



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

(2019-2020)

B. Tech. Computer Science and Engineering with Specialization in IoT

School of Computer Science and Engineering

B.Tech (CSE) - Specialization in IoT

CURRICULUM AND SYLLABUS

(2019-2020 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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B.Tech-CSE (Spl. in Internet of Things)

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

1. Graduates will be engineering practitioners and leaders, who would help solve 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.



B.Tech-CSE (Spl. in Internet of Things)

PROGRAMME OUTCOMES (POs)

PO_1 Having an ability to apply mathematics and science in engineering applications

PO_2 Having a clear understanding of the subject related concepts and of contemporary issues

PO_3 Having an ability to design a component or a product applying all the relevant standards and with realistic constraints

PO_4 Having an ability to design and conduct experiments, as well as to analyze and interpret data

PO_5 Having an ability to use techniques, skills and modern engineering tools necessary for engineering practice

PO_6 Having problem solving ability-solving social issues and engineering problems

PO_7 Having adaptive thinking and adaptability

PO_8 Having a clear understanding of professional and ethical responsibility

PO_9 Having cross cultural competency exhibited by working in teams

PO_10 Having a good working knowledge of communicating in English

PO_11 Having a good cognitive load management [discriminate and filter the available data] skills

PO_12 Having interest in lifelong learning



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B.Tech-CSE (Spl. in Internet of Things)

PROGRAMME 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 design hardware and software interfaces through system programming skills based on the knowledge acquired in the system software and hardware courses.
3. The ability to inter-connect and communicate among the systems, gadgets, sensors to analysis the data and to collectively perform the task to produce innovative, cost-effective and energy efficient products for the betterment of society and industry.

CREDIT STRUCTURE

Category-wise Credit distribution

CREDIT INFO		
S.no	Category	Credits
1	Programme Core	73
2	Programme Elective	10
3	University Core	53
4	University Elective	12
5	Specialization Elective	12
6	Bridge Course	0
7	Non Credit Course	5
Total Credits		165

Programme Core									
sl.no	Course Code	Course Title	Course Type	Version	L	T	P	J	Credits
1	BCT3001	Wireless Ad-hoc and Sensor Networks	Embedded Theory and Project	1.0	3	0	0	4	4.0
2	BCT3002	Embedded System Architecture and Design	Embedded Theory and Lab	1.0	3	0	2	0	4.0
3	CSE1003	Digital Logic and Design	Embedded Theory and Lab	1.1	3	0	2	0	4.0
4	CSE1004	Network and Communication	Embedded Theory and Lab	1.1	3	0	2	0	4.0
5	CSE1007	Java Programming	Embedded Theory and Lab	1.0	3	0	2	0	4.0
6	CSE2001	Computer Architecture and Organization	Theory Only	1.0	3	0	0	0	3.0
7	CSE2002	Theory of Computation and Compiler Design	Theory Only	1.1	4	0	0	0	4.0
8	CSE2003	Data Structures and Algorithms	Embedded Theory, Lab and Project	1.0	2	0	2	4	4.0
9	CSE2004	Database Management Systems	Embedded Theory and Lab	1.1	3	0	2	0	4.0
10	CSE2005	Operating Systems	Embedded Theory and Lab	1.1	3	0	2	0	4.0
11	CSE2010	Advanced C Programming	Embedded Theory and Lab	1.0	2	0	2	0	3.0
12	CSE2015	Internet Programming and Web Technologies	Embedded Theory and Lab	1.0	3	0	2	0	4.0
13	CSE2016	Microprocessor and Microcontrollers	Embedded Theory and Lab	1.0	3	0	2	0	4.0
14	CSE3035	Principles of Cloud Computing	Embedded Theory and Lab	1.0	3	0	2	0	4.0
15	ECE3051	Analog and Digital Signal Processing	Embedded Theory and Lab	1.0	3	0	2	0	4.0
16	EEE1001	Basic Electrical and Electronics Engineering	Embedded Theory and Lab	1.0	2	0	2	0	3.0

Programme Core									
17	MAT1014	Discrete Mathematics and Graph Theory	Theory Only	1.1	3	2	0	0	4.0
18	MAT2002	Applications of Differential and Difference Equations	Embedded Theory and Lab	1.0	3	0	2	0	4.0
19	MAT3004	Applied Linear Algebra	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	Credits
1	CSE1006	Blockchain and Cryptocurrency Technologies	Theory Only	1.0	3	0	0	0	3.0
2	CSE3001	Software Engineering	Embedded Theory, Lab and Project	1.0	2	0	2	4	4.0
3	CSE3013	Artificial Intelligence	Embedded Theory and Project	1.0	3	0	0	4	4.0
4	CSE3022	Soft Computing	Embedded Theory and Project	1.0	3	0	0	4	4.0
5	CSE3501	Information Security Analysis and Audit	Embedded Theory, Lab and Project	1.0	2	0	2	4	4.0
6	CSE3502	Information Security Management	Embedded Theory, Lab and Project	1.0	2	0	2	4	4.0
7	CSE4003	Cyber Security	Embedded Theory and Project	1.0	3	0	0	4	4.0
8	CSE4007	Mobile Computing	Embedded Theory and Project	1.0	3	0	0	4	4.0
9	CSE4019	Image Processing	Embedded Theory and Project	1.0	3	0	0	4	4.0
10	CSE4020	Machine Learning	Embedded Theory, Lab and Project	1.1	2	0	2	4	4.0
11	CSE4022	Natural Language Processing	Embedded Theory and Project	1.0	3	0	0	4	4.0

University Core									
sl.no	Course Code	Course Title	Course Type	Version	L	T	P	J	Credits
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

University Core									
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
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

Specialization Elective									
sl.no	Course Code	Course Title	Course Type	Version	L	T	P	J	Credits
1	BCT3004	Privacy and Security in Internet of Things	Embedded Theory and Project	1.0	3	0	0	4	4.0
2	BCT3005	Fundamentals of Fog and Edge Computing	Embedded Theory and Project	1.0	3	0	0	4	4.0
3	BCT3006	Industrial and Medical Internet of Things	Embedded Theory and Project	1.0	2	0	0	4	3.0
4	BCT3007	Programming for Internet of Things Boards	Embedded Theory, Lab and Project	1.0	2	0	2	4	4.0
5	BCT3008	Software Defined Networks	Embedded Theory and Project	1.0	3	0	0	4	4.0
6	BCT4001	Sensors and Actuator Devices	Embedded Theory and Lab	1.0	3	0	2	0	4.0

Specialization Elective									
7	BCT4002	Architecting Smart Internet of Things Devices	Embedded Theory and Project	1.0	3	0	0	4	4.0
8	BCT4003	Wearable Computing	Embedded Theory and Project	1.0	3	0	0	4	4.0
9	BCT4004	Design of Smart Systems	Embedded Theory and Project	1.0	3	0	0	4	4.0
10	BCT4005	Design of Smart Cities	Embedded Theory and Project	1.0	3	0	0	4	4.0
11	BCT4006	Cognitive Internet of Things	Theory Only	1.0	3	0	0	0	3.0
12	BCT4007	Applications of Internet of Things in Robotics	Theory Only	1.0	3	0	0	0	3.0
13	BCT4009	Internet of Things Architectures and its Protocol	Theory Only	1.0	3	0	0	0	3.0

Bridge Course									
sl.no	Course Code	Course Title	Course Type	Version	L	T	P	J	Credits
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	Credits
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	I	T	P	J	C
		3	0	2	0	4
Pre-requisite	NIL	Syllabus version				
		v1.0				
Course Objectives:						
<ol style="list-style-type: none"> 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:						
<ol style="list-style-type: none"> 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, verification of truth table for logic gates, realization of basic gates using NAND and NOR gates	4.5 hours	
2.	Implementation of Logic Circuits by verification of Boolean laws and verification of De Morgans law	3 hours	
3.	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	
4.	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	
5.	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	
6.	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	
7.	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:						
<ol style="list-style-type: none"> To impart the core language features of Java and its Application Programming Interfaces (API). To demonstrate the use of threads, exceptions, files and collection frameworks in Java. To familiarize students with GUI based application development and database connectivity. 						
Expected Course Outcome:						
<ol style="list-style-type: none"> Comprehend Java Virtual Machine architecture and Java Programming Fundamentals. Design applications involving Object Oriented Programming concepts such as inheritance, association, aggregation, composition, polymorphism, abstract classes and interfaces. Design and build multi-threaded Java Applications. Build software using concepts such as files, collection frameworks and containers. Design and implement Java Applications for real world problems involving Database Connectivity. Design Graphical User Interface using JavaFX. Design, Develop and Deploy dynamic web applications using Servlets and Java Server 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

CSE2001	COMPUTER ARCHITECTURE AND ORGANIZATION	L	T	P	J	C
		3	0	0	0	3
Pre-requisite	CSE1003 Digital Logic Design	Syllabus version				
		v1.0				
Course Objectives:						
<ol style="list-style-type: none"> 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:						
<ol style="list-style-type: none"> 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 - Flynn's 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

CSE2002	THEORY OF COMPUTATION AND COMPILER DESIGN	L	T	P	J	C
		4	0	0	4	4
Pre-requisite	NIL	Syllabus version				
		v1.0				
Course Objectives:						
<ol style="list-style-type: none"> 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:						
<ol style="list-style-type: none"> 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, Alfred 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 Cambridge 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

CSE2003	DATA STRUCTURES AND ALGORITHMS		L	T	P	J	C
			2	0	2	4	4
Pre-requisite	NIL		Syllabus version				
			v1.0				
Course Objectives:							
<ol style="list-style-type: none"> To impart the basic concepts of data structures and algorithms. To assess how the choice of data structures and algorithm design methods impact the performance of programs. To provide an insight into the intrinsic nature of the problem and to develop software systems of varying complexity. 							
Expected Course Outcome:							
<ol style="list-style-type: none"> Evaluating and providing suitable techniques for solving a problem using basic properties of Data Structures. Analyse the performance of algorithms using asymptotic notations. Demonstrate knowledge of basic data structures and legal operations on them. Illustrate different types of algorithmic approaches to problem solving and assess the trade-offs involved. Analyse basic graph algorithms, operations and applications through a structured (well-defined) algorithmic approach. Categorize the feasibility and limitations of solutions to real-world problems. Provide efficient algorithmic solution to real-world problems. 							
Module:1	Introduction to Data structures and Algorithms					1 hour	
Overview and importance of algorithms and data structures, 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, Computing the time complexity of the Algorithm.							
Module:2	Analysis of Algorithms					3 hours	
Asymptotic notations and their significance, Running time of an algorithm, Time-complexity of an algorithm, Performance analysis of an algorithm, Analysis of iterative and recursive algorithms, Master theorem (without proof).							
Module:3	Data Structures					7 hours	
Importance of data structures, Arrays, Stacks, Queues, Linked list, Trees, Hashing table, Binary Search Tree, Heaps.							
Module:4	Algorithm Design Paradigms					8 hours	
Divide and Conquer, Brute force, Greedy, Recursive Backtracking and Dynamic programming.							
Module:5	Graph Algorithms					4 hours	
Breadth First Search (BFS), Depth First Search (DFS), Minimum Spanning Tree (MST), Single Source Shortest Paths.							
Module:6	Computational Complexity classes					5 hours	
Tractable and Intractable Problems, Decidable and Undecidable problems, Computational complexity Classes: P, NP and NP complete - Cooks Theorem (without proof), 3-CNF-SAT Problem, Reduction of 3-CNF-SAT to Clique Problem, Reduction of 3-CNF-SAT to Subset sum							
problem.							
Module:7	Recent Trends					2 hours	

Algorithms related to Search Engines			
		Total Lecture hours:	30 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.	Sanjoy Dasgupta, C.Papadimitriou and U.Vazirani , Algorithms , Tata McGraw-Hill, 2008.		
2.	A. V. Aho, J.E. Hopcroft and J. D. Ullman, Data Structures and Algorithms ,Pearson India, 1st Edition, 2002		
3.	A. V. Aho, J.E. Hopcroft and J. D. Ullman, The Design and Analysis of Computer Algorithms ,Pearson, 1st edition, 2006.		
4.	Sara Baase , Allen Van Gelder, Computer Algorithms, Introduction to Design and Analysis, 3rd edition, Wesley Longman Publishing, 1999.		
Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar			
List of Challenging Experiments (Indicative)			
1.	Extract the features based on various color models and apply on image and video retrieval		2 hours
2.	Arrays, loops and Lists		2 hours
3.	Stacks and Queues		2 hours
4.	Searching and Sorting		3 hours
5.	Linked List and operations		4 hours
6.	Brute force technique		2 hours
7.	Greedy Technique		2 hours
8.	Backtracking		2 hours
9.	Dynamic Programming		2 hours
10.	Trees and Tree Operations		3 hours
11.	BFS and DFS		3 hours
12.	Minimum Spanning Tree		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

