Computing, 4th Edition, Pearson, 2009.
2.	Christopher J. Alberts, Audrey J. Dorofee , Managing Information Security Risks, Addison-Wesley Professional, 2004
3.	Peter Zor, The Art of Computer Virus Research and Defense, Pearson Education Ltd, 2005
4.	Lee Allen, Kevin Cardwell, Advanced Penetration Testing for Highly-Secured Environments - Second Edition, PACKT Publishers, 2016
5.	Chuck Easttom , System Forensics Investigation and Response, Second Edition, Jones & Bartlett Learning, 2014
6.	David Kennedy, Jim O'Gorman, Devon Kearns, and Mati Aharoni, Metasploit The Penetration Tester's Guide, No Starch Press, 2014

7	Practical Malware Analysis by Michael Sikorski and Andrew Honig, No Starch Press, 2015
8.	Ref Links:
9.	https://www.iso.org/isoiec-27001-information-security.html https://csrc.nist.gov/publications/detail/sp/800-55/rev-1/final https://www.sans.org/reading-room/whitepapers/threats/paper/34180 https://www.sscnasscom.com/qualification-pack/SSC/Q0901/

List of Experiments (Indicative)		
	• Install and configure information security devices • Security assessment of information security systems using automated tools. • Vulnerability Identification and Prioritization • Working with Exploits • Password Cracking • Web Application Security Configuration • Patch Management • Bypassing Antivirus Software • Static Malware Analysis • Dynamic Malware Analysis • Penetration Testing • MySQL SQL Injection • Risk Assessment • Information security incident Management • Exhibit Security Analyst Role	
	Total Laboratory Hours	**30 hours**

Recommended by Board of Studies	05-FEB-2020		
Approved by Academic Council	58	Date	26-FEB-2020

CSE3502	Information Security Management	L	T	P	J	C
		2	0	2	4	4
Pre-requisite	Computer Networks	Syllabus version				
		v.1.0				

Objective of the course

1. Explore system security related incidents and gain insight on potential defenses and counter measures against common threat/vulnerabilities.
2. Install, configure and troubleshoot information security devices
3. Gain experience using tools and common processes in information security audits and analysis of compromised systems.

Expected Outcome

After successfully completing the course the student should be able to

- Contribute to managing information security
- Co-ordinate responses to information security incidents
- Install and configure information security devices
- Contribute to information security audits
- Support teams to prepare for and undergo information security audits
- Manage their work to meet requirements
- Work effectively with colleagues
- Maintain a healthy, safe and secure working environment
- Provide data/information in standard formats
- Develop their knowledge, skills and competence

1	**Information Security Devices**	5 hours

Identify And Access Management (IdAM), Networks (Wired And Wireless) Devices, Endpoints/Edge Devices, Storage Devices, Servers, Infrastructure Devices (e.g. Routers, Firewall Services) , Computer Assets, Servers And Storage Networks, Content management, IDS/IPS

2	**Security Device Management**	6 hours

Different types of information security devices and their functions, Technical and configuration specifications, architecture concepts and design patterns and how these contribute to the security of design and devices.

3	**Device Configuration**	5 hours

Common issues in installing or configuring information security devices, Methods to resolve these issues, Methods of testing installed/configured information security devices.

4	**Information Security Audit Preparation**	5 hours

Establish the nature and scope of information security audits, Roles and responsibilities, Identify the procedures/guidelines/checklists, Identify the requirements of information security, audits and prepare for audits in advance, Liaise with appropriate people to gather data/information required for information security audits. **Security Audit Review -**

Organize data/information required for information security audits using standard templates and tools, Audit tasks, Reviews, Comply with the organization's policies, standards, procedures, guidelines and

checklists, Disaster Recovery Plan		
5	**Team Work and Communication**	2 hours
Communicate with colleagues clearly, concisely and accurately , Work with colleagues to integrate their work effectively, Pass on essential information to colleagues in line with organizational requirements, Identify any problems they have working with colleagues and take the initiative to solve these problems, Follow the organization's policies and procedures for working with colleagues		
6	**Managing Health and Safety**	2 hours
Comply with organization's current health, safety and security policies and procedures, Report any identified breaches in health, safety, and Security policies and procedures, Identify, report and correct any hazards, Organization's emergency procedures, Identify and recommend opportunities for improving health, safety, and security.		
7	**Data and Information Management**	3 hours
Fetching the data/information from reliable sources, Checking that the data/information is accurate, complete and up-to-date, Rule-based analysis of the data/information, Insert the data/information into the agreed formats, Reporting unresolved anomalies in the data/information.		
8	**Learning and Self Development**	2 hours
Identify accurately the knowledge and skills needed, Current level of knowledge, skills and competence and any learning and development needs, Plan of learning and development activities to address learning needs, Feedback from appropriate people, Review of knowledge, skills and competence regularly and appropriate action taken		

	Total Lecture hours:	**30 hours**

Text Book(s)

1.	Information Systems Security: Security Management, Metrics, Frameworks and Best Practices, Nina Godbole, Wiley, 2017
2.	Rhodes-Ousley, Mark. Information Security: The Complete Reference, Second Edition, . Information Security Management: Concepts and Practice. New York, McGraw-Hill, 2013.
3.	Christopher J. Alberts, Audrey J. Dorofee , Managing Information Security Risks, Addison-Wesley Professional, 2004

Reference Books

1.	Andrew Vladimirov Michajlowski, Konstantin, Andrew A. Vladimirov, Konstantin V. Gavrilenko, Assessing Information Security: Strategies, Tactics, Logic and Framework, IT Governance Ltd, O'Reilly 2010
2.	Christopher J. Alberts, Audrey J. Dorofee , Managing Information Security Risks, Addison-Wesley Professional, 2004 Chuck Easttom , System Forensics Investigation and Response, Second Edition, Jones & Bartlett Learning, 2014

3. 4. 5.	David Kennedy, Jim O'Gorman, Devon Kearns, and Mati Aharoni, Metasploit The Penetration Tester's Guide, No Starch Press, 2014 Ref Links: https://www.iso.org/isoiec-27001-information-security.html https://www.sans.org/reading-room/whitepapers/threats/paper/34180 https://csrc.nist.gov/publications/detail/sp/800-40/version-20/archive/2005-11-16 https://www.sscnasscom.com/qualification-pack/SSC/Q0901/

List of Experiments (Indicative)		
1.	• Install and configure information security devices • Penetration Testing • MySQL SQL Injection • Information security incident Management • Intrusion Detection/Prevention • Port Redirection and Tunneling • Exploring the Metasploit Framework • Working with Commercial Tools like HP Web Inspect and IBM AppScan etc., • Explore Open Source tools like sqlmap, Nessus, Nmap etc • Documentation with Security Templates from ITIL • Carry out backups of security devices and applications in line with information security policies, procedures and guidelines • Information security audit Tasks - Procedures/guidelines/checklists for the audit tasks	
	Total Laboratory Hours	**30 hours**

Recommended by Board of Studies	05-FEB-2020		
Approved by Academic Council	58	Date	26-FEB-2020

CSE4001	PARALLEL AND DISTRIBUTED COMPUTING	L	T	P	J	C
		2	0	2	4	4
Pre-requisite	**NIL**	**Syllabus version**				
		v1.0				

Course Objectives:

1. To introduce the fundamentals of parallel and distributed computing architectures and paradigms.
2. To understand the technologies, system architecture, and communication architecture that propelled the growth of parallel and distributed computing systems.
3. To develop and execute basic parallel and distributed application using basic programming models and tools.

Expected Course Outcome:

Students who complete this course successfully are expected to:

1. Design and implement distributed computing systems.
2. Asses models for distributed systems.
3. Design and implement distributed algorithms.
4. Experiment with mechanisms such as client/server and P2P algorithms, remote procedure calls (RPC/RMI), and consistency.
5. Analyse the requirements for programming parallel systems and critically evaluate the strengths and weaknesses of parallel programming models.
6. Differentiate between the major classes of parallel processing systems.
7. Analyse the efficiency of a parallel processing system and evaluate the types of application for which parallel programming is useful.

Module:1	**Parallelism Fundamentals**	**2 hours**

Motivation – Key Concepts and Challenges – Overview of Parallel computing – Flynn's Taxonomy – Multi-Core Processors – Shared vs Distributed memory.

Module:2	**Parallel Architectures**	**3 hours**

Introduction to OpenMP Programming – Instruction Level Support for Parallel Programming – SIMD – Vector Processing – GPUs.

Module:3	**Parallel Algorithm and Design**	**5 hours**

Preliminaries – Decomposition Techniques – Characteristics of Tasks and Interactions – Mapping Techniques for Load balancing – Parallel Algorithm Models.

Module:4	**Introduction To Distributed Systems**	**4 hours**

Introduction – Characterization of Distributed Systems – Distributed Shared Memory – Message Passing – Programming Using the Message Passing Paradigm – Group Communication – Case Study (RPC and Java RMI).

Module:5	**Coordination**	**6 hours**

Time and Global States – Synchronizing Physical Clocks – Logical Time and Logical Clock – Coordination and Agreement – Distributed Mutual Exclusion – Election Algorithms – Consensus and Related Problems.

Module:6	**Distributed Transactions**	**6 hours**
Transaction And Concurrency Control – Nested Transactions – Locks – Optimistic Concurrency Control – Timestamp Ordering Distributed Transactions – Flat and Nested – Atomic – Two Phase Commit Protocol – Concurrency Control.		
Module:7	**Distributed System Architecture and its Variants**	**2 hours**
Distributed File System: Architecture – Processes – Communication Distributed Web-based System: Architecture – Processes – Communication. Overview of Distributed Computing Platforms.		
Module:8	**Recent Trends**	**2 hours**

	Total Lecture hours:	**30 hours**	

Text Book(s)	
1.	George Coulouris, Jean Dollimore, Tim Kindberg, and Gordon Blair, "Distributed Systems: Concepts and Design", 5th Edition, Pearson / Addison – Wesley, 2012
2.	Ananth Grama, Anshul Gupta, George Karypis and Vipin Kumar, "Introduction to Parallel Computing", Pearson, 2nd Edition, 2008.
Reference Books	
1.	Andrew S. Tanenbaum and Maarten Van Steen, "Distributed Systems: Principles and Paradigms", Pearson, 2nd Edition, 2006
2.	Pradeep K. Sinha, "Distributed Operating System: Concepts and Design", PHI Learning Pvt. Ltd., 2007
Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar	

List of Challenging Experiments (Indicative)		
1.	OpenMP – Basic programs such as Vector addition, Dot Product	2 hours
2.	OpenMP – Loop work-sharing and sections work-sharing	2 hours
3.	OpenMP – Combined parallel loop reduction and Orphaned parallel loop reduction	2 hours
4.	OpenMP – Matrix multiply (specify run of a GPU card, large scale data … Complexity of the problem need to be specified)	3 hours
5.	MPI – Basics of MPI	3 hours
6.	MPI – Communication between MPI process	3 hours
7.	MPI – Advanced communication between MPI process	3 hours
8.	MPI – Collective operation with 'synchronization'	3 hours
9.	MPI – Collective operation with 'data movement'	3 hours
10.	MPI – Collective operation with 'collective computation'	3 hours
11.	MPI – Non-blocking operation	3 hours
	Total Laboratory Hours	30 hours
Mode of assessment: Project/Activity		

Recommended by Board of Studies	19-11-2018		
Approved by Academic Council	No. 53	Date	13-12-2018

CSE4019	IMAGE PROCESSING	L	T	P	J	C
		3	0	0	4	4
Pre-requisite	**Nil**	**Syllabus version**				
		v. 1.0				

Course Objectives:

1 To provide the basic knowledge on image processing concepts.
2.To develop the ability to apprehend and implement various image processing algorithms.
3.To facilitate the students to comprehend the contextual need pertaining to various image processing applications.

Expected Course Outcome:

1. Ascertain and describe the basics of image processing concepts through mathematical interpretation.
2. Acquire the knowledge of various image transforms and image enhancement techniques involved.
3.Demonstrate image restoration process and its respective filters required.
4. Experiment the various image segmentation and morphological operations for a meaningful partition of objects.
5. Design the various basic feature extraction and selection procedures and illustrate the various image compression techniques and their applications.
6. Analyze and implement image processing algorithms for various real-time applications.

Module:1	**Introduction- Digital Image,its Representation**	**6 hours**

Image Representation and Image Processing Paradigm - Elements of digital image processing-Image model. Sampling and quantization-Relationships between pixels- Connectivity, Distance Measures between pixels - Color image (overview, various color models)-Various image formats bmp, jpeg, tiff, png, gif, etc.

Module:2	**Digital Image Properties- Operations on Digital Images**	**6 hours**

Topological Properties of Digital Images-Histograms, Entropy, Eigen Values-Image Quality Metrics-Noise in Images Sources, types. Arithmetic operations - Addition, Subtraction, Multi- plication, Division-Logical operations NOT, OR, AND, XOR-Set operators-Spatial operations Single pixel, neighbourhood, geometric-Contrast Stretching-Intensity slicing-Bit plane slicing Power Law transforms

Module:3	**Image Enhancement**	**6 hours**

Spatial and Frequency domain-Histogram processing-Spatial filtering-Smoothening spatial filters-Sharpening spatial filters- Discrete Fourier Transform-Discrete Cosine Transform-Haar Trans- form -Hough Transform-Frequency filtering-Smoothening frequency filters-Sharpening frequency filters-Selective filtering.

Module:4	**Digital Image Restoration- Digital Image Registration**	**7 hours**

Noise models - Degradation models-Methods to estimate the degradation-Image de-blurring-Restoration in the presence of noise only spatial filtering-Periodic noise reduction by frequency domain filtering-Inverse filtering-Wiener Filtering. Geometrical transformation-Point based methods- Surface based methods-Intensity based methods

Module:5	**Feature Extraction**	**6 hours**

Region of interest (ROI) selection - Feature extraction: Histogram based features - Intensity features-Color, Shape features-Contour extraction and representation-Homogenous region extraction and representation-Texture descriptors - Feature Selection: Principal Component Analysis (PCA).		
Module:6	**Image Segmentation- Morphological Image Processing**	**6 hours**
Discontinuity detection-Edge linking and boundary detection.Thresholding-Region oriented segmentation- Histogram based segmentation.Object recognition based on shape descriptors.Dilation and Erosion-Opening and Closing-Medial axis transforms-Objects skeletons-Thinning boundaries.		
Module:7	**Image Coding and Compression**	**6 hours**
Lossless compression versus lossy compression-Measures of the compression efficiency- Huf- mann coding-Bitplane coding-Shift codes-Block Truncation coding-Arithmetic coding-Predictive coding techniques-Lossy compression algorithm using the 2-D. DCT transform-The JPEG 2000 standard Baseline lossy JPEG, based on DWT.		
Module:8	**Recent Trends**	**2 hours**
Industry Expert talk		
	Total Lecture hours:	**45 hours**

Text Book(s)	
1.	Rafael C. Gonzalez and Richard E. Woods, Digital Image Processing, Third Ed., Prentice-Hall, 2008.
Reference Books	
1.	William K. Pratt, Digital Image Processing, John Wiley, 4th Edition, 2007
2.	Anil K. Jain, Fundamentals of Digital Image Processing, Prentice Hall of India, 1997
3.	Sonka, Fitzpatrick, Medical Image Processing and Analysis, 1st Edition, SPIE,2000.

Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar			
Recommended by Board of Studies	04-04-2014		
Approved by Academic Council	No. 37	Date	16-06-2015

CSE4027	MOBILE PROGRAMMING	L	T	P	J	C
		2	0	2	4	4
Pre-requisite	**Nil**	**Syllabus version**				
		v. 1.0				

Course Objectives:

1. Students able to learn to write both web apps and native apps for Android using Eclipse and the Android SDK, to write native apps for iPhones, iPod Touches, and iPads using Xcode and the iOS SDK, and to write web apps for both platforms. The course also touches on Windows 8 application programming, so as to provide students with a stepping stone for application development in the mobile operating system of their choice. Additional topics covered include application deployment and availability on the corresponding app stores and markets, application security, efficient power management, and mobile device security

Expected Course Outcome:

1 Exposed to technology and business trends impacting mobile applications.
2.Competent with the characterization and architecture of mobile applications.
3.Competent with designing and developing mobile applications using one application development framework.

Module:1	**Introduction to Mobile Devices**	**4 hours**

Mobile vs.desktop devices and architecture -Power Management-Screen resolution -Touch interfaces -Application deployment -App Store, Google Play, Windows Store -Development environments-XCode- Eclipse -VS2012-PhoneGAP-Native vs. web applications

Module:2	**HTML5/JS/CSS3**	**4 hours**

Quick recap of technologies -Mobile-specific enhancements -Browser- detection-Touch interfaces -Geolocation -Screen orientation-Mobile browser “interpretations”(Chrome/Safari/Gecko/IE)- Case studies().

Module:3	**Mobile OS Architecture**	**3 hours**

Comparing and Contrasting architectures of all three – Android, iOS and Windows-Underlying OS (Darwin vs. Linux vs. Win 8) -Kernel structure and native level programming -Runtime (Objective-C vs. Dalvik vsWinRT) -Approaches to power management -Security

Module:4	**Android/iOS/Win 8 Survival and basic**	**3 hours**

Building Application(IOS, Window, Android).- App structure, built-in Controls, file access, basic graphics Android/iOS/Win8 inbuilt APP- DB access, network access, contacts/photos

Module:5	**Underneath the frameworks**	**4 hours**

Native level programming on Android -Low-level programming on (jailbroken) iOS-Windows low level APIs

Module:6	**Power Management**	**4 hours**

Wake locks and assertions -Low-level OS support -Writing power-smart applications

Module:7	**Augmented Reality(AR) and Mobile Security**	**6 hours**

Web and AR-User interface-Mobile AR-evaluation of AR- standardization-GPS-Accelerometer - Camera -Mobile malware -Device protections - Mobile Secuirty - overview of the current mobile threat landscape-An assessment of your current mobile security solution- complete analysis of your current risks- Recommendations on how to secure your company's mobile devices from advanced threats and targeted attacks		
Module:8	**Recent Trends**	**2 hours**
Industry Expert talk		
	Total Lecture hours:	**30 hours**
Text Book(s)		
1.	Rajiv Ramnath, Roger Crawfis, and Paolo Sivilotti, Android SDK3 for Dummies,Wiley 2011.	
Reference Books		
1.	Valentino Lee, Heather Schneider, and Robbie Schell, Mobile Applications: Architecture, Design, and Development , Prentice Hall , 2004.	
2.	Brian Fling,Mobile Design and Development O'Reilly Media,2009	
3.	Maximiliano Firtman Programming the Mobile Web , O'Reilly Media, 2010.	
4.	Christian Crumlish and Erin Malone Designing Social Interfaces, O'Reilly Media , 2009	
Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar		
List of Challenging Experiments (Indicative)		

1.	1. Get the HelloVIT midlet on the "getting started" page working.
	2. Make some changes - e.g. the text of the String item.
	3. Put in an error - e.g. divide by zero, to see how the development environment attempts to point out on the PC when a runtime error occurs on the phone emulator.
	4. Get the MIDlet "First MIDlet Progam" in the handout working (ok, so it's really our second MIDlet). Copy the code from the handout.
	5. Modify the MIDlet by additing these additional items to the form e.g. TexField, DateField, Gauge. Look up the lcdui package to see what Items can be added and the parameters needed..
	6. You can output to the PC console while the program is running e.g. place this code in the constructor:
	System.out.println("in Constructor"); // This will ouput on the PC console, not on the phone
	7. Now add :*System.out.println("in CommandAction method");* to the Command Action method to see when that method is running.
	8. Add more*Sytem.out.println's*in the following methods:
	1. startApp
	2. pauseApp
	3. destroyApp
	9. Note the sequence of method calls from MIDlet start to end.
		4 Hours

2	**First MIDlet - adding a new command** 1. Continue to add to 2.0 First MIDlet by adding an "OK" command (look up the API command class) 2. Have the"OK" command display on the phone's screen. 3. Add code to process the "OK" command 4. In the actionCommand method display the contents of the TextFrield using System.out.println ( ) 5. Add two more commands e.g. Send, Spell Check. 6. Where were they placed?	4 Hours

	7. Add code to check for these commands - add System.out.println's to show when that code is being executed. 8. Now use System.out.prinln in the OK processing code ad see the text being modified while the program runs. 9. Add another System.out.prinln in the OK to display the value of the gauge (if it's not interactive, go back to the API to see how to make it interactive)	
3	**Additon MIDlet** 1. Create a MIDlet that allows you to enter a number. The number is then added to any prevous number and the running total result is displayed. Use a TextBox to recieve text from the user (instead of a Form as in the previous example). 2. Can you crash the program by entering text instead of numbers? If you can then constrain the user input to numbers only.	4 Hours
4	**Additon MIDlet on a real phone** 1. For the addition MIDlet : Use the IDE to Create a JAR file. 2. (Optionally) Transfer the JAR file to you phone and test. See handout on how to create and deploy a JAR file.	4 Hours
5	**Battery Status** Create an MIDlet that displays a coloured bar to display a car battery's status. The battery voltage is entered into the MIDlet as a floating point number. Display a bar graph as follows: 0-9.5 - Red (battery dead) >9.6 <12 - Yellow (battery poor) >12 <14.4 - Green (battery good) >14.4 - Blue (Alternator faulty)	4 Hours
6	**Secret Text** Develop an MIDlet that has a TextField and Label GUI components. When a piece of text is entered the MIDlet 'encrypts' the text by replacing each letter using the following mapping: **MLKJIHGFEDCBA** **NOPQRSTUVWXYZ** So A -> Z, N-> M, B-> Y, O->L etc Display the encrypted text back in the TextField (so pressing enter should give you back the original text). Display the length of the entered text using the Label. Develop an MIDlet that has a TextField and Label GUI components. When a piece of text is entered the MIDlet 'encrypts' the text by replacing each letter using the following mapping: **MLKJIHGFEDCBA** **NOPQRSTUVWXYZ** So A -> Z, N-> M, B-> Y, O->L etc Display the encrypted text back in the TextField (so pressing enter should give you back the original text). Display the length of the entered text using the Label.	5 Hours
7	**Missing Letter Game** Develop an MIDlet or application that displays a word at random with a random letter(s) missing. The user has to guess the missing letter(s) by entering it/them into a text field(s). You can use an array or vector to store some words internally in the program.	5 hours
	Total Laboratory Hours	30 hours

Mode of assessment: Project/Activity			
Recommended by Board of Studies	13-05-2016		
Approved by Academic Council	No. 41	Date	17-06-2016

MAT2002	APPLICATIONS OF DIFFERENTIAL AND DIFFERENCE EQUATIONS	L	T	P	J	C
		3	0	2	0	4
Pre-requisite	**MAT1011 - Calculus for Engineers**	**Syllabus Version**				
		v1.0				

Course Objectives:

The course is aimed at

1. Presenting the elementary notions of Fourier series, which is vital in practical harmonic analysis
2. Imparting the knowledge of eigenvalues and eigen vectors of matrices and the transform techniques to solve linear systems, that arise in sciences and engineering
3. Enriching the skills in solving initial and boundary value problems
4. Impart the knowledge and application of difference equations and the Z-transform in discrete systems, that are inherent in natural and physical processes

Expected Course Outcomes:

At the end of the course the student should be able to

1. Employ the tools of Fourier series to find harmonics of periodic functions from the tabulated values
2. Apply the concepts of eigenvalues, eigen vectors and diagonalisation in linear systems
3. Know the techniques of solving differential equations
4. Understand the series solution of differential equations and finding eigen values, eigen functions of Strum-Liouville's problem
5. Know the Z-transform and its application in population dynamics and digital signal processing
6. Demonstrate MATLAB programming for engineering problems

Module:1	**Fourier series**	**6 hours**

Fourier series - Euler's formulae - Dirichlet's conditions - Change of interval - Half range series – RMS value – Parseval's identity – Computation of harmonics

Module:2	**Matrices**	**6 hours**

Eigenvalues and Eigen vectors - Properties of eigenvalues and eigen vectors – Cayley-Hamilton theorem - Similarity of transformation - Orthogonal transformation and nature of quadratic form

Module:3	**Solution of ordinary differential equations**	**6 hours**

Linear second order ordinary differential equation with constant coefficients – Solutions of homogenous and non-homogenous equations - Method of undetermined coefficients – method of variation of parameters – Solutions of Cauchy-Euler and Cauchy-Legendre differential equations

Module:4	**Solution of differential equations through Laplace transform and matrix method**	**8 hours**

Solution of ODE's - Nonhomogeneous terms involving Heaviside function, Impulse function - Solving nonhomogeneous system using Laplace transform – Reduction of *n*th order differential equation to first order system - Solving nonhomogeneous system of first order differential equations $(X' = AX + G)$ and $X'' = AX$

Module:5	**Strum Liouville's problems and power series Solutions**	**6 hours**

The Strum-Liouville's Problem - Orthogonality of Eigen functions - Series solutions of differential equations about ordinary and regular singular points - Legendre differential equation - Bessel's differential equation		
Module:6	**Z-Transform**	**6 hours**
Z-transform -transforms of standard functions - Inverse Z-transform: by partial fractions and convolution method		
Module:7	**Difference equations**	**5 hours**
Difference equation - First and second order difference equations with constant coefficients - Fibonacci sequence - Solution of difference equations - Complementary function - Particular integral by the method of undetermined coefficients - Solution of simple difference equations using Z-transform		
Module:8	**Contemporary Issues**	**2 hours**
Industry Expert Lecture		
	Total Lecture hours:	

Text Book(s)	
1.	Advanced Engineering Mathematics, Erwin Kreyszig, 10th Edition, John Wiley India, 2015
Reference Books	
1.	Higher Engineering Mathematics, B. S. Grewal, 43rd Edition, Khanna Publishers, India, 2015
2.	Advanced Engineering Mathematics by Michael D. Greenberg, 2nd Edition, Pearson Education, Indian edition, 2006

Mode of Evaluation		
Digital Assignments (Solutions by using soft skills), Continuous Assessment Tests, Quiz, Final Assessment Test		
1.	Solving Homogeneous differential equations arising in engineering problems	2 hours
2.	Solving non-homogeneous differential equations and Cauchy, Legendre equations	2 hours
3.	Applying the technique of Laplace transform to solve differential equations	2 hours
4.	Applications of Second order differential equations to Mass spring system (damped, undamped, Forced oscillations), LCR circuits etc.	2 hours
5.	Visualizing Eigen value and Eigen vectors	2 hours
6.	Solving system of differential equations arising in engineering applications	2 hours
7.	Applying the Power series method to solve differential equations arising in engineering applications	3 hours
8.	Applying the Frobenius method to solve differential equations arising in engineering applications	3 hours
9.	Visualising Bessel and Legendre polynomials	3 hours
10.	Evaluating Fourier series-Harmonic series	3 hours
11.	Applying Z-Transforms to functions encountered in engineering	3 hours
12.	Solving Difference equations arising in engineering applications	3 hours
	Total Laboratory Hours	**30 hours**
Mode of Evaluation: Weekly Assessment, Final Assessment Test		

Recommended by Board of Studies	25-02-2017		
Approved by Academic Council	No. 47	Date	05-10-2017

MAT3004	APPLIED LINEAR ALGEBRA	L	T	P	J	C
		3	2	0	0	4

Pre-requisite	MAT2002 Applications of Differential and Difference Equations	Syllabus Version
		v1.0

Course Objectives

1. Understanding basic concepts of linear algebra to illustrate its power and utility through applications to computer science and Engineering.
2. apply the concepts of vector spaces, linear transformations, matrices and inner product spaces in engineering.
3. solve problems in cryptography, computer graphics and wavelet transforms

Expected Course Outcomes

At the end of this course the students are expected to learn
1. the abstract concepts of matrices and system of linear equations using decomposition methods
2. the basic notion of vector spaces and subspaces
3. apply the concept of vector spaces using linear transforms which is used in computer graphics and inner product spaces
4. applications of inner product spaces in cryptography
5. Use of wavelet in image processing.

Module:1	System of Linear Equations:	6 hours

Gaussian elimination and Gauss Jordan methods - Elementary matrices- permutation matrix - inverse matrices - System of linear equations - - LU factorizations.

Module:2	Vector Spaces	6 hours

The Euclidean space R^n and vector space- subspace –linear combination-span-linearly dependent-independent- bases - dimensions-finite dimensional vector space.

Module:3	Subspace Properties:	6 hours

Row and column spaces - Rank and nullity – Bases for subspace – invertibility- Application in interpolation.