CSE2004	DATABASE MANAGEMENT SYSTEM	L	T	P	J	C
		2	0	2	4	4
Pre-requisite	NIL	Syllabus version				
		v1.0				
Course Objectives:						
<ol style="list-style-type: none"> To understand the concept of DBMS and ER Modeling. To explain the normalization, Query optimization and relational algebra. To apply the concurrency control, recovery, security and indexing for the real time data. 						
Expected Course Outcome:						
<ol style="list-style-type: none"> Explain the basic concept and role of DBMS in an organization. Illustrate the design principles for database design, ER model and normalization. Demonstrate the basics of query evaluation and heuristic query optimization techniques. Apply Concurrency control and recovery mechanisms for the desirable database problem. Compare the basic database storage structure and access techniques including B Tree, B+ Trees and hashing. Review the fundamental view on unstructured data and its management. 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

CSE2005	OPERATING SYSTEMS	L	T	P	J	C
		2	0	2	4	4
Pre-requisite	NIL	Syllabus version				
		v1.0				
Course Objectives:						
<ol style="list-style-type: none"> 1. To introduce the concept of Operating system concepts and designs and provide the 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:						
<ol style="list-style-type: none"> 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	2 hours				
Introduction to OS: - Functionality of OS - OS Design issues - Structuring methods (monolithic, layered, modular, micro-kernel models) - Abstractions, processes, and resources - influence of security, networking, multimedia.						
Module:2	OS Principles	3 hours				
System Calls System/Application Call Interface - Protection User/Kernel modes - Interrupts Processes and Threads - Structures (Process Control Block, Ready List etc).						
Module:3	Scheduling	5 hours				
Processes Scheduling - CPU Scheduling - Pre-emptive non-pre-emptive - Resource allocation and management - Deadlocks Deadlock Handling Mechanisms.						
Module:4	Concurrency	4 hours				
Inter-process communication Synchronization - Implementing Synchronization Primitives Semaphores - Monitors - Multiprocessors and Locking - Scalable Locks - Lock-free Coordination.						
Module:5	Memory management	5 hours				
Main Memory management Memory allocation strategies Caching -Virtual Memory Hardware TLB - Virtual Memory OS techniques Paging Segmentation Page Faults Page Replacement Thrashing Working Set.						
Module:6	Virtualization	4 hours				
Virtual Machines Virtualization (Hardware/Software, Server, Service, Network) Hypervisors -OS - Container Virtualization - Cost of virtualization.						
Module:7	File systems	3 hours				
File system interface - file system implementation File system recovery Journaling - Soft updates LFS - Distributed file system.						

Module:8	Security Protection and trends	4 hours	
Security and Protection - Mechanism Vs Policies Access and authentication - models of protection Memory Protection Disk Scheduling - OS performance, Scaling OS - Mobile OS: Recent Trends: - Future directions in Mobile OS / Multi-core Optimization /Power efficient Scheduling			
		Total Lecture hours:	30 hours
Text Book(s)			
1.	Abraham Silberschatz, Peter B. Galvin, Greg Gagne-Operating System Concepts, Wiley (2012).		
Reference Books			
1.	Ramez Elmasri, A Carrick, David Levine, Operating Systems, A Spiral Approach - McGrawHill Science Engineering Math (2009).		
2.	Remzi H. Arpaci-Dusseau, Andrea C. Arpaci-Dusseau, Operating Systems, Three Easy Pieces, Arpaci-Dusseau Books, Inc (2015).		
Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar			
List of Challenging Experiments (Indicative)			
1.	Write 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 assessment: Project/Activity			
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“, 5th 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	1	0	0	4
Pre-requisite	Nil	Syllabus Version				
		1.0				
Course Objectives:						
<ol style="list-style-type: none"> To address the challenge of the relevance of lattice theory, coding theory and algebraic structures to computer science and engineering problems. To use number theory, in particular congruence theory to cryptography and computer science problems. To understand the concepts of graph theory and related algorithm concepts. 						
Expected Course Outcome:						
At the end of this course, students are expected to						
<ol style="list-style-type: none"> form truth tables, proving results by truth tables, finding normal forms, learn proof techniques and concepts of inference theory understand the concepts of groups and application of group codes, use Boolean algebra for minimizing Boolean expressions. learn basic concepts of graph theory, shortest path algorithms, concepts of trees and minimum spanning tree and graph colouring, chromatic number of a graph. 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, Graph colouring, covering, Partitioning	12 hours				
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	<ul style="list-style-type: none"> • 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)			
<ol style="list-style-type: none"> 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			
<ol style="list-style-type: none"> 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

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 Sturm-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						
Module:5	Sturm Liouville's problems and power series Solutions	6 hours				
The Sturm-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:		45 hours
Text Book(s)		
1.	Advanced Engineering Mathematics, Erwin Kreyszig, 10 th Edition, John Wiley India, 2015	
Reference Books		
1.	Higher Engineering Mathematics, B. S. Grewal, 43 rd Edition, Khanna Publishers, India, 2015	
2.	Advanced Engineering Mathematics by Michael D. Greenberg, 2 nd 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 \mathbb{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	<ul style="list-style-type: none"> • 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, 9 th 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, 2 nd Edition, Springer 2004.		
3. Contemporary linear algebra, Howard Anton, Robert C Busby, Wiley 2003		
4. Introduction to Linear Algebra, Gilbert Strang, 5 th 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

Course code	Course title	L	T	P	J	C
CSE2016	MICROPROCESSOR AND MICROCONTROLLERS	3	0	2	0	4
Pre-requisite	CSE 2001 – Computer Architecture and Organization	Syllabus version				
Anti-requisite	CSE2006 – Microprocessor and Interfacing	V 1.0				
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 microcontrollers 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. Learn the advanced features of Co-Processor and SHARC - Digital signal Processor						
5. Recognize the functionalities of microcontroller, latest version processors and its application.						
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	Overview of Microprocessor and ALP	7 hours				
Microprocessor pin diagram, Architecture, Memory Interfacing- addressing mode and Instruction set-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:2	Introduction to ARM Architecture	6 hours				
Basic ARM Architecture-ARM organization Core Data Flow Model-ARM Register Organization-Modes and states-Pipeline and Related Issues-Interrupts and Exceptions						
Module:3	ARM and TUUMB Instruction Sets	4 hours				
Data Processing Instructions-Conditional Executions-Load and Store Instructions-Multiplication Instructions-Software Interrupt Instructions-Branching Instructions-Barrel Shifting Operations-Stack in ARM-Programs with ARM Core-THUMB State in ARM Core						
Module:4	SHARC- Digital signal Processor	6 hours				
How DSPs are Different from Other Microprocessors-Circular Buffering-Architecture of the Digital Signal Processor-Fixed versus Floating Point-C versus Assembly-How Fast are DSPs?-The Digital Signal Processor Market.						
Module:5	Introduction to Microcontroller	8 hours				
8051 Microcontroller Architecture, PSW and Flag Bits, 8051 Register Banks and Stack, Internal Memory Organization of 8051, I/O Ports in 8051, Types of Special Function Registers and their uses in 8051- Interfacing of Timer, Serial data transfer and Interrupt- ADC and DAC.						
Module:6	Prototype development with Microcontroller 1	6 hours				
Setting Up Arduino- Controlling a Relay Using an Arduino- Controlling an LED with an Arduino- Playing a Sound with an Arduino-Using an Alphanumeric LCD Shield with Arduino.						

Module:7	Prototype development with Microcontroller 2	6 hours
Setting Up a Raspberry Pi- Connecting to Your Pi from a Second Computer- Blinking an LED- Controlling a Relay with Raspberry Pi.		
Module:8	Recent trends	2 hours
		Total Lecture hours: 45 hours
Text Book(s)		
1.	D.P. Kothari, Shriram K .Vasudevan, Subashri V, Sivaraman Ramachandran - Analysis of Microcontrollers, Scientific International PVT. LTD. First edition 2013	
2.	Simon Monk, Hacking Electronics: Learning Electronics with Arduino and Raspberry Pi, 2nd Edition, McGraw-Hill Education, 2017	
Reference Books		
1.	Douglas V. Hall, SSSP Rao” Microprocessors and Interfacing Programming and Hardware”. Tata McGraw Hill, Third edition, 2012.	
2.	Smith, Steven W. “Digital Signal Processing: A Practical Guide for Engineers and Scientists” 1st edition Newnes, 2013	
Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar		
List of Experiments		
1.	Arithmetic operations 8/16 bit using different addressing modes.	1.5 hours
2.	Finding the factorial of an 8 /16 bit number.	1.5 hours
3.	(a) Solving nCr and nPr (b) Compute nCr and nPr using recursive procedure. Assume that ‘n’ and ‘r’ are non-negative integers	1.5 hours
4.	Fibonacci series	1.5 hours
5.	Sorting in ascending and descending order	1.5 hours
	(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.	1.5 hours
8.	ALP for number system conversions	2.5 hours
9.	(a) String operations(String length, reverse, comparison, concatenation, palindrome)	1.5 hours
10.	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.	Stepper motor interface using 8086/ Arduino	2.5 hours
13.	To build a 2 digit up down counter circuit using Microcontroller	2.0 Hours
14.	Interface ADC converter with Raspberry Pi	2.5 hours
15.	To interfacing an 8X8 LED matrix with Arduino and displaying a message in the form of scrolling text	2.5 hours
Total Laboratory Hours		30 hours
Mode of assessment:		
Recommended by Board of Studies	11-02-2021	
Approved by Academic Council	61	Date 18-02-2021

CSE2015	INTERNET PROGRAMMING AND WEB TECHNOLOGIES	L	T	P	J	C
		3	0	2	0	4
Pre-requisite		Syllabus version				
Anti-requisite	CSE3002	V1.0				
Course Objectives:						
<ol style="list-style-type: none"> 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						
<ol style="list-style-type: none"> 1. Know the different web protocols and web architecture. 2. Apply HTML and CSS effectively to create dynamic websites. 3. Create event responsive webpages using AJAX and JQuery. 4. Implement server-side programming like session, cookies, file handling and database connectivity using PHP. 5. Learn web data storage and transfer technologies using Angular 6. Develop web applications using advanced technologies such as Node JS 						
Module:1	Introduction to Internet	4 hours				
Internet Overview- Networks – WWW –Web Protocols — Web Organization and Addressing – Internet Service Providers, DNS Servers, Connection Types, Internet Addresses - Web Browsers and Web Servers -Security and Vulnerability-Web System Architecture – URL - Domain Name – Web Content Authoring - Webserver Administration – Search Engines						
Module:2	Client Side Scripting	8 hours				
HTML5 – Text tags; Graphics, Form elements, HTML 5 Input types, HTML 5 Input types, semantic tags, CSS3 - Selectors, Box Model, Backgrounds and Borders, Text Effects, Animations, Cascading and inheritance of style properties - Normal Flow Box Layout-Beyond the Normal Flow – Introduction to responsive design – bootstrap						
Module:3	Client Side Scripting	7 hours				
JavaScript -Variables and Data Types - Statements – Operators- Literals- Functions- Objects- Arrays- Built-in Objects, DOM – BOM - Regular Expression Exceptions, Event handling, Validation - JQuery						
Module:4	Developing Interactive Web Applications	5 hours				
AJAX –AJAX calls - XML http – request – response – AJAX with PHP - Data Formats - AJAX with Database – Processing Server Response - AJAX Security						
Module:5	Server Side Scripting	7 hours				
Introduction to Node.js- NPM - Events, Timers, and Callbacks in Node.js – file upload – email – Express framework – request –response –routing - templates- view engines. Introduction to Mongo DB- creating DB, collection – CRUD operations - Accessing MongoDB from Node.js. – Accessing online Mongo DB from Node JS.						

Module:6	React Web Framework	6 hours
Introduction – Environment setup – JSX – React DOM – React Elements - Components – react state – Props – Hooks – Component life cycle		
Module:7	React Web Framework	6 hours
React Router – event handlers - React lists – react forms – react HTML render – react refs – react CSS – Array immutability – Lazy loading – Storing to local storage – Create a sample React App		
Module:8	Recent Trends	2 hours
Total Lecture hours:		45 hours
Text Book(s)		
1.	Paul J. Deitel, Harvey Deitel, Internet and World Wide Web How To Program, 6 th Edition, Pearson, 2020.	
2.	Vasan Subramanian, Pro MERN Stack - Full stack web app development, 2 nd Edition, 2019	
Reference Books		
1.	Jessica Minnick, Responsive Web Design with HTML 5 & CSS, Cengage Learning, 2020.	
2.	Frank Zammetti, Modern Full-Stack Development: TypeScript, React, Node.js, 1 st Edition, Apress,2020	
Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar		
List of Experiments (Indicative)		
1.	HTML form validation with JavaScript	3 hours
2.	PHP : Forms and File handling	3 hours
3.	PHP : Session Management and Cookies, Databases	3 hours
4.	Custom Services in Applications using AJAX	6 hours
5.	Database and Server Response with AJAX	6 hours
6.	React : Content projection, Manipulating Data With Pipes	6 hours
7.	Node JS and Mongo DB	6 hours
Total Laboratory Hours		30 hours
Mode of assessment: Project/Activity		
Recommended by Board of Studies	11-02-2021	
Approved by Academic Council	No. 61	Date 18-02-2021

Course code	Course Title	L	T	P	J	C
CSE3035	PRINCIPLES OF CLOUD COMPUTING	3	0	2	0	4
Pre-requisite		Syllabus version				
		V 1.0				
Course Objectives:						
<ol style="list-style-type: none"> 1. To introduce the cloud computing concepts and map reduce programming model. 2. To provide skills and knowledge about operations and management in cloud technologies so as to implement large scale systems. 3. To provide skills to design suitable cloud infrastructure that meets the business services and customer needs. 						
Expected Course Outcome:						
<ol style="list-style-type: none"> 1. Understand the evolution, principles, and benefits of Cloud Computing in order to assess existing cloud infrastructures to choose an appropriate architecture that meets business needs. 2. Decide a suitable model to capture the business needs by interpreting different service delivery and deployment models. 3. Understand virtualization foundations to cater the needs of elasticity, portability and resilience by cloud service providers. 4. Infer architectural style, work flow of real world applications and to implement the cloud applications using map reduce programming models. 5. Design a cloud framework with appropriate resource management policies and mechanism. 6. Compare operation and economic models of various trending cloud platforms prevailing in IT industry. 						
Module:1	Foundations of cloud					6 hours
Inception and need for cloud computing: Motivations from distributed computing predecessors - Evolution - Characteristics - Business Benefits – Challenges in cloud computing - Exploring the Cloud Computing Stack - Fundamental Cloud Architectures – Advanced Cloud Architectures - Specialized Cloud Architectures						
Module:2	Service Delivery and Deployment Models					5 hours
Service Models (XaaS): Infrastructure as a Service (IaaS) - Platform as a Service (PaaS) - Software as a Service(SaaS) - Deployment Models: Types of cloud - Public cloud - Private cloud - Hybrid cloud – Service level agreements - Types of SLA – Lifecycle of SLA- SLA Management						
Module:3	Cloud Resource Virtualization					5 hours
Virtualization as Foundation of Cloud – Understanding Hypervisors – Understanding Machine Image and Instances - Managing Instances – Virtual Machine Provisioning and Service Migrations						
Module:4	Cloud Computing: Applications and Paradigms					8 hours
Existing Cloud Applications and Opportunities for New Applications - Architectural Styles for Cloud Applications - Workflows: Coordination of Multiple Activities - Coordination Based on a State Machine Model: The ZooKeeper - The MapReduce Programming Model - A Case Study: The GrepTheWeb Application						
Module:5	Resource Management and Scheduling in Cloud					6 hours
Policies and Mechanisms for Resource Management – Stability of a Two-Level Resource Allocation						

Architecture- Feedback Control Based on Dynamic Thresholds - Coordination of Specialized Autonomic Performance Managers - A Utility-Based Model for Cloud-Based Web Services - Resource Bundling: Combinatorial Auctions for Cloud Resources – Scheduling Algorithms for Computing Clouds - Resource Management and Dynamic Application Scaling		
Module:6	Cloud Platforms and Application Development	9 hours
Comparing Amazon web services, Google AppEngine, Microsoft Azure from the perspective of architecture (Compute, Storage Communication) services and cost models. Cloud application development using third party APIs, Working with EC2 API – Google App Engine API - Facebook API, Twitter API.		
Module:7	Advances in Cloud	4 hours
Media Clouds - Security Clouds - Computing Clouds - Mobile Clouds – Federated Clouds – Hybrid Clouds		
Module:8	Recent Trends	2 hours
Total Lecture hours:		45 hours
Text Book(s)		
1.	Rajkumar Buyya, James Broberg, Andrzej, M. Goscinski, Cloud Computing: Principles and Paradigms, Wiley, 1 st Edition, 2013.	
2.	Sosinski, Barrie, Cloud Computing Bible, John Wiley & Sons, 1 st Edition, 2011.	
Reference Books		
1.	Marinescu, Dan C. Cloud Computing: Theory and Practice. Morgan Kaufmann, 2017.	
2.	Toby Velte, Anthony Velte, Robert Elsenpeter, Cloud Computing: A Practical Approach, Mc Graw Hill Education, 1 st Edition, 2017.	
3.	Buyya, Rajkumar, Christian Vecchiola, and S. Thamarai Selvi. Mastering Cloud Computing: Foundations and Applications Programming, Tata Mcgraw Hill, 1 st Edition, 2017.	
Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar		
List of Experiments		
1.	Configure a VM instance in your local machine and in cloud (by creating a cloud account). Allocate CPU, memory and storage space as per a specified requirement. Install Guest OS image in that instance, launch the same and confirm the successful installation of the OS by performing few OS commands.	3 hours
2.	Configure a Nested Virtual Machine (VM under another VM) in cloud and local machine. Install OS images and work with few OS commands.	2 hours
3.	Create a ssh tunnel between your server in local machine and remote clients in EC2 instances and test the connections with programs using X11 traffic	3 hours
4.	Install the Hadoop framework and create an application using Map Reduce Programming Model	2 hours
5.	Perform live QEMU-KVM VM migrations using NFS	3 hours
6.	Experiment cloud scheduling algorithms using Cloud Sim/ OPNET / CloudAnalyst tool.	3 hours
7.	Experiment cloud load balancing algorithms using Cloud Sim/ OPNET/ CloudAnalyst tool.	2 hours
8.	Monitor, visualize and analyze performance of resource utilization in cloud platforms using Grafana tool.	2 hours
9.	Configure a VLAN using cisco packet tracer and analyze traffic issues	2 hours

10.	Build container images, launch the container instance in the cloud and run an application inside the container instance in cloud	2 hours
11.	EC2 AWS – Instance Creation, Migration	2 hours
12.	DaaS – Deployment of a basic web app and add additional Functionality (Javascrpts based)	2 hours
13.	SaaS – Deployment of any SaaS application for a online Collaborative tool	2 hours
Total Laboratory Hours		30 hours
Mode of evaluation: Project/Activity		
Recommended by Board of Studies	11-02-2021	
Approved by Academic Council	No. 61	Date 18-02-2021

Course code	Course title	L	T	P	J	C
BCT3002	EMBEDDED SYSTEM ARCHITECTURE AND DESIGN	3	0	2	0	4
Pre-requisite	Microprocessor and Microcontrollers	Syllabus version				
		v. 1.0				
Course Objectives:						
<p>1. To make the student to design, implement and explore hardware and software design using appropriate techniques and tools.</p> <p>2. Ability to understand comprehensively the technologies and techniques underlying in building an embedded solution to a wearable, mobile and portable system.</p>						
Expected Course Outcome:						
<p>1. Learn embedded systems basic, system modeling, computational tools and control for embedded systems operated in real time.</p> <p>2. Extend their skills in analysis, approach, optimization and implementation</p> <p>3. Design, test and critically evaluate embedded solutions to real world situations using (embedded) computer systems interfaced to hardware.</p> <p>4. Distinguish Real Time Operating Systems (RTOS) from workstation/server Operating System (OS) and differentiate real-times scheduling from traditional OS scheduling.</p> <p>5. Identify roles of hardware and software in networked embedded systems</p> <p>6. Illustrate current and future industrial challenges and emerging embedded systems engineering trends.</p>						
Module:1	Introduction to Embedded System					4 hours
Definition of an Embedded System – Characteristics/Attributes of Embedded Systems – Challenges in embedded system design –Formalism for system design, Example- embedded system.						
Module:2	Embedded System Processor					7 hours
Embedded system processor- PIC, ARM- Programming input and output, Supervisor mode, Exception , traps, Co-processors, Memory System Mechanisms , Introduction to programming in Embedded C.						
Module:3	I/O interfacing					7 hours
CPU Bus, Memory Device, IO device - Timers, watch-dog timer, counters, UART, Sensors and actuators interfacing, LCD controller, Keypad controller, Stepper motor controller, ADC Converters, Real time Clock, Component Interfacing, Designing with microprocessor , Design Example: Alarm Clock.						
Module:4	Program Design Analysis					4 hours
Components for embedded system, Models of program, Assembly, linking, loading, Compilation techniques, Program optimization.						
Module:5	Real Time Operating System (RTOS) and Networks					9 hours
RTOS vs General purpose operating system, Multiple tasks and Multiple process, Preemptive RTOS, Priority based RTOS, Inter process communication- Shared memory communication,						

Message communication and Signals. Distributed Embedded Architectures, Networks for embedded Systems, Network based design, Internet Enabled System.			
Module:6	Layers of embedded system	6 hours	
Embedded Design life cycle, Embedded System modeling, Layers of an Embedded System – hardware layer – Application layer – Software Layer – middleware. EDLC Approaches, Interfaces to the external world.			
Module:7	Reconfigurable Embedded System	6 hours	
FPGA- The Role of FPGAs, FPGAs types, FPGAs vs Custom VLSI, Fine - Grained and Course - Grained Reconfigurable Architecture, Case Studies.			
Module:8	Recent Trends	2 hours	
		Total Lecture hours:	45 hours
Text Book(s)			
1.	Wayner Wolf, Computers as components – Principles of embedded computing system design, 4 th edition, Morgan Kaufman Publishers, 2016		
2.	Kamal R. Embedded systems: architecture, programming and design. Tata McGraw-Hill Education; 2011.		
Reference Books			
1.	Shibu, K. V. Introduction to embedded systems, 1 st edition, Tata McGraw-Hill Education, 2009.		
2.	Vahid, Frank, and Tony D. Givargis. Embedded system design: a unified hardware/software introduction, 1 st edition, John Wiley & Sons, 2006.		
3.	Zhu Y. Embedded Systems with ARM® Cortex-M3 Microcontrollers in Assembly Language and C. E-Man Press; 2014.		
4.	Wolf W. FPGA-based system design. Pearson education; 2004 Jun 15.		
Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar			
List of Experiments (Indicative)			
1	Introduction to Software Development Tools	2 hours	
2.	Programming in Embedded C	4 hours	
3.	Programming in 8051 Handling Port	5 hours	
4.	Interface to Switches, LEDs, and 7-segment displays 4.	5 hours	
5.	Interface to a Hexadecimal Keypad, Interfacing real time clock and serial port.	5 hours	
6	Interfacing stepper motor and temperature sensor	2 hours	
7.	Writing programs to perform user output to the LCD	2 hours	
8	Writing Interrupt Service Routines	5 hours	
		Total Laboratory Hours	30 hours
Mode of evaluation: CAT/FAT			
Recommended by Board of Studies		11.02.2021	
Approved by Academic Council		No. 61	Date 18.02.2021

Course code	Course Title	L	T	P	J	C
CSE3035	PRINCIPLES OF CLOUD COMPUTING	3	0	2	0	4
Pre-requisite		Syllabus version				
		V 1.0				
Course Objectives:						
<ol style="list-style-type: none"> 1. To introduce the cloud computing concepts and map reduce programming model. 2. To provide skills and knowledge about operations and management in cloud technologies so as to implement large scale systems. 3. To provide skills to design suitable cloud infrastructure that meets the business services and customer needs. 						
Expected Course Outcome:						
<ol style="list-style-type: none"> 1. Understand the evolution, principles, and benefits of Cloud Computing in order to assess existing cloud infrastructures to choose an appropriate architecture that meets business needs. 2. Decide a suitable model to capture the business needs by interpreting different service delivery and deployment models. 3. Understand virtualization foundations to cater the needs of elasticity, portability and resilience by cloud service providers. 4. Infer architectural style, work flow of real world applications and to implement the cloud applications using map reduce programming models. 5. Design a cloud framework with appropriate resource management policies and mechanism. 6. Compare operation and economic models of various trending cloud platforms prevailing in IT industry. 						
Module:1	Foundations of cloud					6 hours
Inception and need for cloud computing: Motivations from distributed computing predecessors - Evolution - Characteristics - Business Benefits – Challenges in cloud computing - Exploring the Cloud Computing Stack - Fundamental Cloud Architectures – Advanced Cloud Architectures - Specialized Cloud Architectures						
Module:2	Service Delivery and Deployment Models					5 hours
Service Models (XaaS): Infrastructure as a Service (IaaS) - Platform as a Service (PaaS) - Software as a Service(SaaS) - Deployment Models: Types of cloud - Public cloud - Private cloud - Hybrid cloud – Service level agreements - Types of SLA – Lifecycle of SLA- SLA Management						
Module:3	Cloud Resource Virtualization					5 hours
Virtualization as Foundation of Cloud – Understanding Hypervisors – Understanding Machine Image and Instances - Managing Instances – Virtual Machine Provisioning and Service Migrations						
Module:4	Cloud Computing: Applications and Paradigms					8 hours
Existing Cloud Applications and Opportunities for New Applications - Architectural Styles for Cloud Applications - Workflows: Coordination of Multiple Activities - Coordination Based on a State Machine Model: The ZooKeeper - The MapReduce Programming Model - A Case Study: The GrepTheWeb Application						
Module:5	Resource Management and Scheduling in Cloud					6 hours
Policies and Mechanisms for Resource Management – Stability of a Two-Level Resource Allocation Architecture- Feedback Control Based on Dynamic Thresholds - Coordination of Specialized Autonomic Performance Managers - A Utility-Based Model for Cloud-Based Web Services - Resource Bundling: Combinatorial Auctions for Cloud Resources – Scheduling Algorithms for						