Module:4	Linear Transformations and applications	7 hours

Linear transformations – Basic properties-invertible linear transformation - matrices of linear transformations - vector space of linear transformations – change of bases – similarity

Module:5	Inner Product Spaces:	6 hours

Dot products and inner products – the lengths and angles of vectors – matrix representations of inner products- Gram-Schmidt orthogonalisation

Module:6	Applications of Inner Product Spaces:	6 hours

QR factorization- Projection - orthogonal projections – relations of fundamental subspaces – Least Square solutions in Computer Codes

Module:7	**Applications of Linear equations** :	**6 hours**
An Introduction to coding - Classical Cryptosystems –Plain Text, Cipher Text, Encryption, Decryption and Introduction to Wavelets (only approx. of Wavelet from Raw data)		
Module:8	**Contemporary Issues:**	**2 hours**
Industry Expert Lecture		
	Total Lecture hours:	**45 hours**
Tutorial	• A minimum of 10 problems to be worked out by students in every Tutorial Class • Another 5 problems per Tutorial Class to be given as home work.	**15 hours**

Text Book(s)

1. Linear Algebra, Jin Ho Kwak and Sungpyo Hong, Second edition Springer(2004). (Topics in the Chapters 1,3,4 &5)
2. Introductory Linear Algebra- An applied first course, Bernard Kolman and David, R. Hill, 9th Edition Pearson Education, 2011.

Reference Books

1. Elementary Linear Algebra, Stephen Andrilli and David Hecker, 5th Edition, Academic Press(2016)
2. Applied Abstract Algebra, Rudolf Lidl, Guter Pilz, 2nd Edition, Springer 2004.
3. Contemporary linear algebra, Howard Anton, Robert C Busby, Wiley 2003
4. Introduction to Linear Algebra, Gilbert Strang, 5th Edition, Cengage Learning (2015).

Mode of Evaluation

Digital Assignments, Continuous Assessments, Final Assessment Test

Recommended by Board of Studies	25-02-2017		
Approved by Academic Council	No. 47	Date	05-10-2017

MGT1010	TOTAL QUALITY MANAGEMENT	L	T	P	J	C
		2	2	0	0	3
Pre-requisite	Nil	**Syllabus version**				
		v.1.1				

Course Objectives: To develop the ability to

1. Learn the concepts of quality and quality management
2. Apply and improve process capability using total quality management principles
3. Understanding the need and importance of quality assurance and certification

Expected Course Outcome: On the completion of this course the student will be able to:

1. Know and understand the basic principles of quality, evolution of quality concepts.
2. Understanding the significance of Quality works and apply them in the current scenario.
3. Know statistical tools required to do scientific analysis and improvement of business.
4. Apply and evaluate quality tools to solve real time problems.
5. Know business models and be able to assess organizational performance.
6. Confirm to quality standards and implementing QMS in business organisation

Module:1	**Introduction**	**5 Hours**

Concept of Quality and Quality Management; Determinants of quality of product & service; Quality vs. Reliability; Philosophies of Quality Gurus; Juran's Quality Triology; strategic Impact of Quality management on Business Performance; Quality statements – vision, mission, Policy; SMART goal setting;

Module:2	**Quality Cost**	**4 Hours**

Juran's concept of quality cost; components of Quality Cost; Crosby's concept of „quality is free; Quality-Cost optimization; Quality Index; Quality-Productivity Ratio; Quality Planning

Module:3	**Quality Control**	**7 Hours**

Statistical Quality Control – Inspection, Sampling, Sample Size, Sampling Plan, AQL, OC curve, Producer Risk, Consumer Risk, AOQ, AOQL, Control Charts & Control Limits – X, R & S charts and their application; causes of variations – Assignable & Random; Runs-Test, Chart-Sensitivity Test and Run-Sum Test; Normal-Distribution curve and concept of Six Sigma;

Module:4	**Process Capability**	**6 Hours**

Concept, nature, process and significance, Principles of an organization, Span of Control, Depart mentation, Types of an organization, Authority- Responsibility, Delegation and Decentralization, Formal and Informal Organization.Controlling

Module:5	**Total Quality Management**	**5 Hours**

Recruitment, Selection, Training, Promotion, Transfers and Demotion

Directing: Meaning, Principles of Direction; Elements of Direction.

Module:6	**Tools & Techniques of TQM**	**7 Hours**

Motivation concept, techniques to increase motivation. Leading as a function of management, Leadership traits, Leadership styles

Coordinating: Meaning, Features and Coordination, Principles of Coordination.

Module:7	**QMS**	**7 Hours**

Nature and Scope of control; Types of Control; Control process; Control Techniques – traditional and modern; Effective Control System.

Decision Making Process: Meaning, Decision Making Process.		
Module:8	**Contemporary issues:**	**2 Hours**
	Total Lecture	**45 hours**

Text Book(s)	
1.	L. Suganthi & Dr. Anand Samuel (2004), Total Quality Management – Prentice Hall, Publications.
Reference Books	
1.	Rose J.E. – "Total Quality Management" 1997, S. Chand & Co.,
2	William J. Kolarik, (1995), "Creating Quality", McGraw Hill, Inc, NY.
3	Jill A. Swift, Joel E. Ross and Vincent K. Omachonu, (1998), "Principles of Total Quality", St. Lucie Press, US.
4	amuel. K.H, (2002), "TQM - An Integrated Approach", Kogan Page India Pvt Ltd
5	John Bank .J.E., (1993), "Total Quality Management", Prentice Hall, India.
6	Dale.H. Besterfield et al (2005), "Total Quality Management", 3rd Edition, Pearson Education Asia.
Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar	
Tutorial	
1. Tutorial	15 hours

Recommended by Board of Studies	**03-03-2016**		
Approved by Academic Council	No. **40**	Date	**18-03-2016**

MGT1028 Accounting and Financial Management		L	T	P	J	C
Pre-Requisite: Nil		2	1	0	4	4
Module	**Topics**	**L Hrs**			**SLO**	
1	**Basic Accounting Procedures:** Double entry system - Classification of Accounts – Golden Rules of Accounting. **Accounting Cycle:** Books of original record; Journal, Ledger –Subsidiary Books - Trial Balance	4			1,3,7	
2	**Final Accounts:** Preparation of Final Accounts; Trading, Profit and Loss Account – Balance Sheet.	4			1,6,7	
3	**Financial Statement Analysis I**: Analysis and interpretation of financial statements from investor and company point of view. **Financial Reporting:** Corporate Financial Reporting - Issues and problems with special reference to published financial statements IAS, IFRS.	5			2,4,6,7	
4	**Fundamentals of Financial management:** Financial Management - Meaning - Scope and Objectives – Finance decisions- Financial goal: Profit maximization Vs. Wealth Maximization- Role of finance manager.	1			2,7	
5	**Time Value of Money:** Time preference for money- methods of adjusting cash flows for time value of money : Compounding Method, Discounting Method **Risk and Return:** Introducing risk and return -Risk Diversification: systematic and unsystematic risk - Beta - Risk-free rate - risk premium **Sources of Finance:** Introduction- Short-term Funds, Long-term Funds.	5			2,3,6	
6	**Finance Decisions:** Cost of Capital - significance - Calculation of cost of debt, preference capital, equity capital and retained earnings; Weighted Average Cost of Capital. Capital Structure-Determinants – Theories; Leverage: Financial and Operating Leverage. **Investment Decisions :** Nature of Investment Decisions, Investment Evaluation criteria:net present value, internal rate of return, profitability index, payback period, accounting rate of return	5			5,6,7	
7	**Dividend Decisions :** Determinants of Dividend, Forms of dividends, Issues in Dividend Policy;Walter's model, Gordon's model, M-M hypothesis **Liquidity Decisions:** Concepts of working capital- need of working capital and its determinants – Types -Working capital estimation.	4			5,6,7,8,9	
8	**Contemporary topics**	2				
Total Lecture Hours		**30**				
# Mode: Lecture,Individual Exercises, Team Exercises, Assignments and Continuous Assessment tests.						
Tutorial # A minimum of 2 problems to be worked out by students in every Tutorial Class. Another 5 problems per Tutorial Class to be given as home work.		**15**			2,4,6,7,9	

Projects: *1. Assessment of Financial performance using final accounts 2. Assessment of risk for different industry 3. Financial decision making in listed companies	**60** (Non-Contact Hours)	

TextBooks

1. DhaneshK.Khatri (2012) "Financial Accounting & Analysis", Tata McGraw-Hill Publishing Limited, New Delhi.
2. I.M. Pandey (2015), Financial Management,11th Edition,Vikas Publications

Reference Books:

1. Gupta R. L. and Gupta V. K., (2012), Financial Accounting, S. Chand & Sons Publications, New Delhi.
2. Maheshwari S N and Maheshwari S K, (2009), An Introduction to Accountancy, 9th Edition, Vikas Publishing House.
3. Shashi K Gupta, Rk Sharma (2014), Financial Management Theory & Practice, 8th Edition, Kalyani Publishers.
4. M Y Khan, P. K Jain (2014), Financial Management, Tata Mcgraw Hill.
5. Prasanna Chandra(2014), Fundamentals of Financial Management, Tata Mcgraw Hill
6. James C VanHorne, John M Wachowicz (2008), Fundamentals of Financial Management, 13th Edition, Prentice Hall.
7. Stephen Ross, Randolph Westerfield, Bradford Jordan (2010), Fundamentals of Corporate Finance, Tata Mcgraw Hill.

Recommended by the Board of Studies on: 3.3.2016

Compiled by: Dr. Seetharam V

UNIVERSITY CORE

CHY1701	ENGINEERING CHEMISTRY	L	T	P	J	C
		3	0	2	0	4
Pre-requisite		**Syllabus version**				
		1.1				

Course Objectives:

1. To impart technological aspects of applied chemistry
2. To lay foundation for practical application of chemistry in engineering aspects

Expected Course Outcomes (CO): Students will be able to

1. **Recall** and **analyze** the issues related to impurities in water and their removal methods and **apply** recent methodologies in water treatment for domestic and industrial usage
2. **Evaluate** the causes of metallic corrosion and **apply** the methods for corrosion protection of metals
3. **Evaluate** the electrochemical energy storage systems such as lithium batteries, fuel cells and solar cells, and **design** for usage in electrical and electronic applications
4. **Assess** the quality of different fossil fuels and create an awareness to **develop** the alternative fuels
5. **Analyze** the properties of different polymers and distinguish the polymers which can be degraded and **demonstrate** their usefulness
6. **Apply** the theoretical aspects: (a) in **assessing** the water quality; (b) **understanding** the construction and working of electrochemical cells; (c) **analyzing** metals, alloys and soil using instrumental methods; (d) **evaluating** the viscosity and water absorbing properties of polymeric materials

Module:1	**Water Technology**	**5 hours**

Characteristics of hard water - hardness, DO, TDS in water and their determination – numerical problems in hardness determination by EDTA; Modern techniques of water analysis for industrial use - Disadvantages of hard water in industries.

Module:2	**Water Treatment**	**8 hours**

Water softening methods: - Lime-soda, Zeolite and ion exchange processes and their applications. Specifications of water for domestic use (ICMR and WHO); Unit processes involved in water treatment for municipal supply - Sedimentation with coagulant- Sand Filtration - chlorination; Domestic water purification – Candle filtration- activated carbon filtration; Disinfection methods- Ultrafiltration, UV treatment, Ozonolysis, Reverse Osmosis; Electro dialysis.

Module:3	**Corrosion**	**6 hours**

Dry and wet corrosion - detrimental effects to buildings, machines, devices & decorative art forms, emphasizing Differential aeration, Pitting, Galvanic and Stress corrosion cracking; Factors that enhance corrosion and choice of parameters to mitigate corrosion.

Module:4	**Corrosion Control**	**4 hours**

Corrosion protection - cathodic protection – sacrificial anodic and impressed current protection methods; Advanced protective coatings: electroplating and electroless plating, PVD and CVD.

Alloying for corrosion protection – Basic concepts of Eutectic composition and Eutectic mixtures - Selected examples – Ferrous and non-ferrous alloys.

Module:5	**Electrochemical Energy Systems**	**6 hours**

Brief introduction to conventional primary and secondary batteries; High energy electrochemical energy systems: Lithium batteries – Primary and secondary, its Chemistry, advantages and applications.

Fuel cells – Polymer membrane fuel cells, Solid-oxide fuel cells- working principles, advantages, applications.

Solar cells – Types – Importance of silicon single crystal, polycrystalline and amorphous silicon solar cells, dye sensitized solar cells - working principles, characteristics and applications.

Module:6	**Fuels and Combustion**	**8 hours**

Calorific value - Definition of LCV, HCV. Measurement of calorific value using bomb calorimeter and Boy's calorimeter including numerical problems.

Controlled combustion of fuels - Air fuel ratio – minimum quantity of air by volume and by weight-Numerical problems-three way catalytic converter- selective catalytic reduction of NO_X; Knocking in IC engines-Octane and Cetane number - Antiknocking agents.

Module:7	**Polymers**	**6 hours**

Difference between thermoplastics and thermosetting plastics; Engineering application of plastics - ABS, PVC, PTFE and Bakelite; Compounding of plastics: moulding of plastics for Car parts, bottle caps (Injection moulding), Pipes, Hoses (Extrusion moulding), Mobile Phone Cases, Battery Trays, (Compression moulding), Fibre reinforced polymers, Composites (Transfer moulding), PET bottles (blow moulding);

Conducting polymers- Polyacetylene- Mechanism of conduction – applications (polymers in sensors, self-cleaning windows)

Module:8	**Contemporary issues:**	**2 hours**

Lecture by Industry Experts

	Total Lecture hours:	**45 hours**

Text Book(s)

1. 1. Sashi Chawla, A Text book of Engineering Chemistry, Dhanpat Rai Publishing Co., Pvt. Ltd., Educational and Technical Publishers, New Delhi, 3rd Edition, 2015.
   2. O.G. Palanna, McGraw Hill Education (India) Private Limited, 9th Reprint, 2015.
   3. B. Sivasankar, Engineering Chemistry 1st Edition, Mc Graw Hill Education (India), 2008
   4. "Photovoltaic solar energy : From fundamentals to Applications", AngÃ¨le Reinders, Pierre Verlinden, Wilfried van Sark, Alexandre Freundlich, Wiley publishers, 2017.

Reference Books

2. 1. O.V. Roussak and H.D. Gesser, ***Applied Chemistry-A Text Book for Engineers and Technologists***, Springer Science Business Media, New York, 2nd Edition, 2013.
   2. S. S. Dara, ***A Text book of Engineering Chemistry,*** S. Chand & Co Ltd., New Delhi, 20th Edition, 2013.

Mode of Evaluation: Internal Assessment (CAT, Quizzes, Digital Assignments) & FAT

List of Experiments

	Experiment title	Hours
1.	Water Purification: Estimation of water hardness by EDTA method and its removal by ion-exchange resin	1 h 30 min
2.	Water Quality Monitoring: Assessment of total dissolved oxygen in different water samples by	3 h

3.	Winkler's method Estimation of sulphate/chloride in drinking water by conductivity method	
4/5.	Material Analysis: Quantitative colorimetric determination of divalent metal ions of Ni/Fe/Cu using conventional and smart phone digital-imaging methods	3h
6.	Analysis of Iron in carbon steel by potentiometry	1 h 30 min
7.	Construction and working of an Zn-Cu electrochemical cell	1 h 30 min
8.	Determination of viscosity-average molecular weight of different natural/synthetic polymers	1 h 30 min
9.	Arduino microcontroller based sensor for monitoring pH/temperature/conductivity in samples.	1 h 30 min
	Total Laboratory Hours	17 hours

Mode of Evaluation: Viva-voce and Lab performance & FAT			
Recommended by Board of Studies	**31-05-2019**		
Approved by Academic Council	**54th ACM**	**Date**	**13-06-2019**

Course code	PROBLEM SOLVING AND PROGRAMMING	L	T	P	J	C
CSE1001		0	0	6	0	3
Pre-requisite	NIL	Syllabus version				
		v1.0				

Course Objectives:

1. To develop broad understanding of computers, programming languages and their generations
2. Introduce the essential skills for a logical thinking for problem solving
3. To gain expertise in essential skills in programming for problem solving using computer

Expected Course Outcome:

1. Understand the working principle of a computer and identify the purpose of a computer programming language.
2. Learn various problem solving approaches and ability to identify an appropriate approach to solve the problem
3. Differentiate the programming Language constructs appropriately to solve any problem
4. Solve various engineering problems using different data structures
5. Able to modulate the given problem using structural approach of programming
6. Efficiently handle data using flat files to process and store data for the given problem

List of Challenging Experiments (Indicative)

1	Steps in Problem Solving Drawing flowchart using yEd tool/Raptor Tool	4 Hours
2	Introduction to Python, Demo on IDE, Keywords, Identifiers, I/O Statements	4 Hours
3	Simple Program to display Hello world in Python	4 Hours
4	Operators and Expressions in Python	4 Hours
5	Algorithmic Approach 1: Sequential	4 Hours
6	Algorithmic Approach 2: Selection (if, elif, if.. else, nested if else)	4 Hours
7	Algorithmic Approach 3: Iteration (while and for)	6 Hours
8	Strings and its Operations	6 Hours
9	Regular Expressions	6 Hours
10	List and its operations	6 Hours
11	Dictionaries: operations	6 Hours
12	Tuples and its operations	6 Hours
13	Set and its operations	6 Hours
14	Functions, Recursions	6 Hours
15	Sorting Techniques (Bubble/Selection/Insertion)	6 Hours
16	Searching Techniques : Sequential Search and Binary Search	6 Hours
17	Files and its Operations	6 Hours
	Total hours:	**90 hours**

Text Book(s)

1. John V. Guttag., 2016. Introduction to computation and programming using python: with applications to understanding data. PHI Publisher.

Reference Books

1. Charles Severance.2016.Python for everybody: exploring data in Python 3, Charles Severance.
2. Charles Dierbach.2013.Introduction to computer science using python: a computational problem-solving focus. Wiley Publishers.

Mode of Evaluation: **PAT / CAT / FAT**

Recommended by Board of Studies	04-04-2014		
Approved by Academic Council	No. 38	Date	23-10-2015

CSE1002	PROBLEM SOLVING AND OBJECT ORIENTED PROGRAMMING	L	T	P	J	C
		0	0	6	0	3
Pre-requisite	**Nil**	**Syllabus version**				
		v. 1.0				

Course Objectives:

1. To emphasize the benefits of object oriented concepts.
2. To enable students to solve the real time applications using object oriented programming features
3. To improve the skills of a logical thinking and to solve the problems using any processing elements

Expected Course Outcome:

1. Demonstrate the basics of procedural programming and to represent the real world entities as programming constructs.
2. Enumerate object oriented concepts and translate real-world applications into graphical representations.
3. Demonstrate the usage of classes and objects of the real world entities in applications.
4. Discriminate the reusability and multiple interfaces with same functionality based features to solve complex computing problems.
5. Illustrate possible error-handling constructs for unanticipated states/inputs and to use generic programming constructs to accommodate different datatypes.
6. Validate the program against file inputs towards solving the problem..

List of Challenging Experiments (Indicative)

1.	**Postman Problem** A postman needs to walk down every street in his area in order to deliver themail. Assume that the distances between the streets along the roads are given. The postman starts at the post office and returns back to the post office after delivering all the mails. Implement an algorithm to help the postman to walk minimum distance for the purpose.	10 hours
2.	**Budget Allocation for Marketing Campaign** A mobile manufacturing company has got several marketing options such as Radio advertisement campaign, TV non peak hours campaign, City top paper network, Viral marketing campaign, Web advertising. From their previous experience, they have got a statistics about paybacks for each marketing option. Given the marketing budget (rupees in crores) for the current year and details of paybacks for each option, implement an algorithm to determine the amount that shall spent on each marketing option so that the company attains the maximum profit.	15 hours
3.	**Missionaries and Cannibals** Three missionaries and three cannibals are on one side of a river, along witha boat that can hold one or two people. Implement an algorithm to find a way to get everyone to the other side of the river, without ever leaving a group of missionaries in one place outnumbered by the cannibals in that place.	10 hours
4.	**Register Allocation Problem** A register is a component of a computer processor that can hold any type of	15 hours

	data and can be accessed faster. As registers are faster to access, it is desirable to use them to the maximum so that the code execution is faster. For each code submitted to the processor, a register interference graph (RIG)is constructed. In a RIG, a node represents a temporary variable and an edgeis added between two nodes (variables) t1 and t2 if they are live simultaneously at some point in the program. During register allocation, twotemporaries can be allocated to the same register if there is no edge connecting them. Given a RIG representing the dependencies between variables in a code, implement an algorithm to determine the number of registers required to store the variables and speed up the code execution	
5.	**Selective Job Scheduling Problem** A server is a machine that waits for requests from other machines and responds to them. The purpose of a server is to share hardware and softwareresources among clients. All the clients submit the jobs to the server for execution and the server may get multiple requests at a time. In such a situation, the server schedule the jobs submitted to it based on some criteria and logic. Each job contains two values namely time and memory required for execution. Assume that there are two servers that schedules jobs based on time and memory. The servers are named as Time Schedule Server and memory Schedule Server respectively. Design a OOP model and implementthe time Schedule Server and memory Schedule Server. The Time ScheduleServer arranges jobs based on time required for execution in ascending orderwhereas memory Schedule Server arranges jobs based on memory required for execution in ascending order	15 hours
6.	**Fragment Assembly in DNA Sequencing** DNA, or deoxyribonucleic acid, is the hereditary material in humans and almost all other organisms. The information in DNA is stored as a code made up of four chemical bases: adenine (A), guanine (G), cytosine (C), andthymine (T). In DNA sequencing, each DNA is sheared into millions of small fragments (reads) which assemble to form a single genomic sequence (superstring). Each read is a small string. In such a fragment assembly, givena set of reads, the objective is to determine the shortest superstring that contains all the reads. For example, given a set of strings, 000, 001, 010, 011, 100, 101, 110, 111 the shortest superstring is 0001110100. Given a set of reads, implement an algorithm to find the shortest superstring that contains all the given reads.	15 hours
7.	**House Wiring** An electrician is wiring a house which has many rooms. Each room has many power points in different locations. Given a set of power points andthe distances between them, implement an algorithm to find the minimumcable required.	10 hours
	Total Laboratory Hours	**90 hours**
Text Book(s)		
1.	Stanley B Lippman, Josee Lajoie, Barbara E, Moo, C++ primer, Fifth edition, Addison-Wesley, 2012.	
2	Ali Bahrami, Object oriented Systems development, Tata McGraw - Hill Education, 1999.	
3	Brian W. Kernighan, Dennis M. Ritchie , The C programming Language, 2nd edition, Prentice Hall Inc., 1988.	

Reference Books				
1.	Bjarne stroustrup, The C++ programming Language, Addison Wesley, 4th edition, 2013			
2.	Harvey M. Deitel and Paul J. Deitel, C++ How to Program, 7th edition, Prentice Hall, 2010			
3.	Maureen Sprankle and Jim Hubbard, Problem solving and Programming concepts, 9th edition, Pearson Eduction, 2014.			
Mode of assessment: **PAT / CAT / FAT**				
Recommended by Board of Studies		29-10-2015		
Approved by Academic Council		No. 39	Date	17-12-2015

CSE1901	Technical Answers for Real World Problems (TARP)	L	T	P	J	C
		1	0	0	4	2

Pre-requisite	Nil	Syllabus version
		1.0

Course Objectives:

- To help students to identify the need for developing newer technologies for industrial / societal needs
- To train students to propose and implement relevant technology for the development ofthe prototypes / products
- To make the students learn to the use the methodologies available for analysing the developed prototypes / products

Expected Course Outcome:

At the end of the course, the student will be able to

1. Identify real life problems related to society
2. Apply appropriate technology(ies) to address the identified problems usingengineering principles and arrive at innovative solutions

Module:1 **15 hours**

1. Identification of real life problems
2. Field visits can be arranged by the faculty concerned
3. 6 – 10 students can form a team (within the same / different discipline)
4. Minimum of eight hours on self-managed team activity
5. Appropriate scientific methodologies to be utilized to solve the identified issue
6. Solution should be in the form of fabrication/coding/modeling/product design/process design/relevant scientific methodology(ies)
7. Consolidated report to be submitted for assessment
8. Participation, involvement and contribution in group discussions during the contact hours will be used as the modalities for the continuous assessment of the theory component
9. Project outcome to be evaluated in terms of technical, economical, social, environmental, political and demographic feasibility
10. Contribution of each group member to be assessed
11. The project component to have three reviews with the weightage of 20:30:50

Mode of Evaluation: (No FAT) Continuous Assessment the project done – Mark weightage of 20:30:50 – project report to be submitted, presentation and project reviews

Recommended by Board of Studies	28-02-2016		
Approved by Academic Council	No.37	Date	16-06-2015

CSE1902	Industrial Internship	L	T	P	J	C
		0	0	0	0	1
Pre-requisite	Completion of minimum of Two semesters					

Course Objectives:

The course is designed so as to expose the students to industry environment and to take up on-site assignment as trainees or interns.

Expected Course Outcome:

At the end of this internship the student should be able to:

1. Have an exposure to industrial practices and to work in teams
2. Communicate effectively
3. Understand the impact of engineering solutions in a global, economic, environmental and societal context
4. Develop the ability to engage in research and to involve in life-long learning
5. Comprehend contemporary issues
6. Engage in establishing his/her digital footprint

Contents	**4**	**Weeks**

Four weeks of work at industry site.
Supervised by an expert at the industry.

Mode of Evaluation: Internship Report, Presentation and Project Review

Recommended by Board of Studies	28-02-2016		
Approved by Academic Council	No. 37	Date	16-06-2015

CSE1903	Comprehensive Examination	L	T	P	J	C
		0	0	0	0	1
Pre-requisite		**Syllabus version**				
		1.00				

Digital Logic and Microprocessor

Simplification of Boolean functions using K-Map – Combinational logic: Adder, subtractor, encoder, decoder, multiplexer, de-multiplexer – Sequential Logic: Flip flops- 8086 Microprocessor: instructions – peripherals: 8255, 8254, 8257.

Computer Architecture and Organization

Instructions - Instruction types- Instruction Formats - Addressing Modes- Pipelining- Data Representation - Memory Hierarchy- Cache memory-Virtual Memory- I/O Fundamentals- I/O Techniques - Direct Memory Access - Interrupts-RAID architecture

Programming, Data Structures and Algorithms

Programming in C; Algorithm Analysis – Iterative and Recursive Algorithms; ADT - Stack and its Applications - Queue and its Applications; Data Structures – Arrays and Linked Lists; Algorithms - Sorting – Searching; Trees – BST, AVL; Graphs – BFS , DFS , Dijkstra"s Shortest Path Algorithm.

Theory of Computation

Deterministic Finite Automata, Non deterministic Finite Automata, Regular Expressions, Context Free Grammar, Push down Automata and Context Free Languages, Turing Machines.

Web Technologies

Web Architecture- JavaScript – objects String, date, Array, Regular Expressions, DHTML- HTML DOM Events; Web Server – HTTP- Request/Response model-RESTful methods- State Management – Cookies , Sessions – AJAX.

Operating Systems

Processes, Threads, Inter-process communication, CPU scheduling, Concurrency and synchronization, Deadlocks, Memory management and Virtual memory & File systems.

Database Management System

DBMS, Schema, catalog, metadata, data independence, pre-compiler; Users-naïve, sophisticated, casual ;ER Model- Entity, attributes, structural constraints; Relational Model-Constraints, Relational Algebra operations; SQL- DDL, DML, TCL, DCL commands, basic queries and Top N queries; Normalization-properties, 1NF, 2NF, 3NF, BCNF; Indexing-different types, Hash Vs B-tree Index; Transaction-problems, Concurrency Control-techniques, Recovery-methods.

Data Communication and Computer Networks

Circuit Switching, Packet Switching, Frame Relay, Cell Switching, ATM , OSI Reference model, TCP\IP, Network topologies, LAN Technologies, Error detection and correction techniques, Internet protocols , IPv4/IPv6, Routing algorithms, TCP and UDP, Sockets, Congestion control, Application Layer Protocols, Network Security: Basics of public and private key cryptosystems- Digital Signatures and Hash codes, Transport layer security, VPN, Firewalls.

Recommended by Board of Studies	05-03-2016		
Approved by Academic Council	No. 40	Date	18-03-2016

CSE1904	Capstone Project	L	T	P	J	C
		0	0	0	0	12
Pre-requisite	**As per the academic regulations**	**Syllabus version**				
		v. 1.0				

Course Objectives:

To provide sufficient hands-on learning experience related to the design, development and analysis of suitable product / process so as to enhance the technical skill sets in the chosen field.

Expected Course Outcome:

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

1. Formulate specificproblemstatementsfor ill-defined real life problemswithreasonable assumptions and constraints.
2. Perform literature search and /or patent search in the area of interest.
3. Conductexperiments / Design and Analysis / solution iterations and documentthe results.
4. Perform error analysis / benchmarking / costing
5. Synthesise the results and arrive at scientific conclusions / products / solution
6. Document the results in the form of technical report / presentation

Contents

1. Capstone Project may be a theoretical analysis, modeling & simulation, experimentation & analysis, prototype design, fabrication of new equipment, correlation and analysis of data, software development, applied research and any other related activities.

2. Project can be for one or two semesters based on the completion of required number of credits as per the academic regulations.

3. Can be individual work or a group project, with a maximum of 3 students.

4. In case of group projects, the individual project report of each student should specify the individual's contribution to the group project.