Computing Clouds - Resource Management and Dynamic Application Scaling		
Module:6	Cloud Platforms and Application Development	9 hours
Comparing Amazon web services, Google AppEngine, Microsoft Azure from the perspective of architecture (Compute, Storage Communication) services and cost models. Cloud application development using third party APIs, Working with EC2 API – Google App Engine API - Facebook API, Twitter API.		
Module:7	Advances in Cloud	4 hours
Media Clouds - Security Clouds - Computing Clouds - Mobile Clouds – Federated Clouds – Hybrid Clouds		
Module:8	Recent Trends	2 hours
Total Lecture hours:		45 hours
Text Book(s)		
1.	Rajkumar Buyya, James Broberg, Andrzej, M. Goscinski, Cloud Computing: Principles and Paradigms, Wiley, 1 st Edition, 2013.	
2.	Sosinski, Barrie, Cloud Computing Bible, John Wiley & Sons, 1 st Edition, 2011.	
Reference Books		
1.	Marinescu, Dan C. Cloud Computing: Theory and Practice. Morgan Kaufmann, 2017.	
2.	Toby Velte, Anthony Velte, Robert Elsenpeter, Cloud Computing: A Practical Approach, Mc Graw Hill Education, 1 st Edition, 2017.	
3.	Buyya, Rajkumar, Christian Vecchiola, and S. Thamarai Selvi. Mastering Cloud Computing: Foundations and Applications Programming, Tata Mcgraw Hill, 1 st Edition, 2017.	
Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar		
List of Experiments		
1.	Configure a VM instance in your local machine and in cloud (by creating a cloud account). Allocate CPU, memory and storage space as per a specified requirement. Install Guest OS image in that instance, launch the same and confirm the successful installation of the OS by performing few OS commands.	3 hours
2.	Configure a Nested Virtual Machine (VM under another VM) in cloud and local machine. Install OS images and work with few OS commands.	2 hours
3.	Create a ssh tunnel between your server in local machine and remote clients in EC2 instances and test the connections with programs using X11 traffic	3 hours
4.	Install the Hadoop framework and create an application using Map Reduce Programming Model	2 hours
5.	Perform live QEMU-KVM VM migrations using NFS	3 hours
6.	Experiment cloud scheduling algorithms using Cloud Sim/ OPNET / CloudAnalyst tool.	3 hours
7.	Experiment cloud load balancing algorithms using Cloud Sim/ OPNET/ CloudAnalyst tool.	2 hours
8.	Monitor, visualize and analyze performance of resource utilization in cloud platforms using Grafana tool.	2 hours
9.	Configure a VLAN using cisco packet tracer and analyze traffic issues	2 hours
10.	Build container images, launch the container instance in the cloud and run an application inside the container instance in cloud	2 hours
11.	EC2 AWS – Instance Creation, Migration	2 hours

12.	DaaS – Deployment of a basic web app and add additional Functionality (Javascrpts based)	2 hours
13.	SaaS – Deployment of any SaaS application for a online Collaborative tool	2 hours
Total Laboratory Hours		30 hours
Mode of evaluation: Project/Activity		
Recommended by Board of Studies	11-02-2021	
Approved by Academic Council	No. 61	Date 18-02-2021

Course code	WIRELESS AD-HOC AND SENSOR NETWORKS	L	T	P	J	C
BCT3001		3	0	0	4	4
Pre-requisite	CSE1004 Computer Networks	Syllabus version				
		V. XX.XX				
Course Objectives:						
<ol style="list-style-type: none"> 1. Understand the design issues in ad hoc and sensor networks. 2. Learn the different types of MAC protocols. 3. Familiar with different types of adhoc routing protocols. 4. Expose to the TCP issues in adhoc networks. 5. Learn the architecture and protocols of wireless sensor networks 						
Expected Course Outcome:						
<ol style="list-style-type: none"> 1. Understanding the concepts, network architectures and applications of ad hoc and wireless sensor networks 2. Understanding challenges in the layered architecture of Ad hoc wireless networks 3. Understanding the working of MAC and Routing Protocols for ad hoc and sensor networks 4. Analyze the protocol design issues of ad hoc and sensor networks 5. Design routing protocols for ad hoc and wireless sensor networks with respect to some protocol design issues 6. Evaluate the QoS related performance measurements of ad hoc and sensor networks 7. Design Transport layer QoS protocols using Tools 						
Module:1	INTRODUCTION	5 hours	CO: 1, 2			
Fundamentals of Wireless Communication Technology – The Electromagnetic Spectrum – Radio propagation Mechanisms – Characteristics of the Wireless Channel						
Module:2	MANET and WSN	5 hours	CO: 1, 2			
Mobile Ad hoc Networks (MANETs) and wireless sensor networks (WSNs) :concepts and architectures. Applications of Ad Hoc and Sensor networks. Design Challenges in Ad hoc and Sensor Networks.						
Module:3	MAC PROTOCOLS FOR AD HOC WIRELESS NETWORKS	5 hours	CO: 1, 2,3			
Issues in designing a MAC Protocol- Classification of MAC Protocols- Contention based protocols- Contention based protocols with Reservation Mechanisms- Contention based protocols with Scheduling Mechanisms – Multi channel MAC-IEEE 802.11						
Module:4	ROUTING PROTOCOLS IN WIRELESS AD-HOC NETWORKS	6 hours	CO: 3,4,5			
Issues in designing a routing protocol for Ad hoc networks- proactive routing, reactive routing (on-demand), hybrid routing						
Module:5	TRANSPORT LAYER IN AD-HOC NETWORKS	6 hours	CO: 3,4,5			
Classification of Transport Layer solutions-TCP over Ad hoc wireless Networks.						

Module:6	WIRELESS SENSOR NETWORKS (WSNS) AND MAC PROTOCOLS	5 hours	CO: 3,4,5
Issues in Designing in MAC protocol for WSN, MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols And Wakeup Concepts – S-MAC, T-MAC, Schedule based protocols – LEACH, IEEE 802.15.4 MAC protocol, BLUETOOTH, ZIGBEE, RFID			
Module:7	WSN ROUTING, LOCALIZATION	10 hours	CO: 4,5,6
Issues in Ad- Hoc and WSN routing protocols - Secure Ad hoc routing protocols – LEACH, PEGASIS, Direct Diffusion, Energy Efficient WSN Routing protocols, QoS WSN Routing Protocols -Localization – Indoor and Sensor Network Localization-absolute and relative localization, triangulation, Transport Layer issues-QOS in WSN-Energy Efficient Design-Synchronization and basic security issues in WSN- Supporting Tools TinyOS, nesC, CONTIKIOS, COOJA, TOSSIM.			
Module:8	Recent Trends	2 hours	CO: 6,7
Total Lecture hours:		45 hours	
Text Book(s)			
1.	C. Siva Ram Murthy, and B. S. Manoj, “Ad Hoc Wireless Networks: Architectures and Protocols”, Prentice Hall Professional Technical Reference, 2008.		
2	Dargie, Walteneagus, and Christian Poellabauer. Fundamentals of wireless sensor networks: theory and practice. John Wiley & Sons, 2010.		
Reference Books			
1.	Carlos De Morais Cordeiro, Dharma Prakash Agrawal “Ad Hoc & Sensor Networks: Theory and Applications”, World Scientific Publishing Company, 2006.		
2	Feng Zhao and Leonides Guibas, “Wireless Sensor Networks”, Elsevier Publication – 2002.		
3	Holger Karl and Andreas Willig “Protocols and Architectures for Wireless Sensor Networks”, Wiley, 2005		
4	Kazem Sohraby, Daniel Minoli, & Taieb Znati, “Wireless Sensor Networks- Technology, Protocols, and Applications”, John Wiley, 2007. Anna Hac, “Wireless Sensor Network Designs”, John Wiley, 2003.		
Mode of Evaluation: Exam, Digital Assignment, Quiz			
Recommended by Board of Studies		09-09-2020	
Approved by Academic Council		No. 59	Date 24-09-2020

Some J Component Topics

1. Compare the Proactive based routing protocols in MANET
2. Compare the Re-active based routing protocols in MANET
3. Load balancing Routing Protocols in MANET
4. Secure Routing protocols in MANET
5. WSN based remote Monitoring system
6. WSN based remote Monitoring Healthcare system using ZigBEE protocol
7. WSN based remote Environment Monitoring system
8. Wireless Sensors Based System for Home Energy Consumption
9. *Military Applications Based on Wireless Sensor Networks*
10. *Agriculture Applications Based on Wireless Sensor Networks*
11. *Accident Identification System using WSN*
12. WSN based remote Logistics Monitoring system

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, stdout 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 - lseek, 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; 2 nd 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	Course title	L	T	P	J	C
ECE3051	ANALOG AND DIGITAL SIGNAL PROCESSING	3	0	2	0	4
Pre-requisite		Syllabus version				
		v. 1.0				
Course Objectives:						
<ol style="list-style-type: none"> 1. To Characterize the concepts of signals, systems in time and frequency domain 2. To analyze the analog and digital system using Laplace and Z Transforms 3. To instruct students the design of analog and digital infinite impulse response (IIR), finite impulse response (FIR) filters. 4. To teach students the usage of appropriate tools for realizing signal processing modules 						
Course Outcomes:						
<ol style="list-style-type: none"> 1. Comprehend, classify and analyze the continuous and discrete time signals and systems 2. Analyze the continuous and discrete time systems using Fourier Analysis 3. Ability to analyze the stability of the system using Laplace and Z Transforms 4. Ability to simplify the Fourier transform computations using fast algorithms 5. Comprehend the various analog filter design techniques and their digitization. 6. Ability to design the digital FIR and IIR filters. 7. Ability to analyze and exploit the real-time signal processing applications 						
Module:1	Introduction to Signals and Systems	7 hours				
<p>Continuous-time and Discrete-time Signals: Representation of signals, Signal classification, Types of signals, Operations on signals - Scaling, Shifting, Transformation of independent variables, Sampling.</p> <p>Continuous-time and Discrete-time Systems: Continuous-time convolution, Convolution sum, Correlation between signals, Cross correlation, Autocorrelation, Classification of systems - Static and dynamic, Linear and non-linear, Time-variant and time-invariant, Causal and non-causal, Stable and unstable, Impulse response and step response of systems.</p>						
Module:2	Frequency Analysis of Continuous Time Systems	6 hours				
Introduction to Fourier series, Gibbs Phenomenon, Continuous-time Fourier transform (CTFT), Existence, Properties, Magnitude and phase response, Parseval's theorem, Inverse Fourier transform.						
Module:3	Frequency Analysis of Discrete Time Systems	6 hours				
Fourier Series representation of discrete time periodic signals (DTFS), Properties of DTFS, Discrete-time Fourier transform, Properties, Inverse discrete-time Fourier transform, Frequency response-System analysis, Comparison between CTFT and DTFT.						
Module:4	System Analysis Using Laplace and Z transforms	7 hours				
<p>Relation between Laplace and Fourier transforms, Properties, Inverse Laplace transform, Solution to differential equations using Laplace transform, Region of convergence, Stability analysis for continuous time systems.</p> <p>Z-transform, Properties, s-plane to z-plane mapping, Inverse z-transform, Solution to difference equations using z-transform, Region of convergence, Stability analysis for discrete time systems</p>						
Module:5	Discrete Fourier Transform	6 hours				
Frequency domain sampling- Band limited discrete time signals- Phase and group delay- DFT- Properties. Frequency analysis of signals using DFT-FFT Algorithm-Radix-2 FFT algorithms- Applications of FFT						

Module:6	Filter Design	5 hours
Design techniques for analog low pass filter -Butterworth and Chebyshev approximations, frequency transformation, Properties -Constant group delay and zero phase filters		
Module:7	Digital FIR and IIR Filter design	6 hours
IIR filter design: Bilinear and Impulse Invariant Techniques- Spectral transformation of Digital filters.		
FIR Filter Design: Design characteristics of FIR filters with linear- phase – Frequency response of linear phase FIR filters – Design of FIR filters using window functions (Rectangular, Hamming, Hanning and Blackmann).		
Module:8	Recent Trends	2 hours
Total Lecture hours:		45 hours
Text Book(s)		
1.	Alan. V. Oppenheim, Alan. S. Willsk and S. Hamid Nawab, Signals and Systems, 2 nd Edition, Pearson Education India, 2015.	
Reference Books		
1.	S Simon Haykin and Barry VanVeen, Signals and systems, 2 nd Edition, Wiley ,2007	
2.	Oppenheim V.A.V and Schaffer R.W, Discrete – time Signal Processing, 3 rd edition, Prentice Hall, New Jersey, US,2013	
3.	Lyons, Understanding Digital Signal Processing, 1 st edition, Pearson Edition, Noida, India,2013	
Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar		
List of Experiments (Indicative)		
1	Introduction to MATLAB	2 hours
2	Time domain representation and Basics operation on Continuous and Discrete time signals	4 hours
3	Frequency domain analysis of the continuous and discrete time signals	6 hours
4	Frequency domain analysis of the continuous and discrete time systems	6 hours
5	Stability Analysis of the continuous and discrete time signals	6 hours
6	Signal processing mechanisms for IoT applications - simulation, optimization and implementation.	6 hours
Total Laboratory Hours		30 hours
Mode of Evaluation: CAT /FAT.		
Recommended by Board of Studies		11-02-2021
Approved by Academic Council	No. 61	Date 18-02-2021