5. Carried out inside or outside the university, in any relevant industry or research institution.

6. Publications in the peer reviewed journals / International Conferences will be an added advantage

Mode of Evaluation: Periodic reviews, Presentation, Final oral viva, Poster submission

Recommended by Board of Studies	10.06.2015		
Approved by Academic Council	37th AC	Date	16.06.2015

Course Code	Course Title	L	T	P	J	C
ENG1901	**Technical English - I**	**0**	**0**	**4**	**0**	**2**
Pre-requisite	Foundation English-II	**Syllabus Version**				
		1				

Course Objectives:

1. To enhance students' knowledge of grammar and vocabulary to read and write error-free language in real life situations.
2. To make the students' practice the most common areas of written and spoken communications skills.
3. To improve students' communicative competency through listening and speaking activities in the classroom.

Expected Course Outcome:

1. Develop a better understanding of advanced grammar rules and write grammatically correct sentences.
2. Acquire wide vocabulary and learn strategies for error-free communication.
3. Comprehend language and improve speaking skills in academic and social contexts.
4. Improve listening skills so as to understand complex business communication in a variety of global English accents through proper pronunciation.
5. Interpret texts, diagrams and improve both reading and writing skills which would help them in their academic as well as professional career.

Module:1	**Advanced Grammar (CO: 1,2)**	**4 hours**

Articles, Tenses, Voice and Prepositions

Activity: Worksheets on Impersonal Passive Voice, Exercises from the prescribed text

Module:2	**Vocabulary Building I (CO:2&5)**	**4 hours**

Idioms and Phrases, Homonyms, Homophones and Homographs

Activity: Jigsaw Puzzles; Vocabulary Activities through Web tools

Module:3	**Listening for Specific Purposes (CO:4&5)**	**4 hours**

Gist, monologues, short conversations, announcements, briefings and discussions

Activity: Gap filling; Interpretations

Module:4	**Speaking for Expression (CO:3&4)**	**6 hours**

Introducing oneself and others, Making Requests & responses, Inviting and Accepting/Declining Invitations

Activity: Brief introductions; Role-Play; Skit.

Module:5	**Reading for Information (CO: 5&4)**	**4 hours**

Reading Short Passages, News Articles, Technical Papers and Short Stories

Activity: Reading specific news paper articles; blogs

Module:6	**Writing Strategies (CO:5&3)**	**4 hours**
Joining the sentences, word order, sequencing the ideas, introduction and conclusion Activity: Short Paragraphs; Describing familiar events; story writing		
Module:7	**Vocabulary Building II (CO:2,3&5)**	**4 hours**
Enrich the domain specific vocabulary by describing Objects, Charts, Food, Sports and Employment. Activity: Describing Objects, Charts, Food, Sports and Employment		
Module:8	**Listening for Daily Life (CO: 4 &5)**	**4 hours**
Listening for statistical information, Short extracts, Radio broadcasts and TV interviews Activity: Taking notes and Summarizing		
Module:9	**Expressing Ideas and Opinions (3,4 &5)**	**6 hours**
Telephonic conversations, Interpretation of Visuals and describing products and processes. Activity: Role-Play (Telephonic); Describing Products and Processes		
Module: 10	**Comprehensive Reading (1,2&5)**	**4 hours**
Reading Comprehension, Making inferences, Reading Graphics, Note-making, and Critical Reading. Activity: Sentence Completion; Cloze Tests		
Module: 11	**Narration (5,2 &4)**	**4 hours**
Writing narrative short story, Personal milestones, official letters and E-mails. Activity: Writing an E-mail; Improving vocabulary and writing skills.		
Module:12	**Pronunciation (2,3 &4)**	**4 hours**
Speech Sounds, Word Stress, Intonation, Various accents Activity: Practicing Pronunciation through web tools; Listening to various accents of English		
Module:13	**Editing (1,4&5)**	**4 hours**
Simple, Complex & Compound Sentences, Direct & Indirect Speech, Correction of Errors, Punctuations. Activity: Practicing Grammar		
Module:14	**Short Story Analysis (5,2&3)**	**4 hours**
"The Boundary" by Jhumpa Lahiri Activity: Reading and analyzing the theme of the short story.		
	Total Lecture hours	**60 hours**

Text Book / Workbook	
1.	Wren, P.C.; Martin, H.; Prasada Rao, N.D.V. (1973–2010). *High School English Grammar & Composition*. New Delhi: Sultan Chand Publishers.
2	Kumar, Sanjay,; Pushp Latha. (2018) English Language and Communication Skills for Engineers, India: Oxford University Press.

Reference Books	
1.	Guptha S C, (2012) *Practical English Grammar & Composition*, 1st Edition, India: Arihant Publishers
2.	Steven Brown, (2011) Dorolyn Smith, *Active Listening* ***3***, 3rd Edition, UK: Cambridge University Press.
3.	Liz Hamp-Lyons, Ben Heasley, (2010) *Study Writing*, 2nd Edition, UK: Cambridge University Pres.
4.	Kenneth Anderson, Joan Maclean, (2013) Tony Lynch, *Study Speaking*, 2nd Edition, UK: Cambridge, University Press.
5.	Eric H. Glendinning, Beverly Holmstrom, (2012) *Study Reading*, 2nd Edition, UK: Cambridge University Press.
6.	Michael Swan, (2017) *Practical English Usage* (Practical English Usage), 4th edition, UK: Oxford University Press.
7.	Michael McCarthy, Felicity O'Dell, (2015) *English Vocabulary in Use Advanced* (South Asian Edition), UK: Cambridge University Press.
8.	Michael Swan, Catherine Walter, (2012) *Oxford English Grammar Course Advanced*, Feb, 4th Edition, UK: Oxford University Press.
9.	Watkins, Peter. (2018) *Teaching and Developing Reading Skills: Cambridge Handbooks for Language teachers*, UK: Cambridge University Press.
10.	(*The Boundary by Jhumpa Lahiri)* URL: https://www.newyorker.com/magazine/2018/01/29/the-boundary?intcid=inline_amp
Mode of evaluation: Quizzes, Presentation, Discussion, Role play, Assignments and FAT	

List of Challenging Experiments (Indicative)		
1.	Self-Introduction	**12 hours**
2.	Sequencing Ideas and Writing a Paragraph	**12 hours**
3.	Reading and Analyzing Technical Articles	**8 hours**
4.	Listening for Specificity in Interviews (Content Specific)	**12 hours**
5.	Identifying Errors in a Sentence or Paragraph	**8 hours**
6.	Writing an E-mail by narrating life events	**8 hours**
	Total Laboratory Hours	**60 hours**
Mode of evaluation: Quizzes, Presentation, Discussion, Role play, Assignments and FAT		
Recommended by Board of Studies	08.06.2019	
Approved by Academic Council	55	Date: 13-06-2019

Course Code	Course Title	L	T	P	J	C
ENG 1902	Technical English - II	0	0	4	0	2

Pre-requisite	71% to 90% EPT score	Syllabus Version
		1

Course Objectives:

1. To acquire proficiency levels in LSRW skills on par with the requirements for placement interviews of high-end companies / competitive exams.
2. To evaluate complex arguments and to articulate their own positions on a range of technical and general topics.
3. To speak in grammatical and acceptable English with minimal MTI, as well as develop a vast and active vocabulary.

Expected Course Outcome:

1. Communicate proficiently in high-end interviews and exam situations and all social situations
2. Comprehend academic articles and draw inferences
3. Evaluate different perspectives on a topic
4. Write clearly and convincingly in academic as well as general contexts
5. Synthesize complex concepts and present them in speech and writing

Module:1	Listening for Clear Pronunciation	4 hours

Ice-breaking, Introduction to vowels, consonants, diphthongs.
Listening to formal conversations in British and American accents (BBC and CNN) as well as other 'native' accents
Activity: Factual and interpretive exercises; note-making in a variety of global English accents

Module:2	Introducing Oneself	4 hours

Speaking: Individual Presentations
Activity: Self-Introductions, Extempore speech

Module:3	Effective Writing	6 hours

Writing: Business letters and Emails, Minutes and Memos
Structure/ template of common business letters and emails: inquiry/ complaint/ placing an order; Formats of Minutes and Memos
Activity: Students write a business letter and Minutes/ Memo

Module:4	Comprehensive Reading	4 hours

Reading: Reading Comprehension Passages, Sentence Completion (Technical and General Interest), Vocabulary and Word Analogy
Activities: Cloze tests, Logical reasoning, Advanced grammar exercises

Module:5	Listening to Narratives	4 hours

Listening: Listening to audio files of short stories, News, TV Clips/ Documentaries, Motivational Speeches in UK/ US/ global English accents.
Activity: Note-making and Interpretive exercises

Module:6	**Academic Writing and Editing**	**6 hours**
Writing: Editing/ Proofreading symbols Citation Formats Structure of an Abstract and Research Paper Activity: Writing Abstracts and research paper; Work with Editing/ Proofreading exercise		
Module:7	**Team Communication**	**4 hours**
Speaking: Group Discussions and Debates on complex/ contemporary topics Discussion evaluation parameters, using logic in debates Activity: Group Discussions on general topics		
Module:8	**Career-oriented Writing**	**4 hours**
Writing: Resumes and Job Application Letters, SOP Activity: Writing resumes and SOPs		
Module:9	**Reading for Pleasure**	**4 hours**
Reading: Reading short stories Activity: Classroom discussion and note-making, critical appreciation of the short story		
Module: 10	**Creative Writing**	**4 hours**
Writing: Imaginative, narrative and descriptive prose Activity: Writing about personal experiences, unforgettable incidents, travelogues		
Module: 11	**Academic Listening**	**4 hours**
Listening: Listening in academic contexts Activity: Listening to lectures, Academic Discussions, Debates, Review Presentations, Research Talks, Project Review Meetings		
Module:12	**Reading Nature-based Narratives**	**4 hours**
Narratives on Climate Change, Nature and Environment Activity: Classroom discussions, student presentations		
Module:13	**Technical Proposals**	**4 hours**
Writing: Technical Proposals Activities: Writing a technical proposal		
Module:14	**Presentation Skills**	**4 hours**
Persuasive and Content-Specific Presentations Activity: Technical Presentations		
	Total Lecture hours:	**60 hours**

Text Book / Workbook

1.	Oxenden, Clive and Christina Latham-Koenig. *New English File: Advanced Students Book*. Paperback. Oxford University Press, UK, 2017.
2	Rizvi, Ashraf. *Effective Technical Communication*. McGraw-Hill India, 2017.

Reference Books

1.	Oxenden, Clive and Christina Latham-Koenig, *New English File: Advanced: Teacher's Book with Test and Assessment*. CD-ROM: Six-level General English Course for Adults. Paperback. Oxford University Press, UK, 2013.
2.	Balasubramanian, T. *English Phonetics for the Indian Students: A Workbook*. Laxmi Publications, 2016.

3.	Philip Seargeant and Bill Greenwell, *From Language to Creative Writing*. Bloomsbury Academic, 2013.
4.	Krishnaswamy, N. *Eco-English*. Bloomsbury India, 2015.
5.	Manto, Saadat Hasan. *Selected Short Stories*. Trans. Aatish Taseer. Random House India, 2012.
6.	Ghosh, Amitav. *The Hungry Tide*. Harper Collins, 2016.
7.	Ghosh, Amitav. *The Great Derangement: Climate Change and the Unthinkable*. Penguin Books, 2016.
8.	*The MLA Handbook for Writers of Research Papers,* 8th ed. 2016.
	Online Sources: https://americanliterature.com/short-short-stories. (75 *short* short stories) http://www.eco-ction.org/dt/thinking.html (Leopold, Aldo."Thinking like a Mountain") /www.esl-lab.com/; www.bbc.co.uk/learningenglish/; /www.bbc.com/news; /learningenglish.voanews.com/a/using-voa-learning-english-to-improve-listening-skills/3815547.html

Mode of evaluation: Quizzes, Presentation, Discussion, Role play, Assignments and FAT

List of Challenging Experiments (Indicative)		
1.	Self-Introduction using SWOT	**12 hours**
2.	Writing minutes of meetings	**10 hours**
3.	Writing an abstract	**10 hours**
4.	Listening to motivational speeches and interpretation	**10 hours**
5.	Cloze Test	**6 hours**
6.	Writing a proposal	**12 hours**
	Total Laboratory Hours	**60 hours**

Mode of evaluation: Quizzes, Presentation, Discussion, Role play, Assignments and FAT

Recommended by Board of Studies	08.06.2019	
Approved by Academic Council	55	Date: 13-06-2019

Course Code	Course title	L	T	P	J	C
ENG1903	Advanced Technical English	0	0	2	4	2
Pre-requisite	Greater than 90 % EPT score	Syllabus Version				
		1				

Course Objectives:

1. To review literature in any form or any technical article
2. To infer content in social media and respond accordingly
3. To communicate with people across the globe overcoming trans-cultural barriers and negotiate successfully

Expected Course Outcome:

1. Analyze critically and write good reviews
2. Articulate research papers, project proposals and reports
3. Communicate effectively in a trans-cultural environment
4. Negotiate and lead teams towards success
5. Present ideas in an effective manner using web tools

Module:1	Negotiation and Decision Making Skills through Literary Analysis	5 hours

Concepts of Negotiation and Decision Making Skills

Activity: Analysis of excerpts from Shakespeare's "The Merchant of Venice" (court scene) and discussion on negotiation skills.

Critical evaluation of excerpts from Shakespeare's "Hamlet"(Monologue by Hamlet) and discussion on decision making skills

Module:2	Writing reviews and abstracts through movie interpretations	5 hours

Review writing and abstract writing with competency

Activity: Watching Charles Dickens "Great Expectations" and writing a movie review

Watching William F. Nolan's "Logan's Run" and analyzing it in tune with the present scenario of depletion of resources and writing an abstract

Module:3	Technical Writing	4 hours

Stimulate effective linguistics for writing: content and style

Activity: Proofreading

Statement of Purpose

Module:4	Trans-Cultural Communication	4 hours

Nuances of Trans-cultural communication

Activity:

Group discussion and case studies on trans-cultural communication.

Debate on trans-cultural communication.

Module:5	**Report Writing and Content Writing**	**4 hours**
Enhancing reportage on relevant audio-visuals Activity: Watch a documentary on social issues and draft a report Identify a video on any social issue and interpret		
Module:6	**Drafting project proposals and article writing**	**4 hours**
Dynamics of drafting project proposals and research articles Activity: Writing a project proposal. Writing a research article.		
Module:7	**Technical Presentations**	**4 hours**
Build smart presentation skills and strategies Activity: Technical presentations using PPT and Web tools		
	Total Lecture hours	**30 hours**

Text Book / Workbook	
1.	Raman, Meenakshi & Sangeeta Sharma. *Technical Communication: Principles and Practice*, 3rd edition, Oxford University Press, 2015.
Reference Books	
1	Basu B.N. *Technical Writing*, 2011 Kindle edition
2	Arathoon, Anita. *Shakespeare's The Merchant of Venice* (Text with Paraphrase), Evergreen Publishers, 2015.
3	Kumar, Sanjay and Pushp Lata. *English Language and Communication Skills for Engineers,* Oxford University Press, India, 2018.
4	Frantisek, Burda. *On Transcultural Communication*, 2015, LAP Lambert Academic Publishing, UK.
5	Geever, C. Jane. *The Foundation Center's Guide to Proposal Writing*, 5th Edition, 2007, Reprint 2012 The Foundation Center, USA.
6	Young, Milena. *Hacking Your Statement of Purpose: A Concise Guide to Writing Your SOP*, 2014 Kindle Edition.
7	Ray, Ratri, *William Shakespeare's Hamlet*, The Atlantic Publishers, 2011.
8	C Muralikrishna & Sunitha Mishra, *Communication Skills for Engineers,* 2nd edition, NY: Pearson, 2011.

Mode of Evaluation: Quizzes, Presentation, Discussion, Role Play, Assignments

List of Challenging Experiments (Indicative)		
1.	Enacting a court scene - Speaking	**6 hours**
2.	Watching a movie and writing a review	**4 hours**
3.	Trans-cultural – case studies	**2 hours**
4.	Drafting a report on any social issue	**6 hours**
5.	Technical Presentation using web tools	**6 hours**
6.	Writing a research paper	**6 hours**

J- Component Sample Projects		
1.	Short Films	
2.	Field Visits and Reporting	

3.	Case studies	
4.	Writing blogs	
5.	Vlogging	
	Total Hours (J-Component)	**60 hours**

Mode of evaluation: Quizzes, Presentation, Discussion, Role play, Assignments and FAT		
Recommended by Board of Studies	08.06.2019	
Approved by Academic Council	55	Date: 13-06-2019

HUM1021	ETHICS AND VALUES	L	T	P	J	C
		2	0	0	0	2
Pre-requisite	Nil	**Syllabus version**				
		1.1				

Course Objectives:

1. To understand and appreciate the ethical issues faced by an individual in profession, society and polity
2. To understand the negative health impacts of certain unhealthy behaviors
3. To appreciate the need and importance of physical, emotional health and social health

Expected Course Outcome:

Students will be able to:

1. Follow sound morals and ethical values scrupulously to prove as good citizens
2. Understand various social problems and learn to act ethically
3. Understand the concept of addiction and how it will affect the physical and mental health
4. Identify ethical concerns in research and intellectual contexts, including academic integrity, use and citation of sources, the objective presentation of data, and the treatment of human subjects
5. Identify the main typologies, characteristics, activities, actors and forms of cybercrime

Module:1	**Being Good and Responsible**	**5 hours**

Gandhian values such as truth and non-violence – Comparative analysis on leaders of past and present – Society's interests versus self-interests - Personal Social Responsibility: Helping the needy, charity and serving the society

Module:2	**Social Issues 1**	**4 hours**

Harassment – Types - Prevention of harassment, Violence and Terrorism

Module:3	**Social Issues 2**	**4 hours**

Corruption: Ethical values, causes, impact, laws, prevention – Electoral malpractices;
White collar crimes - Tax evasions – Unfair trade practices

Module:4	**Addiction and Health**	**5 hours**

Peer pressure - Alcoholism: Ethical values, causes, impact, laws, prevention – Ill effects of smoking - Prevention of Suicides;
Sexual Health: Prevention and impact of pre-marital pregnancy and Sexually Transmitted Diseases

Module:5	**Drug Abuse**	**3 hours**

Abuse of different types of legal and illegal drugs: Ethical values, causes, impact, laws and prevention

Module:6	**Personal and Professional Ethics**	**4 hours**

Dishonesty - Stealing - Malpractices in Examinations – Plagiarism

Module:7	**Abuse of Technologies**	**3 hours**

Hacking and other cyber crimes, Addiction to mobile phone usage, Video games and Social

networking websites			
Module:8	**Contemporary issues:**		**2 hours**
Guest lectures by Experts			
	Total Lecture hours:	**30 hours**	

Reference Books

1. Dhaliwal, K.K , "Gandhian Philosophy of Ethics: A Study of Relationship between his Presupposition and Precepts,2016, Writers Choice, New Delhi, India.
2. Vittal, N, "Ending Corruption? - How to Clean up India?", 2012, Penguin Publishers, UK.
3. Pagliaro, L.A. and Pagliaro, A.M, "Handbook of Child and Adolescent Drug and Substance Abuse: Pharmacological , Developmental and Clinical Considerations", 2012Wiley
4. Publishers, U.S.A.
   Pandey, P. K (2012), "Sexual Harassment and Law in India", 2012, Lambert Publishers, Germany.

Mode of Evaluation: CAT, Assignment, Quiz, FAT and Seminar			
Recommended by Board of Studies	26-07-2017		
Approved by Academic Council	No. 46	Date	24-08-2017

MAT1011	CALCULUS FOR ENGINEERS	L	T	P	J	C
		3	0	2	0	4
Pre-requisite	10+2 Mathematics or MAT1001	Syllabus Version				
		1.0				

Course Objectives :

1. To provide the requisite and relevant background necessary to understand the other important engineering mathematics courses offered for Engineers and Scientists.
2. To introduce important topics of applied mathematics, namely Single and Multivariable Calculus and Vector Calculus etc.
3. To impart the knowledge of Laplace transform, an important transform technique for Engineers which requires knowledge of integration

Expected Course Outcome:

At the end of this course the students should be able to

1. Apply single variable differentiation and integration to solve applied problems in engineering and find the maxima and minima of functions
2. Understand basic concepts of Laplace Transforms and solve problems with periodic functions, step functions, impulse functions and convolution
3. Evaluate partial derivatives, limits, total differentials, Jacobians, Taylor series and optimization problems involving several variables with or without constraints
4. Evaluate multiple integrals in Cartesian, Polar, Cylindrical and Spherical coordinates.
5. Understand gradient, directional derivatives, divergence, curl and Greens', Stokes, Gauss theorems
6. Demonstrate MATLAB code for challenging problems in engineering

Module: 1	Application of Single Variable Calculus	9 hours

Differentiation-Extrema on an Interval-Rolle's Theorem and the Mean Value Theorem-Increasing and Decreasing functions and First derivative test-Second derivative test-Maxima and Minima-Concavity. Integration-Averagefunction value - Area between curves - Volumes of solids of revolution - Beta and Gamma functions–interrelation

Module: 2	Laplace transforms	7 hours

Definition of Laplace transform-Properties-Laplace transform of periodic functions-Laplace transform of unit step function, Impulse function-Inverse Laplace transform-Convolution.

Module: 3	Multivariable Calculus	4 hours

Functions of two variables-limits and continuity-partial derivatives –total differential-Jacobian and its properties.

Module: 4	Application of Multivariable Calculus	5 hours

Taylor's expansion for two variables–maxima and minima–constrained maxima and minima-Lagrange's multiplier method.

Module: 5	Multiple integrals	8 hours

Evaluation of double integrals–change of order of integration–change of variables between Cartesian and polar co-ordinates - Evaluation of triple integrals-change of variables between Cartesian and cylindrical and spherical co-ordinates- evaluation of multiple integrals using gamma and beta functions.

Module: 6	Vector Differentiation	5 hours

Scalar and vector valued functions – gradient, tangent plane–directional derivative-divergence and curl–scalar and vector potentials–Statement of vector identities-Simple problems

Module: 7	Vector Integration	5 hours

line, surface and volume integrals - Statement of Green's, Stoke's and Gauss divergence theorems -verification and evaluation of vector integrals using them.

Module: 8	**Contemporary Issues:**	**2 hours**
Industry Expert Lecture		
Total Lecture hours		**45 hours**

Text Book(s)

1. Thomas' Calculus, George B.Thomas, D.Weir and J. Hass, 13th edition, Pearson, 2014.
2. Advanced Engineering Mathematics, Erwin Kreyszig, 10th Edition, Wiley India, 2015.

Reference Books

1. Higher Engineering Mathematics, B.S. Grewal, 43rd Edition,Khanna Publishers, 2015
2. Higher Engineering Mathematics, John Bird, 6thEdition,Elsevier Limited, 2017.
3. Calculus: Early Transcendentals, James Stewart, 8th edition, Cengage Learning, 2017.
4. Engineering Mathematics, K.A.Stroud and Dexter J. Booth, 7thEdition, Palgrave Macmillan (2013)

Mode of Evaluation: Digital Assignments, Quiz, Continuous Assessments, Final Assessment Test

List of Challenging Experiments (Indicative)

1.	Introduction to MATLAB through matrices, and general Syntax	2 hours
2.	Plotting and visualizing curves and surfaces in MATLAB – Symbolic computations using MATLAB	2 hours
3.	Evaluating Extremum of a single variable function	2 hours
4.	Understanding integration as Area under the curve	2 hours
5.	Evaluation of Volume by Integrals (Solids of Revolution)	2 hours
6.	Evaluating maxima and minima of functions of several variables	2 hours
7.	Applying Lagrange multiplier optimization method	2 hours
8.	Evaluating Volume under surfaces	2 hours
9.	Evaluating triple integrals	2 hours
10.	Evaluating gradient, curl and divergence	2 hours
11.	Evaluating line integrals in vectors	2 hours
12.	Applying Green's theorem to real world problems	2 hours
Total Laboratory Hours		**24 hours**

Mode of Assessment: Weekly Assessment, Final Assessment Test

Recommended by Board of Studies	12.06.2015		
Approved by Academic Council	37th ACM	**Date**	16.06.2015

MAT2001	STATISTICS FOR ENGINEERS	L	T	P	J	C
		3	0	2	0	4
Prerequisites	MAT1011 – Calculus for Engineers	Syllabus Version: 1.0				

Course Objectives :

1. To provide students with a framework that will help them choose the appropriate descriptive methods in various data analysis situations.
2. To analyse distributions and relationship of real-time data.
3. To apply estimation and testing methods to make inference and modelling techniques for decision making.

Expected Course Outcome:

At the end of the course the student should be able to:

1. Compute and interpret descriptive statistics using numerical and graphical techniques.
2. Understand the basic concepts of random variables and find an appropriate distribution for analysing data specific to an experiment.
3. Apply statistical methods like correlation, regression analysis in analysing, interpreting experimental data.
4. Make appropriate decisions using statistical inference that is the central to experimental research.
5. Use statistical methodology and tools in reliability engineering problems.
6. Demonstrate R programming for statistical data

Module: 1	Introduction to Statistics	6 hours
Introduction to statistics and data analysis-Measures of central tendency–Measuresof variability-[Moments-Skewness-Kurtosis (Concepts only)].		
Module: 2	**Random variables**	**8 hours**
Introduction–random variables–Probability mass Function, distribution and density functions–joint Probability distribution and joint density functions–Marginal, conditional distribution and density functions–Mathematical expectation, and its properties Covariance, moment generating function–characteristic function.		
Module: 3	**Correlation and regression**	**4 hours**
Correlation and Regression – Rank Correlation– Partial and Multiple correlation– Multiple regression.		
Module: 4	**Probability Distributions**	**7 hours**
Binomial and Poisson distributions – Normal distribution – Gamma distribution – Exponential distribution – Weibull distribution.		
Module: 5	**Hypothesis Testing I**	**4 hours**
Testing of hypothesis – Introduction–Types of errors, critical region, procedure of testing hypothesis-Large sample tests– Z test for Single Proportion, Difference of Proportion, mean and difference of means.		
Module: 6	**Hypothesis Testing II**	**9 hours**
Small sample tests- Student's t-test, F-test- chi-square test- goodness of fit - independence of attributes-Design of Experiments - Analysis of variance – one and two way classifications - CRD-RBD-LSD.		
Module: 7	**Reliability**	**5 hours**
Basicconcepts-Hazard function-Reliabilities of series and parallel systems-System Reliability-Maintainability-Preventive and repair maintenance-Availability.		
Module: 8	**Contemporary Issues**	**2 hours**
Industry Expert Lecture		
Total Lecture hours		**45 hours**

Text book(s)		
1. Probability and Statistics for engineers and scientists, R.E.Walpole, R.H.Myers,S.L.Mayers and K.Ye, 9th Edition, Pearson Education (2012). 2. Applied Statistics and Probability for Engineers, Douglas C. Montgomery, George C. Runger, 6th Edition, John Wiley & Sons (2016).		
Reference books		
1. Reliability Engineering, E.Balagurusamy, Tata McGraw Hill, Tenth reprint 2017. 2. Probability and Statistics, J.L.Devore, 8th Edition, Brooks/Cole, Cengage Learning (2012). 3. Probability and Statistics for Engineers, R.A.Johnson, Miller Freund's, 8th edition, Prentice Hall India (2011). 4. Probability, Statistics and Reliability for Engineers and Scientists, Bilal M. Ayyub and Richard H. McCuen, 3rdedition, CRC press (2011).		
Mode of Evaluation: Digital Assignments, Continuous Assessment Tests, Quiz, Final Assessment Test.		
List of Experiments (Indicative)		
1.	Introduction: Understanding Data types; importing / exporting data.	2 hours
2.	Computing Summary Statistics /plotting and visualizing data using Tabulation and Graphical Representations.	2 hours
3.	Applying correlation and simple linear regression model to real dataset; computing and interpreting the coefficient of determination.	2 hours
4.	Applying multiple linear regression model to real dataset; computing and interpreting the multiple coefficient of determination.	2 hours
5.	Fitting the following probability distributions: Binomial distribution	2 hours
6.	Normal distribution, Poisson distribution	2 hours
7.	Testing of hypothesis for One sample mean and proportion from real-time problems.	2 hours
8.	Testing of hypothesis for Two sample means and proportion from real-time problems	2 hours
9.	Applying the t test for independent and dependent samples	2 hours
10.	Applying Chi-square test for goodness of fit test and Contingency test to real dataset	2 hours
11.	Performing ANOVA for real dataset for Completely randomized design, Randomized Block design, Latin square Design	2 hours
Total laboratory hours		**22 hours**
Mode of Evaluation: Weekly Assessment, Final Assessment Test		
Recommended by Board of Studies	25.02.2017	
Approved by Academic Council	47th ACM **Date**	05.10.2017

MGT1022	LEAN START-UP MANAGEMENT	L	T	P	J	C
		1	0	0	4	2
Pre-requisite	Nil	Syllabus version				
		1.0				

Course Objectives:

To develop the ability to

4. Learn methods of company formation and management.
5. Gain practical skills in and experience of stating of business using pre-set collection of business ideas.
6. Learn basics of entrepreneurial skills.