PROGRAMME ELECTIVE

CSE1006	BLOCKCHAIN AND CRYPTOCURRENCY TECHNOLOGIES	L	T	F	J	C
		3	0	0	0	3
Pre-requisite	NIL	Syllabus version				
		v1.0				
Course Objectives:						
<ol style="list-style-type: none"> 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:						
<ol style="list-style-type: none"> 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 without 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 Bitcoin 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
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	Total Lecture hours:	45 hours	
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Text Book(s)

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| 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. O'Reilly 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
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Approved by Academic Council	No. 52	Date	14-09-2018
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CSE4003	CYBER SECURITY				L	T	P	J	C
					3	0	0	4	4
Pre-requisite	Nil				Syllabus version				
					v1.0				
Course Objectives:									
<ol style="list-style-type: none"> 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:									
<ol style="list-style-type: none"> 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 Remainder 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 Authentication 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				
		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

CSE3013	ARTIFICIAL INTELLIGENCE				L	T	P	J	C
					3	0	0	4	4
Pre-requisite	NIL				Syllabus version				
					v1.0				
Course Objectives:									
<ol style="list-style-type: none"> To impart artificial intelligence principles, techniques and its history To assess the applicability, strengths, and weaknesses of the basic knowledge representation, problem solving, and learning methods in solving engineering problems To develop intelligent systems by assembling solutions to concrete computational problems 									
Expected Course Outcome:									
<ol style="list-style-type: none"> Evaluate Artificial Intelligence (AI) methods and describe their foundations. Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation and learning. Demonstrate knowledge of reasoning and knowledge representation for solving realworld problems Analyze and illustrate how search algorithms play vital role in problem solving Illustrate the construction of learning and expert system 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

CSE3022		SOFT COMPUTING				
		3	0	0	4	4
Pre-requisite		NIL				
Objective of the course		The objective of this course is to introduce methods for handling imprecise and uncertain data using Rough sets, Neuro Fuzzy Systems and foster their abilities in designing and implementing optimal solutions for real-world and engineering problems using derivative free optimization techniques.				
Expected Outcome		<p>After successfully completing the course the student should be able to</p> <p>Expected</p> <ul style="list-style-type: none"> • Have a general understanding of soft computing methodologies, to deal with imprecise and uncertain data • Develop computational neural network models for some simple biological systems • Develop fuzzy models for engineering systems, particularly for control systems; • Apply derivative free optimization methods to solve real world problems • Demonstrate some applications of computational intelligence 				
Module	Topics	L Hrs				
1	Introduction to Soft Computing Soft Computing Overview – Uncertainty in data, Hard vs Soft Computing	2				
2	Neural Networks Introduction, RBF Networks, Self-Organizing Map, Boltzmann Machines, Convolutional Neural Networks	7				
3	Fuzzy Systems Fuzzy Sets, Fuzzy Relations, and Membership functions, Properties of Membership functions, Fuzzification and Defuzzification	7				
4	Fuzzy logic Fuzzy Rule based systems, Fuzzy Decision making, Fuzzy Classification, Fuzzy C-Means Clustering	7				
5	Rough Sets Rough Sets – Definition, Upper and Lower Approximations, Boundary Region, Decision Tables and Decision Algorithms. Properties of Rough Sets. Rough K-means clustering, Rough Support Vector Clustering	7				
6	Optimization Techniques Introduction, Genetic Algorithm, Memetic Algorithms, Particle Swarm Optimization, Ant Colony Optimization, Frog-Leaping Hybrid	8				

	Systems	
7	GA Based Back Propagation Networks, Fuzzy Back Propagation Networks, Evolutionary Ensembles	5
8	Recent trends	2
	Total hours	45

Reference Books

1. S.N. Sivanandham and S.N. Deepa, "Principles of Soft Computing", 2nd Edition, Wiley Publications.
2. Andries P. Engelbrecht, "Computational Intelligence: An Introduction", John Wiley & Sons, 2007
3. Laurene V. Fausett "Fundamentals of Neural Networks: Architectures, Algorithms And Applications", Pearson, 1993
4. Simon Haykin "Neural Networks and Learning Machines" Prentice Hall, 2008.
5. Timothy Ross, "Fuzzy Logic with Engineering Applications", Third Edition, Wiley, 2010
6. S. N. Sivanandam, S. Sumathi and S. N. Deepa, "Introduction to Fuzzy Logic using Matlab" – Springer, 2007.
7. Samir Roy, Udit Chakraborty, "Introduction to Soft Computing Neuro Fuzzy Genetic Algorithms", Pearson Education, 2013.
8. Witold Pedrycz, Andrzej Skowron, Vladik Kreinovich "Handbook of Granular Computing", Wiley, 2008

Approved by Academic Council	No. 41	Date	19-06-2016
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Project J Component:

- # Generally a team project consists of four to six members
- # Down to earth application and innovative idea should have been attempted
- # Report in Digital format with all drawings using software package to be submitted.
- # Assessment on a continuous basis with a min of 3 reviews.

The following is the sample project that can be given to students to be implemented in any programming languages.

- Develop Fuzzy Decision-Making for Job Assignment Problem
- Implement TSP using Optimization Techniques
- Develop a suitable method for Health Care Application using Neuro-Fuzzy systems
- Develop a suitable method for Face Recognition System
- Layout Optimization using Genetic Algorithms
- Fault Diagnosis using rough set theory
- Software safety analysis using rough sets

A Neuro-fuzzy Approach to Bad Debt Recovery in Healthcare

Course Code	Course Title	L	T	P	J	C
CSE3034	NATURE INSPIRED COMPUTING	3	0	0	0	3
Pre-requisite		Syllabus Version				
		v1.0				
Course Objectives:						
<ol style="list-style-type: none"> 1. To establish basic knowledge in NP hard problems and understand the need for approximation algorithms. 2. Design algorithms that include operators, representations, fitness functions and potential hybridizations for non-trivial problems. 3. Design algorithms that utilize the collective intelligence of simple organisms to solve problems. 4. Design and implement an artificial neural network that employs learning to solve non-trivial problems. 						
Expected Course Outcome:						
<ol style="list-style-type: none"> 1. Understand fundamental concepts of NP-hardness and computational complexity 2. Understand the strengths, weaknesses and appropriateness of nature-inspired algorithms. 3. Apply nature-inspired algorithms to optimization, design and learning problems. 4. Analyze the Behavior systems of nature inspired algorithm applied in real world problems. 5. Understand the theory behind the design of immune networks and DNA computing and their potential applications. 						
Module:1	Introduction to Computational Problems	3 hours				
Computational Problems, Decision Problem, Optimization Problem, Hardness in Optimization Problems, NP class, NP-Hard, examples for NP-Hard problems, tackling NP-Hard problems, Rationale for seeking inspiration from nature						
Module:2	Evolutionary Systems	7 hours				
Pillars of Evolutionary Theory, The Genotype , Artificial Evolution, Genetic representations, Initial Population ,Fitness Functions, Selection and Reproduction ,Genetic Operators ,Evolutionary Measures ,Types of Evolutionary Algorithms						
Module:3	Collective Systems	7 hours				
Particle Swarm Optimization Algorithm, Hybrid PSO algorithms, Ant Colony Optimization, Artificial Bee Colony, Firefly Algorithm						
Module:4	Artificial Neural Networks	6 hours				
History, Mathematical model of neuron, ANN architectures, Learning rules Backpropagation network, Backpropagation learning and its applications, Variants of BPA.						
Module:5	Behavioral systems	7 hours				
Behavior in Cognitive Science , Behavior in Artificial Intelligence , Behavior-Based Robotics , Biological Inspiration for Robots , Robots as Biological Models, Robot Learning , Evolution of Behavioral Systems Evolution and Learning in Behavioral Systems , Evolution and Neural Development in Behavioral Systems.						

Module:6	Immuno Computing	6 hours	
Introduction- Immune System, Physiology and main components, Immune Network Theory- Danger Theory, Evaluation Interaction- Immune Algorithms, Bone Marrow Models , Forest's Algorithm, Artificial Immune Networks.			
Module:7	DNA Computing	7 hours	
DNA Computing: Motivation, DNA Molecule , Adleman's experiment , Test tube programming language, Universal DNA Computers , PAM Model , Splicing Systems , Lipton's Solution to SAT Problem , Scope of DNA Computing , From Classical to DNA Computing.			
Module:8	Recent Trends	2 hours	
		Total Lecture Hours:	45 hours
Text Book(s)			
1.	Xin-She Yang, “Nature-Inspired Computation and Swarm Intelligence Algorithms, Theory and Applications”, Elsevier, Academic Press, 2020.		
Reference Books			
1.	Leandro Nunes de Castro, "Fundamentals of Natural Computing, Basic Concepts, Algorithms and Applications", Chapman & Hall/ CRC, Taylor and Francis Group, 2007.		
2.	Floreano D. and Mattiussi C., "Bio-Inspired Artificial Intelligence: Theories, Methods, and Technologies", MIT Press, Cambridge, MA, 2008.		
3.	Licheng Jiao, Ronghua Shang , Fang Liu , Weitong Zhang , Brain and Nature-Inspired Learning, Computation and Recognition, Elsevier, 2020.		
Recommended by Board of Studies		11-02-2021	
Approved by Academic Council		No. 61	Date 18-02-2021

Course Code	Course Title	L	T	P	J	C
CSE3044	CRYPTOGRAPHY AND NETWORK SECURITY	3	0	0	0	3
Pre-requisite	Nil	Syllabus Version				
		v1.0				
Course Objectives:						
<ol style="list-style-type: none"> 1. To acquaint students with the basic concepts in security mechanism, classical and traditional Encryption techniques. 2. To teach students the significance of message authentication and digital signature in cryptography. 3. To acquaint the students to the different types of network security and its significance 						
Expected Course Outcome:						
<ol style="list-style-type: none"> 1. Learn to analyze the security of the in-built cryptosystems. 2. Know the fundamental mathematical concepts related to security. 3. Develop cryptographic algorithms for information security. 4. Comprehend the various types of data integrity and authentication schemes. 5. Understand the various types of network security, threats and attacks. 						
Module:1	Introduction to Security	5 hours				
Security properties (confidentiality, integrity and availability), security vulnerabilities, threats and attacks, security models, policies and mechanisms Security Services and Mechanisms, Encryption Techniques, Basic notions of security protocol						
Module:2	Number Theory Concepts	8 hours				
Number theory - Group, Rings, Fields, Galois field, Euclidean algorithm, Principles of Pseudorandom Number Generation, Fermat's and Euler's Theorems, The Chinese Remainder Theorem, Discrete Logarithms, Elliptic Curve Arithmetic						
Module:3	Symmetric Ciphers	6 hours				
Block Ciphers - DES, AES, Blowfish, modes of operation, Stream Ciphers-RC4, Linear and Differential cryptanalysis, Homomorphic encryption, PALISADE, SEAL, and HElib.						
Module:4	Asymmetric Ciphers	6 hours				
Public-Key Cryptography – RSA - Diffie-Hellman Key Exchange, ElGamal Cryptosystem, Elliptic Curve Cryptography, PKI, Privacy Preservation, Perturbation, K-anonymity, L-diversity, Randomization, Taxonomy tree, Condensation, and Cryptographic approach						
Module:5	Data Integrity and Key Management	6 hours				
Data Integrity in storage - Mirroring – RAID parity- Check summing - Access control for maintenance of integrity – Role based Access control- Discretionary Access control and Rule based access control - Cryptographic Hash Functions, Message Authentication Codes, SHA-3 algorithm, Digital Signatures- DSA algorithm, Key Management and Distribution, User Authentication Protocols, Kerberos – Key Distribution Centre- Trust Management						
Module:6	Network Security	6 hours				
E-Mail Security-PGP,S/MIME, Transport-Level Security, IP Security, WLAN Security – Firewalls, Web Security						

Module:7	Threats & Attacks	6 hours	
Buffer overflow, DoS, DDoS, birthday attack, Intrusion Detection and Prevention, SQL Injections- Phishing-Password Attacks – Computer Virus			
Module:8	Recent Trends	2 hours	
Total Lecture hours:			
45 hours			
Text Book(s)			
1.	Stallings, William, “Cryptography and network security: principles and practice”, Pearson, 2017.		
2	Behrouz A.Forouzan : Cryptography & Network Security – The McGraw Hill Company, 2010.		
Reference Books			
1	Wade Trappe, Lawrence C. Washington, Introduction to Cryptography with Coding Theory, 3rd Edition, Pearson, 2020.		
2	Neal Koblitz, A course in number theory and cryptography, Springer, 1994.		
3	Shreya Dey , Ashraf Hossain , “Session-Key Establishment and Authentication in a Smart Home Network Using Public Key Cryptography”, IEEE Sensors Letters , Volume: 3, Issue: 4 , April 2019.		
Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar			
Mode of evaluation: Project/Activity			
Recommended by Board of Studies		11-02-2021	
Approved by Academic Council		No. 61	Date 18-02-2021

Course Code	Course Title	L	T	P	J	C
CSE3055	DEEP LEARNING	3	0	0	4	4
Prerequisite:	Nil	Syllabus Version				
Antirequisite:		v1.0				
Course Objectives:						
<ol style="list-style-type: none"> 1. To present theoretical foundations, algorithms, methodologies, and applications of neural networks and deep Learning. 2. To design and develop an application-specific deep learning models and to provide the practical knowledge 3. To apply the deep learning models in various real world applications. 						
Expected Course Outcomes:						
<ol style="list-style-type: none"> 1. Recognize the characteristics of deep learning models that are useful to solve real-world problems. 2. Understand different methodologies to create application-specific Deep Neural Networks 3. Identify and apply appropriate deep learning algorithms for analyzing the data for variety of problems. 4. Design and Implement different deep learning algorithms. 5. Develop deep learning models to encode the original data and reconstruct data. 6. Generate the generative models for unsupervised learning task and choose appropriate models for real world problems. 						
Module:1	Machine Learning Basics	4 hours				
Learning algorithms, Maximum likelihood estimation, Building machine learning algorithm, Neural Networks Multilayer Perceptron, Back-propagation algorithm and its variants Stochastic gradient decent, Curse of Dimensionality						
Module:2	Introduction to Deep Learning & Architectures	8 hours				
Machine Learning Vs. Deep Learning, Representation Learning, Width Vs. Depth of Neural Networks, Activation Functions: RELU, LRELU, ERELU, Unsupervised Training of Neural Networks, Regularization- dropout, drop connect, optimization methods for neural networks- Adagrad, adadelata, rmsprop, adam, NAG.						
Module:3	Convolutional Neural Networks & Transfer Learning	8 hours				
Architectural Overview – Motivation - Layers – Filters – Parameter sharing – Regularization, Popular CNN Architectures: LeNet, ResNet, Vggnet, AlexNet. Transfer learning Techniques - DenseNet, PixelNet.						
Module:4	Training Neural Networks	9 hours				
Deep Learning Hardware and Software - CPUs, GPUs, TPUs, PyTorch, TensorFlow, Dynamic vs Static computation graphs, Data Preprocessing-Data Augmentation, batch normalization, Transfer Learning- Deep Transfer Learning Strategies, Update rules, hyperparameter tuning, Learning rate scheduling, variants of CNN- ResNet, GoogleNet, Xception, etc						
Module:5	Sequence Modelling – Recurrent and Recursive Nets	6 hours				
Recurrent Neural Networks, Bidirectional RNNs – Encoder-decoder sequence to sequence						

architectures - Backpropagation Through Time for training RNN, Long Short Term Memory Networks.			
Module:6	Auto Encoders	6 hours	
Under complete Autoencoders, Regularized Autoencoders, Sparse Autoencoders, Denoising Autoencoders, Representational Power, Layer, Size, and Depth of Autoencoders, Stochastic Encoders and Decoders – Contractive Encoders.			
Module:7	Deep Generative Models	2 hours	
Deep Belief networks – Boltzmann Machines – Deep Boltzmann Machine - Generative Adversarial Networks.			
Module:8	Recent Trends	2 hours	
		Total Lecture Hours:	45 hours
Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar			
Text Books			
1.	Ian Goodfellow, Yoshua Bengio and Aaron Courville, “ Deep Learning”, MIT Press, 2017.		
2.	Josh Patterson, Adam Gibson "Deep Learning: A Practitioner's Approach", O'Reilly Media, 2017		
Reference Books			
1.	Kevin P. Murphy "Machine Learning: A Probabilistic Perspective", The MIT Press, 2012.		
2.	Ethem Alpaydin,"Introduction to Machine Learning”, MIT Press, Prentice Hall of India, Third Edition 2014.		
3.	Giancarlo Zaccaro, Md. Rezaul Karim, Ahmed Menshawy "Deep Learning with TensorFlow: Explore neural networks with Python", Packt Publisher, 2017.		
Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar			
Project Component:			
The following is the sample project that can be given to students to be implemented:			
1. Applying the Convolution Neural Network on computer vision problems			
2. Applying the Deep Learning Models in the field of Natural Language Processing			
3. Applying the Autoencoder algorithms for encoding the real-world data			
4. Applying Generative Adversarial Networks for image generation and unsupervised tasks.			
Mode of evaluation: Project/Activity			
Recommended by Board of Studies		11-02-2021	
Approved by Academic Council	No. 61	Date	18-02-2021

CSE3053	BIG DATA ANALYTICS	L	T	P	J	C
		3	0	0	4	4
Pre-requisite	NIL	Syllabus Version				
		v1.0				
Course Objectives:						
<ol style="list-style-type: none"> 1. To understand the need of Hadoop framework to process the Big Data 2. Introduction to theoretical techniques and practical tools used in data analytics 3. Applications in various engineering and scientific domains. 						
Expected Course Outcome:						
<ol style="list-style-type: none"> 1. Discuss the challenges and their solutions in Big Data and work on Hadoop Framework 2. Understand the concepts of R programming and its applications. 3. Implement different statistical methods on sample data using R Programming library. 4. Analyse the Big Data using Map-reduce programming in Both Hadoop and Spark framework. 5. Demonstrate spark programming with different programming languages. 6. Lab: Practice different analytics tools and implement data analysis applications/models by taking sample data sets. 						
Module:1	Introduction Big Data	3 hours				
Data Storage and Analysis - Characteristics of Big Data – Big Data Analytics - Typical Analytical Architecture – Requirement for new analytical architecture – Challenges in Big Data Analytics – Need of big data frameworks, Introduction to Hadoop ecosystems.						
Module:2	Hadoop Framework	6 hours				
Hadoop Framework: Hadoop – Requirement of Hadoop Framework - Design principle of Hadoop – Comparison with other system - Hadoop Components – Hadoop Daemon’s – Working with HDFS Commands						
Module:3	Mapreduce Programming	7 hours				
Map Reduce working principle, Map Reduce types and formats, MapReduce features, Combiner optimization, Map side join, Reduce SideJoin, Secondary sorting, Pipelining MapReduce jobs.						
Module:4	R Programming	6 hours				
History and overview of R , Install and configuration of R programming environment , Basic language elements and data structures, Data input/output, Data storage formats , Subsetting objects.						
Module:5	Visualization Using R	7 hours				
Vectorization, Control structures, Functions, Scoping Rules, Loop functions, R Graphs and visualization using lattice, ggplot2						
Module:6	Spark Framework	7 hours				
Overview of Spark – Hadoop vs Spark – Cluster Design – Cluster Management – performance, Application Programming interface(API): Spark Context, Resilient Distributed Datasets, Creating RDD, RDD Operations, Saving RDD - Lazy Operation – Spark Jobs-spark ML library.						

Module:7	Data Analysis Models	7 hours	
Association and correlation analysis- regression models- Predictive analytics -Exploratory analysis. Prescriptive analysis.			
Module:8	Recent Trends	2 hours	
Total Lecture Hours:			
		45 hours	
Text Book(s)			
<ol style="list-style-type: none"> 1. Garrett Grolemond, "Hands-On Programming with R", O'Reilly Media, Inc, 2014. 2. Seema Acharya, SubhashiniChellapan, "Big Data and Analytics", Wiley, 2015. 3. Mike Frampton, "Mastering Apache Spark", Packt Publishing, 2015. 			
Reference Books			
<ol style="list-style-type: none"> 1. Nick Pentreath, Machine Learning with Spark, Packt Publishing, 2015. 2. Donald Miner, Adam Shook, "MapReduce Design Pattern", O'Reilly, 2012 3. Raj Kamal, PreetiSaxena, "Big Data Analytics:Introduction to Hadoop, Spark, and Machine-Learning", McGraw-Hill Education, 2019. 			
Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar			
Project Component:			
Projects may be given as group projects.			
The project component should be taken as real time applications like e-commerce, social medial, streaming data and so on . The students should use the technologies learnt in theory to develop and implement the project.			
Mode of assessment: Project/Activity			
Recommended by Board of Studies	11-02-2021		
Approved by Academic Council	No. 61	Date	18-02-2021

CSE4022	NATURAL LANGUAGE PROCESSING	L	T	P	J	C
		3	0	0	4	4
Pre-requisite	Nil	Syllabus version				
		v1.0				
Course Objectives:						
<ol style="list-style-type: none"> 1. To introduce the fundamental concepts and techniques of Natural language Processing for analyzing words based on Morphology and CORPUS. 2. To examine the NLP models and interpret algorithms for classification of NLP sentences by using both the traditional, symbolic and the more recent statistical approach. 3. To get acquainted with the algorithmic description of the main language levels that includes morphology, syntax, semantics, and pragmatics for information retrieval and machine translation applications. 						
Expected Course Outcome:						
<ol style="list-style-type: none"> 1. Understand the principles and Process the Human Languages Such as English and other Indian Languages using computers. 2. Creating CORPUS linguistics based on digestive approach (Text Corpus method) 3. Demonstrate understanding of state-of-the-art algorithms and techniques for text-based processing of natural language with respect to morphology. 4. Perform POS tagging for a given natural language. 5. Select a suitable language modelling technique based on the structure of the language. 6. Check the syntactic and semantic correctness of sentences using grammars and labelling. 7. Develop Computational Methods for Real World Applications and explore deeplearning based NLP 						
Module:1	INTRODUCTION TO NLP	3 hours				
Introduction to various levels of natural language processing, Ambiguities and computational challenges in processing various natural languages. Introduction to Real life applications of NLP such as spell and grammar checkers, information extraction, question answering, and machine translation.						
Module:2	TEXT PROCESSING	6 hours				
Character Encoding, Word Segmentation, Sentence Segmentation, Introduction to Corpora, Corpora Analysis.						
Module:3	MORPHOLOGY	6 hours				
Inflectional and Derivation Morphology, Morphological Analysis and Generation using finite state transducers.						
Module:4	LEXICAL SYNTAX	6 hours				
Introduction to word types, POS Tagging, Maximum Entropy Models for POS tagging, Multi-word Expressions.						
Module:5	LANGUAGE MODELING	6 hours				
The role of language models. Simple N-gram models. Estimating parameters and smoothing. Evaluating language models.						
Module:6	SYNTAX & SEMANTICS	10 hours				
Introduction to phrases, clauses and sentence structure, Shallow Parsing and Chunking, Shallow Parsing with Conditional Random Fields (CRF), Lexical Semantics, Word Sense Disambiguation, WordNet, Thematic Roles, Semantic Role Labelling with CRFs.						
Module:7	APPLICATIONS OF NLP	6 hours				

NL Interfaces, Text Summarization, Sentiment Analysis, Machine Translation, Question answering.			
Module:8 RECENT TRENDS			
			2 hours
Recent Trends in NLP			
		Total Lecture hours:	45 hours
Text Book(s)			
1.	Daniel Jurafsky and James H. Martin “Speech and Language Processing”, 3rd edition, Prentice Hall, 2009.		
Reference Books			
1.	Chris Manning and Hinrich Schütze, “Foundations of Statistical Natural Language Processing”, 2nd edition, MIT Press Cambridge, MA, 2003.		
2.	Nitin Indurkha, Fred J. Damerau “Handbook of Natural Language Processing”, Second Edition, CRC Press, 2010.		
3.	James Allen “Natural Language Understanding”, Pearson Publication 8th Edition. 2012.		
Mode of Evaluation: Continuous Assessment Test –I (CAT-I), Continuous Assessment Test –II (CAT-II), Digital Assignments/ Quiz / Completion of MOOC, Final Assessment Test (FAT).			
Recommended by Board of Studies		04-04-2014	
Approved by Academic Council		No. 37	Date 16-06-2015