Expected Course Outcome:

On completion of this course the students will be able to:

1. Understand developing business models and growth drivers
2. Use the business model canvas to map out key components of enterprise
3. Analyze market size, cost structure, revenue streams, and value chain
4. Understand build-measure-learn principles
5. Foreseeing and quantifying business and financial risks

Module: 1		**2hours**
Creativity and Design Thinking (identify the vertical for business opportunity, understand your customers, accurately assess market opportunity)		
Module: 2		**3 hours**
Minimum Viable Product (Value Proposition, Customer Segments, Build-measure-learn process)		
Module: 3		**3hours**
Business Model Development (Channels and Partners, Revenue Model and streams, Key Resources, Activities and Costs, Customer Relationships and Customer Development Processes, Business model canvas–the lean model-templates)		
Module: 4		**3 hours**
Business Plan and Access to Funding (visioning your venture, taking the product / service to market, Market plan including Digital & Viral Marketing, start-up finance – Costs / Profits & Losses / cash flow, Angel / VC / Bank Loans and Key elements of raising money)		
Module: 5		**2hours**
Legal, Regulatory, CSR, Standards,Taxes		
Module: 6		**2 hours**
Lectures by Entrepreneurs		
Total Lecture hours		**15 hours**

Text Book (s)

1.	Steve Blank, K & S Ranch (2012)The Startup Owner's Manual: The Step-By-Step Guide for Building a Great Company, 1st edition
2.	Steve Blank (2013) The Four Steps to the Epiphany, K&S Ranch; 2nd edition
3.	Eric Ries (2011) The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses, Crown Business

Reference Books	
1.	Holding a Cat by the Tail, Steve Blank, K & S Ranch Publishing LLC (August 14, 2014)
2.	Product Design and Development, Karal TUlrich, SDEppinger, McGrawHill
3.	Zero to One: Notes on Startups, or How to Build the Future, Peter Thiel, Crown Business (2014)
4.	Lean Analytics: Use Data to Build a Better Startup Faster (Lean Series), Alistair Croll & Benjamin Yoskovitz, O' Reilly Media; 1st Edition (March 21, 2013)
5.	Inspired: How to create Products Customers Love, Marty Cagan,S VPG Press; 1st edition (June18, 2008)
6.	**Website References:** 1. http://theleanstartup.com/ 2. https://www.kickstarter.com/projects/881308232/only-on-kickstarter-the-leaders-guide-by-eric-ries 3. http://businessmodelgeneration.com/ 4. https://www.leanstartupmachine.com/ 5. https://www.youtube.com/watch?v=fEvKo90qBns 6. http://thenextweb.com/entrepreneur/2015/07/05/whats-wrong-with-the-lean-startup-methodology/#gref 7. http://www.businessinsider.in/Whats-Lean-about-Lean-Startup/articleshow/53615661.cms 8. https://steveblank.com/tools-and-blogs-for-entrepreneurs/ 9. https://hbr.org/2013/05/why-the-lean-start-up-changes-everything 10. chventures.blogspot.in/platformsandnetworks.blogspot.in/p/saas-model.html
Teaching Modes: Assignments; Field Trips, Case Studies; e-learning; Learning through research, TED Talks	

Project				
1.	Project	60 hours		
Total Project		**60 hours**		
Recommended by Board of Studies		08.06.2015		
Approved by Academic Council		37th ACM	**Date**	16.06.2015

PHY1701	ENGINEERING PHYSICS	L	T	P	J	C
		3	0	2	0	4
Pre-requisite	Physics of 12th standard or equivalent	Syllabus version				
		2.1				

Course Objectives:

To enable the students to understand the basics of the latest advancements in Physics viz., Quantum Mechanics, Nanotechnology, Lasers, Electro Magnetic Theory and Fiber Optics.

Expected Course Outcome:

On completion of this course the students will be able to:

1. To understand the dual nature of radiation and matter.
2. To apply Schrodinger's equations to solve finite and infinite potential problems.
3. To apply quantum ideas at the nanoscale.
4. To apply quantum ideas for understanding the operation and working principle of optoelectronic devices.
5. To analyze the Maxwell's equations in differential and integral form.
6. To classify the optical fiber for different Engineering applications.
7. To apply concept of Lorentz Transformation for engineering applications.
8. To demonstrate the quantum mechanical ideas – Lab

Module: 1	Introduction to Modern Physics	6 hours

Planck's concept (hypothesis), Compton Effect, Particle properties of wave: Matter Waves, Davisson Germer Experiment, Heisenberg Uncertainty Principle, Wave function, and Schrodinger equation (time dependent & independent).

Module: 2	Applications of Quantum Physics	5 hours

Particle in a 1-D box (Eigen Value and Eigen Function), 3-D Analysis (Qualitative), Tunneling Effect (Qualitative) (AB 205), Scanning Tunneling Microscope (STM).

Module: 3	Nanophysics	5 hours

Introduction to Nano-materials, Moore's law, Properties of Nano-materials, Quantum confinement, Quantum well, wire & dot, Carbon Nano-tubes (CNT), Applications of nanotechnology in industry.

Module: 4	Laser Principles and Engineering Application	6 hours

Laser Characteristics, Spatial and Temporal Coherence, Einstein Coefficient & its significance, Population inversion, Two, three & four level systems, Pumping schemes, Threshold gain coefficient, Components of laser, Nd-YAG, He-Ne, CO2 and Dye laser and their engineering applications.

Module: 5	Electromagnetic Theory and its application	6 hours

Physics of Divergence, Gradient and Curl, Qualitative understanding of surface and volume integral, Maxwell Equations (Qualitative), Wave Equation (Derivation), EM Waves, Phase velocity, Group velocity, Group index , Wave guide (Qualitative)

Module: 6	Propagation of EM waves in Optical fibers and Optoelectronic Devices	6 hours

Light propagation through fibers, Acceptance angle, Numerical Aperture, Types of fibers - step index, graded index, single mode & multimode, Attenuation, Dispersion-intermodal and intramodal. Sources-LED & Laser Diode, Detectors-Photodetectors- PN & PIN - Applications of fiber optics in communication- Endoscopy.

Module: 7	Special Theory of Relativity	9 hours

Frame of reference, Galilean relativity, Postulate of special theory of relativity, Simultaneity, length contraction and time dilation.

Module: 8	Contemporary issues	2 hours
Lecture by Industry Experts		
Total Lecture hours		**45 hours**

Text Book (s)	
1.	Arthur Beiser et al., Concepts of Modern Physics, 2013, Sixth Edition, Tata McGraw Hill. William Silfvast,
2.	Laser Fundamentals, 2008, Cambridge University Press
3.	D. J. Griffith, Introduction to Electrodynamics, 2014, 4th Edition, Pearson
4.	Djafar K. Mynbaev and Lowell L.Scheiner, Fiber Optic Communication Technology, 2011, Pearson
Reference Books	
1.	Raymond A. Serway, Clement J. Mosses, Curt A. Moyer Modern Physics, 2010, 3rd Indian Edition Cengage learning.
2.	John R. Taylor, Chris D. Zafiratos and Michael A. Dubson, Modern Physics for Scientists and Engineers, 2011, PHI Learning Private Ltd.
3.	Kenneth Krane Modern Physics, 2010, Wiley Indian Edition.
4.	Nityanand Choudhary and RichaVerma, Laser Systems and Applications, 2011, PHI Learning Private Ltd.
5.	S. Nagabhushana and B. Sathyanarayana, Lasers and Optical Instrumentation, 2010, I.K. International Publishing House Pvt. Ltd.
6.	R. Shevgaonkar, Electromagnetic Waves, 2005, 1st Edition, Tata McGraw Hill
7.	Principles of Electromagnetics, Matthew N.O. Sadiku, 2010, Fourth Edition, Oxford
8.	Ajoy Ghatak and K. Thyagarajan, Introduction to Fiber Optics, 2010, Cambridge University Press

Mode of Evaluation: Quizzes , Digital Assignments, CAT-I and II and FAT

List of Challenging Experiments (Indicative)

1.	Determination of Planck's constant using electrolumine scence process	2 hrs
2.	Electron diffraction	2 hrs
3.	Determination of wave length of laser source (He-Ne laser and diodelasers of Different wave lengths) using diffraction technique	2 hrs
4.	Determination of size offine particle using laser diffraction	2 hrs
5.	Determination of the track width (periodicity) in a written CD	2 hrs
6.	Optical Fiber communication (source+optical fiber+detector)	2 hrs
7.	Analysis of crystallite size and strain in a nano-crystalline film using X-ray diffraction	2 hrs
8.	Numerical solutions of Schrödinger equation (e.g. particle in a box problem) (can be given as an assignment)	2 hrs
9.	Laser coherence length measurement	2 hrs
10.	Proof for transverse nature of E.M. waves	2 hrs
11.	Quantum confinement and Heisenberg's uncertainty principle	2 hrs
12.	Determination of angle of prism and refractive index for various colour – Spectrometer	2 hrs
13.	Determination of divergence of a laser beam	2 hrs
14.	Determination of crystalline size for nanomaterial (Computer simulation)	2 hrs
15.	Demonstration of phase velocity and group velocity (Computer simulation)	2 hrs
Total Laboratory Hours		**30 hours**

Mode of assessment: CAT / FAT

Recommended by Board of Studies	04.06.2019		
Approved by Academic Council	55th ACM	**Date**	13.06.2019

Course code	Course title	L	T	P	J	C
PHY1901	Introduction to Innovative Projects	1	0	0	0	1
Pre-requisite	Nil	Syllabus version				
		1.0				

Course Objectives:

This course is offered to the students in the 1st Year of B.Tech. in order to orient them towards independent, systemic thinking and be innovative.

1. To make students confident enough to handle the day to day issues.
2. To develop the "Thinking Skill" of the students, especially Creative Thinking Skills
3. To train the students to be innovative in all their activities
4. To prepare a project report on a socially relevant theme as a solution to the existing issues

Expected Course Outcome: Students will be able to

1. Understand the various types of thinking skills.
2. Enhance the innovative and creative ideas.
3. Find out a suitable solution for socially relevant issues- J component

Module:1 A	Self Confidence	1 hour

Understanding self – Johari Window –SWOT Analysis – Self Esteem – Being a contributor – Case Study

Project : Exploring self, understanding surrounding, thinking about how s(he) can be a contributor for the society, Creating a big picture of being an innovator – writing a 1000 words imaginary autobiography of self – Topic "Mr X – the great innovator of 2015" and upload. **(4 non- contact hours)**

Module:1 B	Thinking Skill	1 hour

Thinking and Behaviour – Types of thinking– Concrete – Abstract, Convergent, Divergent, Creative, Analytical, Sequential and Holistic thinking – Chunking Triangle – Context Grid – Examples – Case Study.

Project : Meeting at least 50 people belonging to various strata of life and talk to them / make field visits to identify a min of100 society related issues, problems for which they need solutions and categories them and upload along with details of people met and lessons learnt. **(4 non-contact hours)**

Module:1 C	Lateral Thinking Skill	1 hour

Blooms Taxonomy – HOTS – Outof the box thinking – deBono lateral thinking model – Examples **Project :** Last weeks - incomplete portion to be done and uploaded		
Module:2 A	**Creativity**	**1 hour**
Creativity Models – Walla – Barrons – Koberg & Begnall – Examples **Project :** Selecting 5 out of 100 issues identified for future work. Criteria based approach for prioritisation, use of statistical tools & upload . **(4 non- contact hours)**		
Module:2 B	**Brainstorming**	**1 hour**
25 brainstorming techniques and examples **Project :** Brainstorm and come out with as many solutions as possible for the top 5 issues identified & upload . **(4 non- contact hours)**		
Module:3	**Mind Mapping**	**1 hour**
Mind Mapping techniques and guidelines. Drawing a mind map **Project :** Using Mind Maps get another set of solutions forthe next 5 issues (issue 6 – 10) . **(4 non- contact hours)**		
Module:4 A	**Systems thinking**	**1 hour**
Systems Thinking essentials – examples – Counter Intuitive condemns **Project :** Select 1 issue / problem for which the possible solutions are available with you. Apply Systems Thinking process and pick up one solution [explanation should be given why the other possible solutions have been left out]. Go back to the customer and assess the acceptability and upload. . **(4 non- contact hours)**		
Module:4 B	**Design Thinking**	**1 hour**
Design thinking process – Human element of design thinking – case study **Project :** Apply design thinking to the selected solution, apply the engineering & scientific tinge to it. Participate in "design week" celebrations upload the weeks learning out come.		
Module:5 A	**Innovation**	**1 hour**
Difference between Creativity and Innovation – Examples of innovation –Being innovative. **Project:** A literature searches on prototyping of your solution finalized. Prepare a prototype model or process and upload. . **(4 non- contact hours)**		
Module:5 B	**Blocks for Innovation**	**1 hour**
Identify Blocks for creativity and innovation – overcoming obstacles – Case Study **Project :** Project presentation on problem identification, solution, innovations-expected results – Interim review with PPT presentation. . **(4 non- contact hours)**		
Module:5 C	**Innovation Process**	**1 hour**
Steps for Innovation – right climate for innovation **Project:** Refining the project, based on the review report and uploading the text. . **(4 non-contact hours)**		
Module:6 A	**Innovation in India**	**1 hour**
Stories of 10 Indian innovations **Project:** Making the project better with add ons. . **(4 non- contact hours)**		
Module:6 B	**JUGAAD Innovation**	**1 hour**
Frugal and flexible approach to innovation - doing more with less Indian Examples **Project:** Fine tuning the innovation project with JUGAAD principles and uploading (Credit for JUGAAD implementation) . **(4 non- contact hours)**		
Module:7 A	**Innovation Project Proposal Presentation**	**1 hour**
Project proposal contents, economic input, ROI – Template **Project:** Presentation of the innovative project proposal and upload . **(4 non- contact hours)**		
Module:8 A	Contemporary issue in Innovation	**1 hour**

Contemporary issue in Innovation **Project:** Final project Presentation , Viva voce Exam (**4 non- contact hours)**			
	Total Lecture hours:	**15 hours**	

Text Book(s)	
1.	How to have Creative Ideas, Edward debone, Vermilon publication, UK, 2007
2.	The Art of Innovation, Tom Kelley & Jonathan Littman, Profile Books Ltd, UK, 2008
Reference Books	
1.	Creating Confidence, Meribeth Bonct, Kogan Page India Ltd, New Delhi, 2000
2.	Lateral Thinking Skills, Paul Sloane, Keogan Page India Ltd, New Delhi, 2008
3.	Indian Innovators, Akhat Agrawal, Jaico Books, Mumbai, 2015
4.	JUGAAD Innovation, Navi Radjou, Jaideep Prabhu, Simone Ahuja Random house India, Noida, 2012.

Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar

Three reviews with weightage of 25 : 25 : 50 along with reports

Recommended by Board of Studies	15-12-2015		
Approved by Academic Council	No. 39	Date	17-12-2015

NON CREDIT COURSE

Course Code	Course Title	L	T	P	J	C
CHY1002	Environmental Sciences	3	0	0	0	3
Pre-requisite	Chemistry of 12th standard or equivalent	Syllabus version				
		v. 1.1				

Course Objectives:

1. To make students understand and appreciate the unity of life in all its forms, the implications of life style on the environment.
2. To understand the various causes for environmental degradation.
3. To understand individuals contribution in the environmental pollution.
4. To understand the impact of pollution at the global level and also in the local environment.

Expected Course Outcome:

Students will be able to

1. Students will recognize the environmental issues in a problem oriented interdisciplinary perspectives
2. Students will understand the key environmental issues, the science behind those problems and potential solutions.
3. Students will demonstrate the significance of biodiversity and its preservation
4. Students will identify various environmental hazards
5. Students will design various methods for the conservation of resources
6. Students will formulate action plans for sustainable alternatives that incorporate science, humanity, and social aspects
7. Students will have foundational knowledge enabling them to make sound life decisions aswell as enter a career in an environmental profession or higher education.

Module:1	Environment and Ecosystem	7 hours

Key environmental problems, their basic causes and sustainable solutions. IPAT equation. Ecosystem, earth – life support system and ecosystem components; Food chain, food web, Energy flow in ecosystem; Ecological succession- stages involved, Primary and secondary succession, Hydrarch, mesarch, xerarch; Nutrient, water, carbon, nitrogen, cycles; Effect of human activities on these cycles.

Module:2	Biodiversity	6 hours

Importance, types, mega-biodiversity; Species interaction - Extinct, endemic, endangered and rare species; Hot-spots; GM crops- Advantages and disadvantages; Terrestrial biodiversity and Aquatic biodiversity – Significance, Threats due to natural and anthropogenic activities and Conservation methods.

Module:3	Sustaining Natural Resources and Environmental Quality	7 hours
Environmental hazards – causes and solutions. Biological hazards – AIDS, Malaria, Chemical hazards- BPA, PCB, Phthalates, Mercury, Nuclear hazards- Risk and evaluation of hazards. Water footprint; virtual water, blue revolution. Water quality management and its conservation. Solid and hazardous waste – types and waste management methods.		
Module:4	**Energy Resources**	**6 hours**
Renewable - Non renewable energy resources- Advantages and disadvantages - oil, Natural gas,Coal, Nuclear energy. Energy efficiency and renewable energy. Solar energy, Hydroelectric power, Ocean thermal energy, Wind and geothermal energy. Energy from biomass, solar- Hydrogen revolution.		
Module:5	**Environmental Impact Assessment**	**6 hours**
Introduction to environmental impact analysis. EIA guidelines, Notification of Government of India (Environmental Protection Act – Air, water, forest and wild life). Impact assessment methodologies. Public awareness. Environmental priorities in India.		
Module:6	**Human Population Change and Environment**	**6 hours**
Urban environmental problems; Consumerism and waste products; Promotion of economic development – Impact of population age structure – Women and child welfare, Women empowerment. Sustaining human societies: Economics, environment, policies and education.		
Module:7	**Global Climatic Change and Mitigation**	**5 hours**
Climate disruption, Green house effect, Ozone layer depletion and Acid rain. Kyoto protocol,Carbon credits, Carbon sequestration methods and Montreal Protocol. Role of Information technology in environment-Case Studies.		
Module:8	**Contemporary issues :** Lecture by Industry Experts	**2 hours**
Total Lecture hours:		**45 hours**

Text Books

1.	G. Tyler Miller and Scott E. Spoolman (2016), Environmental Science, 15th Edition, Cengage learning.
2.	George Tyler Miller, Jr. and Scott Spoolman (2012), Living in the Environment – Principles, Connections and Solutions, 17th Edition, Brooks/Cole, USA.

Reference Books

1.	David M.Hassenzahl, Mary Catherine Hager, Linda R.Berg (2011), Visualizing Environmental Science, 4thEdition, John Wiley & Sons, USA.

Mode of evaluation: Internal Assessment (CAT, Quizzes, Digital Assignments) & FAT

Recommended by Board of Studies	**12.08.2017**		
Approved by Academic Council	**No. 46**	**Date**	**24.08.2017**

Course code	Course title	L	T	P	J	C
ENG1000	Foundation English - I	0	0	4	0	2
Pre-requisite	Less than 50% EPT score	Syllabus Version				
		v. 1.0				

Course Objectives:

1. To equip learners with English grammar and its application.
2. To enable learners to comprehend simple text and train them to speak and write flawlessly.
3. To familiarize learners with MTI and ways to overcome them.

Expected Course Outcome:

1. Develop the skills to communicate clearly through effective grammar, pronunciation and writing.
2. Understand everyday conversations in English
3. Communicate and respond to simple questions about oneself.
4. Improve vocabulary and expressions.
5. Prevent MTI (Mother Tongue Influence) during usual conversation.

Module:1	**Essentials of grammar**	**3 Hours**
Understand basic grammar-Parts of Speech Activity: Grammar worksheets on parts of speech		
Module:2	**Vocabulary Building**	**3 Hours**
Vocabulary development; One word substitution Activity: Elementary vocabulary exercises		
Module:3	**Applied grammar and usage**	**4 Hours**
Types of sentences; Tenses Activity: Grammar worksheets on types of sentences; tenses		
Module:4	**Rectifying common errors in everyday conversation**	**4 Hours**
Detect and rectify common mistakes in everyday conversation Activity: Common errors in prepositions, tenses, punctuation, spelling and other parts of speech; Colloquialism		
Module :5	**Jumbled sentences**	**2 Hours**
Sentence structure; Jumbled words to form sentences; Jumbled sentences to form paragraph/ short story Activity: Unscramble a paragraph / short story		
Module:6	**Text-based Analysis**	**4 Hours**
Wings of Fire -Autobiography of APJ Abdul Kalam (Excerpts) Activity: Enrich vocabulary by reading and analyzing the text		

Module:7	Correspondence	3 Hours
Letter, Email, Application Writing Activity: Compose letters; Emails, Leave applications		
Module:8	**Listening for Understanding**	**4 Hours**
Listening to simple conversations & gap fill exercises Activity: Simple conversations in Received Pronunciation using audio-visual materials.		
Module:9	**Speaking to Convey**	**6 Hours**
Self-introduction; role-plays; Everyday conversations Activity**:** Identify and communicate characteristic attitudes, values, and talents; Working and interacting within groups		
Module:10	**Reading for developing pronunciation**	**6 Hours**
Loud reading with focus on pronunciation by watching relevant video materials Activity: Practice pronunciation by reading aloud simple texts; Detecting syllables; Visually connecting to the words shown in relevant videos		
Module:11	**Reading to Contemplate**	**4 Hours**
Reading short stories and passages Activity: Reading and analyzing the author's point of view; Identifying the central idea.		
Module:12	**Writing to Communicate**	**6 Hours**
Paragraph Writing; Essay Writing; Short Story Writing Activity: Writing paragraphs, essays and short- stories		
Module:13	**Interpreting Graphical Data**	**6 Hours**
Describing graphical illustrations; interpreting basic charts, tables, and formats Activity: Interpreting and presenting simple graphical representations/charts in the form of PPTs		
Module:14	**Overcoming Mother Tongue Influence (MTI) in Pronunciation**	**5 Hours**
Practicing common variants in pronunciation Activity: Identifying and overcoming mother tongue influence.		
	Total Laboratory Hours	**60 Hours**

Text Book / Workbook

1.	Wren, P.C., & Martin, H. (2018).High School English Grammar & Composition N.D.V. PrasadaRao (Ed.). NewDelhi: S. Chand & Company Ltd.
2.	McCarthy, M. O'Dell, F.,& Bunting, J.D. (2010).Vocabulary in Use(High Intermediate students book with answers). Cambridge University Press

Reference Books

1.	Watkins, P.(2018).Teaching and Developing Reading Skills: Cambridge Handbooks for Language teachers. Cambridge University Press.
2.	Mishra, S., &Muralikrishna, C. (2014).Communication Skills for Engineers. Pearson Education

	India			
3	Lewis, N. (2011).Word Power Made Easy. Goyal Publisher			
4	https:/americanliterature.com/short-short-stories			
5	Tiwari, A., &Kalam, A. (1999).Wings of Fire - An Autobiography of Abdul Kalam. Universities Press (India) Private Limited.			
Mode of Evaluation: Quizzes, Presentation, Discussion, Role Play, Assignments				
List of Challenging Experiments (Indicative)				
1.	Rearranging scrambled sentences			**8 hours**
2.	Identifying errors in oral and written communication			**12 hours**
3.	Critically analyzing the text			**8 hours**
4.	Developing passages from hint words			**8 hours**
5.	Role-plays			**12 hours**
6.	Listening to a short story and analyzing it			**12 hours**
			Total Laboratory Hours	**60 hours**
Mode of Evaluation: Quizzes, Presentation, Discussion, Role Play, Assignments				
Recommended by Board of Studies		**08-06-2019**		
Approved by Academic Council		**55**	**Date**	**13-06-2019**

Course code	Course title	L	T	P	J	C
ENG2000	Foundation English - II	0	0	4	0	2
Pre-requisite	51% - 70% EPT Score / Foundation English I	Syllabus version				
		v.1.0				

Course Objectives:

1. To practice grammar and vocabulary effectively
2. To acquire proficiency levels in LSRW skills in diverse social situations.
3. To analyze information and converse effectively in technical communication.

Expected Course Outcome:

1. Accomplish a deliberate reading and writing process with proper grammar and vocabulary.
2. Comprehend sentence structures while Listening and Reading.
3. Communicate effectively and share ideas in formal and informal situations.
4. Understand specialized articles and technical instructions and write clear technical correspondence.
5. Critically think and analyze with verbal ability.

Module:1	Grammatical Aspects	4 hours

Sentence Pattern, Modal Verbs, Concord (SVA), Conditionals, Connectives
Activity : Worksheets, Exercises

Module:2	Vocabulary Enrichment	4 hours

Active & Passive Vocabulary, Prefix and Suffix, High Frequency Words
Activity : Worksheets, Exercises

Module:3	Phonics in English	4 Hours

Speech Sounds – Vowels and Consonants – Minimal Pairs- Consonant Clusters- Past Tense Marker and Plural Marker
Activity : Worksheets, Exercises

Module:4	Syntactic and Semantic Errors	2 Hours

Tenses /SVA/Articles/ Prepositions/ Punctuation & Right Choice of Vocabulary
Activity : Worksheets, Exercises

Module:5	Stylistic errors	2 Hours

Dangling Modifiers, Parallelism, Standard English, Ambiguity, Redundancy, Brevity
Activity : Worksheets, Exercises

Module:6	Listening and Note making	6 Hours

Intensive and Extensive Listening - Scenes from plays of Shakespeare (Eg: Court scene in *The Merchant of Venice*, Disguise Scene in *The Twelfth Night*, Death of Desdemona in *Othello*, Death scene in *Julius Caesar* and Balcony scene from *Romeo and Juliet*)
Activity : Summarizing; Note-making and drawing inferences from Short videos

Module:7	**Art of Public Speaking**	**6 Hours**
Impromptu, Importance of Non-verbal Communication, Technical Talks, Dynamics of Professional Presentations – Individual & Group Activity : Ice Breaking; Extempore speech; Structured technical talk and Group presentation		
Module:8	**Reading Comprehension Skills**	**4 Hours**
Skimming, scanning, comprehensive reading, guessing words from context, understanding text organization, recognizing argument and counter-argument; distinguishing between main information and supporting detail, fact and opinion, hypothesis versus evidence; summarizing and note-taking, Critical Reasoning Questions – Reading and Discussion Activity: Reading of Newspapers Articles and Worksheets on Critical Reasoning from web resources		
Module: 9	**Creative Writing**	**4 Hours**
Structure of an essay, Developing ideas on analytical/ abstract topics Activity: Movie Review, Essay Writing on suggested Topics, Picture Descriptions		
Module: 10	**Verbal Aptitude**	**6 hours**
Word Analogy, Sentence Completion using Appropriate words, Sentence Correction Activity: Practicing the use of appropriate words and sentences through web tools.		
Module: 11	**Business Correspondence**	**4 hours**
Formal Letters- Format and purpose: Business Letters - Sales and complaint letter Activity: Letter writing- request for Internship, Industrial Visit and Recommendation		
Module: 12	**Career Development**	**6 hours**
Telephone Etiquette, Resume Preparation, Video Profile Activity: Preparation of Video Profile		
Module: 13	**Art of Technical Writing - I**	**4 hours**
Technical Instructions, Process and Functional Description Activity: Writing Technical Instructions		
Module: 14	**Art of Technical Writing – II**	**4 hours**
Format of a Report and Proposal Activity: Technical Report Writing, Technical Proposal		
	Total Lecture hours:	**60 hours**
Text Book / Workbook		
1.	Sanjay Kumar & Pushp Lata, Communication Skills, 2nd Edition, OUP, 2015	
2	Wren & Martin, High School English Grammar & Composition, Regular ed., ND: Blackie ELT Books, 2018	
Reference Books		

1	Peter Watkins, Teaching and Developing Reading Skills: Cambridge Handbooks for Language Teachers, Cambridge, 2018
2	Aruna Koneru, Professional Speaking Skills, OUP, 2015.
3	J.C.Nesfield, English Grammar English Grammar Composition and Usage, Macmillan. 2019.
4	Richard Johnson-Sheehan, Technical Communication Today, 6th edition, ND: Pearson, 2017.
5	Balasubramaniam, Textbook of English Phonetics For Indian Students, 3rd Edition , S. Chand Publishers, 2013.

Web Resources

1. https://www.hitbullseye.com/Sentence-Correction-Practice.php
2. https://hitbullseye.com/Critical-Reasoning-Practice-Questions.php

Mode of Evaluation: Presentation, Discussion, Role Play, Assignments , FAT

List of Challenging Experiments (Indicative)		
1.	Reading and Analyzing Critical Reasoning questions	8 hours
2.	Listening and Interpretation of Videos	12 hours
3.	Letter to the Editor	6 hours
4.	Developing structured Technical Talk	12 hours
5.	Drafting SOP (Statement of Purpose)	10 hours
6.	Video Profile	12 hours
	Total Laboratory Hours	**60 hours**

Mode of Evaluation: Presentation, Discussion, Role Play, Assignments , FAT

Recommended by Board of Studies	**08.06.2019**		
Approved by Academic Council	**55**	**Date**	**13-06-2019**