CSE3001	SOFTWARE ENGINEERING				L	T	F	J	C
					2	0	2	4	4
Pre-requisite	NIL				Syllabus version				
					v1.0				
Course Objectives:									
<ol style="list-style-type: none"> 1. To introduce the essential software engineering concepts involved 2. To impart skills in the design and implementation of efficient software systems across disciplines 3. To familiarize engineering practices and standards used in developing software products and components 									
Expected Course Outcome:									
<ol style="list-style-type: none"> 1. Apply the principles of the engineering processes in software development. 2. Demonstrate software project management activities such as planning, scheduling and Estimation. 3. Model the requirements for the software projects. 4. Design and Test the requirements of the software projects. 5. Implement the software development processes activities from requirements to validation and verification. 6. Apply and evaluate the standards in process and in product. 									
Module:1	OVERVIEW OF SOFTWARE ENGINEERING				5 hours				
Nature of Software, Software Engineering, Software process, project, product, Process Models Classical Evolutionary models, Overview of System Engineering									
Module:2	INTRODUCTION TO SOFTWARE PROJECT MANAGEMENT				3 hours				
Planning scope, milestones deliverables, Risk Management, Metrics Measurement									
Module:3	MODELLING REQUIREMENTS				6 hours				
Requirements Engineering process Requirement Elicitation, System Modelling - Requirements Specification and Requirement Validation									
Module:4	SOFTWARE DESIGN				4 hours				
Design concepts and principles - Abstraction - Refinement - Modularity Cohesion coupling, Architectural design, Detailed Design Transaction Transformation, Refactoring of designs, Object-oriented Design User-Interface Design									
Module:5	VALIDATION and VERIFICATION				4 hours				
Strategic Approach to Software Testing, Testing Fundamentals Test Plan, Test Design, Test Execution, Reviews, Inspection Auditing									
Module:6	SOFTWARE EVOLUTION				4 hours				
Software Maintenance, Types of Maintenance, Software Configuration Management, Overview of RE-engineering Reverse Engineering									
Module:7	QUALITY ASSURANCE				2 hours				
Product Process Metrics, Quality Standards Models ISO, TQM, Six-Sigma									
Module:8	RECENT TRENDS				2 hours				
Recent Trends in Software Design/Specialized Software Testing, Related Tools and Standards									

	Total Lecture hours:	30 hours	
Text Book(s)			
1.	Roger Pressman, Software Engineering: A Practitioner's Approach, 7th Edition, McGraw-Hill, 2010.		
Reference Books			
1.	Ian Sommerville, Software Engineering, 9th Edition, Addison-Wesley, 2016		
2.	Pankaj Jalote, A Concise Introduction to Software Engineering, Springer, 2008		
3.	William E. Lewis, Software Testing and Continuous Quality Improvement, Third Edition, Auerbach Publications, 2008		
Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar			
List of Challenging Experiments (Indicative)			
1.	Work Break-down Structure (Process Based, Product Based, Geographic Based and Role Based)		3 hours
2.	Estimations Cost and Schedule		3 hours
3.	Entity Relationship Diagram, Context flow diagram, DFD (Structural Modeling and Functional Modeling)		4 hours
4.	State Transition Diagrams (Behavioral Modeling)		4 hours
5.	System Requirements Specification		4 hours
6.	UML diagrams for OO Design		4 hours
7.	Tools for Version Control		3 hours
8.	Black-box, White-box testing		3 hours
9.	Non-functional testing		2 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

CSE4019	IMAGE PROCESSING				L	T	P	J	C
					3	0	0	4	4
Pre-requisite	Nil				Syllabus version				
					v1.0				
Course Objectives:									
<ol style="list-style-type: none"> 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:									
<ol style="list-style-type: none"> 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, Multiplication, 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-Smoothing spatial filters- Sharpening spatial filters- Discrete Fourier Transform-Discrete Cosine Transform-Haar Transform -Hough Transform-Frequency filtering-Smoothing 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- Huffman 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	
		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

CSE4020	MACHINE LEARNING				L	T	P	J	C
					2	0	2	4	4
Pre-requisite	Nil				Syllabus version				
					v1.0				
Course Objectives:									
<ol style="list-style-type: none"> 1. Ability to comprehend the concept of supervised and unsupervised learning techniques 2. Differentiate regression, classification and clustering techniques and to implement their algorithms. 3. To analyze the performance of various machine learning techniques and to select appropriate features for training machine learning algorithms. 									
Expected Course Outcome:									
<ol style="list-style-type: none"> 1. Recognize the characteristics of machine learning that makes it useful to solve real-world problems. 2. Provide solution for classification and regression approaches in real-world applications. 3. Gain knowledge to combine machine learning models to achieve better results. 4. Choose an appropriate clustering technique to solve real world problems. 5. Realize methods to reduce the dimension of the dataset used in machine learning algorithms. 6. Choose a suitable machine learning model, implement and examine the performance of the chosen model for a given real world problems. 7. Understand cutting edge technologies related to machine learning applications. 									
Module:1	Introduction to Machine Learning				3 hours				
What is Machine Learning, Examples of Various Learning Paradigms, Perspectives and Issues, Version Spaces, Finite and Infinite Hypothesis Spaces, PAC Learning									
Module:2	Supervised Learning - I				4 hours				
Learning a Class from Examples, Linear, Non-linear, Multi-class and Multi-label classification, Generalization error bounds: VC Dimension, Decision Trees: ID3, Classification and Regression Trees, Regression: Linear Regression, Multiple Linear Regression, Logistic Regression.									
Module:3	Supervised Learning - II				5 hours				
Neural Networks: Introduction, Perceptron, Multilayer Perceptron, Support vector machines: Linear and Non-Linear, Kernel Functions, K-Nearest Neighbors									
Module:4	Ensemble Learning				3 hours				
Ensemble Learning Model Combination Schemes, Voting, Error-Correcting Output Codes, Bagging: Random Forest Trees, Boosting: Adaboost, Stacking									
Module:5	Unsupervised Learning - I				7 hours				
Introduction to clustering, Hierarchical: AGNES, DIANA, Partitional : K-means clustering, K-Mode Clustering, Self-Organizing Map, Expectation Maximization, Gaussian Mixture Models									
Module:6	Unsupervised Learning - II				3 hours				
Principal components analysis (PCA), Locally Linear Embedding (LLE), Factor Analysis									
Module:7	Machine Learning in Practice				3 hours				
Machine Learning in Practice Design, Analysis and Evaluation of Machine Learning Experiments, Feature selection Mechanisms, Other Issues: Imbalanced data, Missing Values, Outliers									
Module:8	Recent Trends				2 hours				
Industry Expert talk									

		Total Lecture hours:	30 hours	
Text Book(s)				
1.	Ethem Alpaydin, Introduction to Machine Learning , MIT Press, Prentice Hall of India, Third Edition 2014			
Reference Books				
1.	Sergios Theodoridis, Konstantinos Koutroumbas, Pattern Recognition, Academic Press, 4th edition, 2008, ISBN:9781597492720.			
2.	Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar "Foundations of Machine Learning, MIT Press, 2012			
3.	Tom Mitchell, Machine Learning, McGraw Hill, 3rd Edition, 1997.			
4.	Charu C. Aggarwal, Data Classification Algorithms and Applications , CRC Press, 2014			
5.	Charu C. Aggarwal, DATA CLUSTERING Algorithms and Applications, CRC Press, 2014			
6.	Kevin P. Murphy "Machine Learning: A Probabilistic Perspective", The MIT Press, 2012			
Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar				
List of Challenging Experiments (Indicative)				
1.	Implement Decision Tree learning.			2 hours
2.	Implement Logistic Regression.			2 hours
3.	Implement classification using Multilayer perceptron.			2 hours
4.	Implement classification using SVM			2 hours
5.	Implement Adaboost			2 hours
6.	Implement Bagging using Random Forests			2 hours
7.	Implement K-means Clustering to Find Natural Patterns in Data.			2 hours
8.	Implement Hierarchical clustering.			2 hours
9.	Implement K-mode clustering			2 hours
10.	Implement Principle Component Analysis for Dimensionality Reduction.			2 hours
11.	Implement Multiple Correspondence Analysis for Dimensionality Reduction.			2 hours
12.	Implement Gaussian Mixture Model Using the Expectation Maximization.			2 hours
13.	Evaluating ML algorithm with balanced and unbalanced datasets.			2 hours
14.	Comparison of Machine Learning algorithms.			2 hours
15.	Implement k-nearest neighbors algorithm			2 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

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						
<ol style="list-style-type: none"> 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						
<ul style="list-style-type: none"> • 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 Ref Links: https://www.iso.org/isoiec-27001-information-security.html	
8.	https://csrc.nist.gov/publications/detail/sp/800-55/rev-1/final	
9.	https://www.sans.org/reading-room/whitepapers/threats/paper/34180	
	https://www.sscnasscom.com/qualification-pack/SSC/Q0901/	
List of Experiments (Indicative)		

	<ul style="list-style-type: none"> • 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						
<ol style="list-style-type: none"> 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						
<ul style="list-style-type: none"> • 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.	David Kennedy, Jim O’Gorman, Devon Kearns, and Mati Aharoni, Metasploit The Penetration Tester’s Guide, No Starch Press, 2014	
4.	Ref Links:	
5.	https://www.iso.org/iso/iec-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.	<ul style="list-style-type: none"> • 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

UNIVERSITY CORE

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:							
<ol style="list-style-type: none"> To enhance students' knowledge of grammar and vocabulary to read and write error-free language in real life situations. To make the students' practice the most common areas of written and spoken communications skills. To improve students' communicative competency through listening and speaking activities in the classroom. 							
Expected Course Outcome:							
<ol style="list-style-type: none"> Develop a better understanding of advanced grammar rules and write grammatically correct sentences. Acquire wide vocabulary and learn strategies for error-free communication. Comprehend language and improve speaking skills in academic and social contexts. Improve listening skills so as to understand complex business communication in a variety of global English accents through proper pronunciation. 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). <i>High School English Grammar & Composition</i> . New Delhi: Sultan Chand Publishers.	
2	Kumar, Sanjay,; Pushp Latha. (2018) <i>English Language and Communication Skills for Engineers</i> , India: Oxford University Press.	

Reference Books		
1.	Guptha S C, (2012) <i>Practical English Grammar & Composition</i> , 1 st Edition, India: Arihant Publishers	
2.	Steven Brown, (2011) Dorolyn Smith, <i>Active Listening 3</i> , 3 rd Edition, UK: Cambridge University Press.	
3.	Liz Hamp-Lyons, Ben Heasley, (2010) <i>Study Writing</i> , 2 nd Edition, UK: Cambridge University Pres.	
4.	Kenneth Anderson, Joan Maclean, (2013) Tony Lynch, <i>Study Speaking</i> , 2 nd Edition, UK: Cambridge, University Press.	
5.	Eric H. Glendinning, Beverly Holmstrom, (2012) <i>Study Reading</i> , 2 nd Edition, UK: Cambridge University Press.	
6.	Michael Swan, (2017) <i>Practical English Usage</i> (Practical English Usage), 4th edition, UK: Oxford University Press.	

7.	Michael McCarthy, Felicity O'Dell, (2015) <i>English Vocabulary in Use Advanced</i> (South Asian Edition), UK: Cambridge University Press.
8.	Michael Swan, Catherine Walter, (2012) <i>Oxford English Grammar Course Advanced</i> , Feb, 4 th Edition, UK: Oxford University Press.
9.	Watkins, Peter. (2018) <i>Teaching and Developing Reading Skills: Cambridge Handbooks for Language teachers</i> , UK: Cambridge University Press.
10.	(<i>The Boundary by Jhumpa Lahiri</i>) 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:						
<ol style="list-style-type: none"> 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:						
<ol style="list-style-type: none"> 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. <i>New English File: Advanced Students Book</i> . Paperback. Oxford University Press, UK, 2017.	
2.	Rizvi, Ashraf. <i>Effective Technical Communication</i> . McGraw-Hill India, 2017.	
Reference Books		
1.	Oxenden, Clive and Christina Latham-Koenig, <i>New English File: Advanced: Teacher's Book with Test and Assessment</i> . CD-ROM: Six-level General English Course for Adults. Paperback. Oxford University Press, UK, 2013.	
2.	Balasubramanian, T. <i>English Phonetics for the Indian Students: A Workbook</i> . Laxmi Publications, 2016.	
3.	Philip Seargeant and Bill Greenwell, <i>From Language to Creative Writing</i> . Bloomsbury Academic, 2013.	
4.	Krishnaswamy, N. <i>Eco-English</i> . Bloomsbury India, 2015.	
5.	Manto, Saadat Hasan. <i>Selected Short Stories</i> . Trans. Aatish Taseer. Random House India, 2012.	

6.	Ghosh, Amitav. <i>The Hungry Tide</i> . Harper Collins, 2016.	
7.	Ghosh, Amitav. <i>The Great Derangement: Climate Change and the Unthinkable</i> . Penguin Books, 2016.	
8.	<i>The MLA Handbook for Writers of Research Papers</i> , 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:						
<ol style="list-style-type: none"> 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:						
<ol style="list-style-type: none"> 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. <i>Technical Communication: Principles and Practice</i> , 3 rd edition, Oxford University Press, 2015.	
Reference Books		
1	Basu B.N. <i>Technical Writing</i> , 2011 Kindle edition	
2	Arathoon, Anita. <i>Shakespeare's The Merchant of Venice</i> (Text with Paraphrase), Evergreen Publishers, 2015.	
3	Kumar, Sanjay and Pushp Lata. <i>English Language and Communication Skills for Engineers</i> , Oxford University Press, India, 2018.	
4	Frantisek, Burda. <i>On Transcultural Communication</i> , 2015, LAP Lambert Academic Publishing, UK.	
5	Geever, C. Jane. <i>The Foundation Center's Guide to Proposal Writing</i> , 5 th Edition, 2007, Reprint 2012 The Foundation Center, USA.	
6	Young, Milena. <i>Hacking Your Statement of Purpose: A Concise Guide to Writing Your SOP</i> , 2014 Kindle Edition.	
7	Ray, Ratri, <i>William Shakespeare's Hamlet</i> , The Atlantic Publishers, 2011.	
8	C Muralikrishna & Sunitha Mishra, <i>Communication Skills for Engineers</i> , 2 nd 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

CHY1701	Engineering Chemistry	L	T	P	J	C
		3	0	2	0	4
Pre-requisite	Chemistry of 12 th standard or equivalent	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, 9 th Reprint, 2015. 3. B. Sivasankar, Engineering Chemistry 1 st Edition, Mc Graw Hill Education (India), 2008 4. Photovoltaic solar energy : From fundamentals to Applications , Ang le Reinders, Pierre Verlinden, Wilfried van Sark, Alexandre Freundlich, Wiley publishers, 2017.		
Reference Books			
2.	1. O.V. Roussak and H.D. Gesser, <i>Applied Chemistry-A Text Book for Engineers and Technologists</i> , Springer Science Business Media, New York, 2 nd Edition, 2013. 2. S. S. Dara, <i>A Text book of Engineering Chemistry</i> , S. Chand & Co Ltd., New Delhi, 20 th 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 Winkler's method	3 h	
3.	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		54 th ACM	Date 13-06-2019

PHY1701	Engineering Physics	L	T	P	J	C
		3	0	2	0	4
Pre-requisite	None	Syllabus version				
		V.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: Students will be able to						
<ol style="list-style-type: none"> 1. Comprehend the dual nature of radiation and matter. 2. Compute Schrodinger's equations to solve finite and infinite potential problems. 3. Analyze quantum ideas at the nanoscale. 4. Apply quantum ideas for understanding the operation and working principle of optoelectronic devices. 5. Recall the Maxwell's equations in differential and integral form. 6. Design the various types of optical fibers for different Engineering applications. 7. Explain concept of Lorentz Transformation for Engineering applications. 8. Demonstrate the quantum mechanical ideas 						
Module:1	Introduction to Modern Physics	6 hours				
Planck's concept (hypothesis), Compton Effect, Particle properties of wave: Matter Waves, Davison 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, CO ₂ 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	10 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	5 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.	
2.	William Silfvast, 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 Richa Verma, 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: CAT / Assignment / Quiz / FAT / Project / Seminar		
List of Experiments		
1.	Determination of Planck's constant using electroluminescence process	2 hrs
2.	Electron diffraction	2 hrs
3.	Determination of wavelength of laser source (He -Ne laser and diode lasers of different wavelengths) using diffraction technique	2 hrs
4.	Determination of size of fine 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 hrs
Mode of evaluation: CAT / FAT		

Recommended by Board of Studies	04-06-2019		
Approved by Academic Council	No. 55	Date	13-06-2019

MAT1011	Calculus for Engineers	L	T	P	J	C
		3	0	2	0	4
Pre-requisite		Syllabus Version				
		1.0				
Course Objectives :						
<ol style="list-style-type: none"> 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 Outcomes:						
At the end of this course the students should be able to						
<ol style="list-style-type: none"> 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-Average function 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, 13 th edition, Pearson, 2014. [2] Advanced Engineering Mathematics, Erwin Kreyszig, 10 th Edition, Wiley India, 2015.		
Reference Books		
<ol style="list-style-type: none"> Higher Engineering Mathematics, B.S. Grewal, 43rd Edition ,Khanna Publishers, 2015 Higher Engineering Mathematics, John Bird, 6th Edition, Elsevier Limited, 2017. Calculus: Early Transcendentals, James Stewart, 8th edition, Cengage Learning, 2017. Engineering Mathematics, K.A.Stroud and Dexter J. Booth, 7th Edition, 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	3 hours
2	Plotting and visualizing curves and surfaces in MATLAB – Symbolic computations using MATLAB	3 hours
3.	Evaluating Extremum of a single variable function	3 hours
4.	Understanding integration as Area under the curve	3 hours
5.	Evaluation of Volume by Integrals (Solids of Revolution)	3 hours
6.	Evaluating maxima and minima of functions of several variables	3 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		30 hours
Mode of Assessment:		
Weekly assessment, Final Assessment Test		
Recommended by Board of Studies	12-06-2015	
Approved by Academic Council	No. 37	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 :						
<ol style="list-style-type: none"> To provide students with a framework that will help them choose the appropriate descriptive methods in various data analysis situations. To analyse distributions and relationship of real-time data. 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:						
<ol style="list-style-type: none"> Compute and interpret descriptive statistics using numerical and graphical techniques. Understand the basic concepts of random variables and find an appropriate distribution for analysing data specific to an experiment. Apply statistical methods like correlation, regression analysis in analysing, interpreting experimental data. Make appropriate decisions using statistical inference that is the central to experimental research. Use statistical methodology and tools in reliability engineering problems. demonstrate R programming for statistical data 						
Module: 1	Introduction to Statistics	6 hours				
Introduction to statistics and data analysis-Measures of central tendency –Measures of 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				
Basic concepts- 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)		

<ul style="list-style-type: none"> • Probability and Statistics for engineers and scientists, R.E.Walpole, R.H.Myers, S.L.Mayers and K.Ye, 9th Edition, Pearson Education (2012). • Applied Statistics and Probability for Engineers, Douglas C. Montgomery, George C. Runger, 6th Edition, John Wiley & Sons (2016). 		
Reference books		
<ul style="list-style-type: none"> • Reliability Engineering, E.Balagurusamy, Tata McGraw Hill, Tenth reprint 2017. • Probability and Statistics, J.L.Devore, 8th Edition, Brooks/Cole, Cengage Learning (2012). • Probability and Statistics for Engineers, R.A.Johnson, Miller Freund's, 8th edition, Prentice Hall India (2011). • Probability, Statistics and Reliability for Engineers and Scientists, Bilal M. Ayyub and Richard H. McCuen, 3rd edition, CRC press (2011). 		
Mode of Evaluation		
Digital Assignments, Continuous Assessment Tests, Quiz, Final Assessment Test.		
List of Experiments (Indicative)		
•	Introduction: Understanding Data types; importing/exporting data.	2 hours
•	Computing Summary Statistics /plotting and visualizing data using Tabulation and Graphical Representations.	2 hours
•	Applying correlation and simple linear regression model to real dataset; computing and interpreting the coefficient of determination.	2 hours
•	Applying multiple linear regression model to real dataset; computing and interpreting the multiple coefficient of determination.	2 hours
•	Fitting the following probability distributions: Binomial distribution	2 hours
•	Normal distribution, Poisson distribution	2 hours
•	Testing of hypothesis for One sample mean and proportion from real-time problems.	2 hours
•	Testing of hypothesis for Two sample means and proportion from real-time problems	2 hours
•	Applying the t test for independent and dependent samples	2 hours
•	Applying Chi-square test for goodness of fit test and Contingency test to real dataset	2 hours
•	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	47	Date: 05-10-2017

ESP1001	ESPAÑOL FUNDAMENTAL	L	T	P	J	C
		2	0	0	0	2
Pre-requisite	Nil	Syllabus version				
		1.0				
Course Objectives:						
<p>The course gives students the necessary background to:</p> <ol style="list-style-type: none"> 1. Demonstrate Proficiency in reading, writing, and speaking in basic Spanish. Learning vocabulary related to profession, education centres, day today activities, food, culture, sports and hobby, family set up, workplace, market and classroom activities is essential. 2. Demonstrate the ability to describe things and will be able to translate into English and vice versa. 3. Describe in simple terms (both in written and oral form) aspects of their background, immediate environment and matters in areas of immediate need. 						
Expected Course Outcome:						
<p>The students will be able to</p> <ol style="list-style-type: none"> 1. Remember greetings, giving personal details and Identify genders by using correct articles 2. Apply the correct use of SER, ESTAR and TENER verb for describing people, place and things 3. Create opinion about time and weather conditions by knowing months, days and seasons in Spanish 4. Create opinion about people and places by using regular verbs 5. Apply reflexive verbs for writing about daily routine and create small paragraphs about hometown, best friend and family 						
Module: 1	Abecedario, Saludos y Datos personales: Origen, Nacionalidad, Profesión					3 hours
Competencia Gramática: Vocales y Consonantes. Artículos definidos e indefinidos (Numero y Genero).						
Competencia Escrita: Saludos y Datos personales						
Module: 2	Edad y posesión. Números (1-20)					3 hours
Competencia Gramática: Pronombres personales. Adjetivos. Los verbos SER y TENER.						
Competencia Escrita: Escribe sobre mismo/a y los compañeros de la clase						
Module: 3	Vocabulario de Mi habitación. Colores. Descripción de lugares y cosas					5 hours
Competencia Gramática: Adjetivos posesivos. El uso del verbo ESTAR. Diferencia entre SER y ESTAR.						
Competencia Escrita: Mi habitación						
Module: 4	Mi familia. Números (21-100). Direcciones. Expresar la hora. Los meses del año.					5hours
Competencia Gramática: Frases preposicionales. Uso del HAY. La diferencia entre MUY y MUCHO. Uso del verbo GUSTAR						
Competencia Escrita: Mi familia. Dar opiniones sobre tiempo						
Module: 5	Expresar fechas y el tiempo. Dar opiniones sobre personas y lugares.					5 hours
Competencia Gramática: Los verbos regulares (-AR, -ER, -IR) en el presente. Adjetivos demostrativos.						
Competencia Escrita: Mi mejor amigo/a. Expresar fechas. Traducción ingles a español y Español a Ingles.						
Module: 6	Describir el diario. Las actividades cotidianas.					3 hours
Competencia Gramática: Los Verbos y pronombres reflexivos. Los verbos pronominales con e/ie, o/ue, e/i, u/ue.						
Competencia Escrita: El horario. Traducción ingles a español y Español a Ingles.						

Module: 7	Dar opiniones sobre comidas y bebidas. Decir lo que está haciendo. Describir mi ciudad y Ubicar los sitios en la ciudad.	4 hours
Competencia Gramática: Los verbos irregulares. Estar + gerundio. Poder + Infinitivo. Competencia Escrita: Conversación en un restaurante. Traducción inglés a español y Español a Inglés. Mi ciudad natal. Mi Universidad. La clase. Mi fiesta favorita.		
Module: 8	Guest Lectures / Native Speakers	2 hours
Total Lecture hours		30 hours
Text Book(s)		
1.	Text Book: "Aula Internacional 1", Jaime Corpas, Eva Garcia, Agustin Garmendia, Carmen Soriano Goyal Publication; reprinted Edition, (2010)	
Reference Books		
1.	"¡Acción Gramática!" Phil Turk and Mike Zollo, Hodder Murray, London 2006. "Practice makes perfect: Spanish Vocabulary", Dorothy Richmond, McGraw Hill Contemporary, USA, 2012.	
2.	"Practice makes perfect: Basic Spanish", Dorothy Richmond, McGraw Hill Contemporary, USA 2009.	
3.	"Pasaporte A1 Foundation", Matilde Cerrolaza Aragón, Óscar Cerrolaza Gili, Begoña Llovet Barquero, Edelsa Grupo, España, 2010.	
Recommended by Board of Studies	22.02.2016	
Approved by Academic Council	41 st ACM	Date 17.06.2016

ESP2001	ESPAÑOL INTERMEDIO	L	T	P	J	C
		2	0	2	0	3
Pre-requisite		Syllabus version				
		1.0				
Course Objectives:						
The course gives students the necessary background to:						
<ol style="list-style-type: none"> enable students to read, listen and communicate in Spanish in their day to day life. enable students to describe situations by using present, past and future tenses in Spanish. enable to develop the comprehension skill in Spanish language. 						
Expected Course Outcome:						
The students will be able to						
<ol style="list-style-type: none"> create sentences in near future and future tenses and correctly using the prepositions like POR and PARA create sentences in preterito perfecto and correctly use the direct and indirect object pronouns create sentences related to likes and dislikes and also give commands in formal and informal way create sentences in past tense by using imperfecto and indefinido forms and describe past events create conversations in Spanish at places like restaurants, hotels, Shops and Railway stations understand about different Spanish speaking countries and its culture and traditions. 						
Module:1	Números (101 – 1 millón). Expresar los planes futuros. Los números ordinales.	7 hours				
Competencia Gramática: Futuros cercanos (Ir+a+Infinitivo). Futuros (Verbos regulares e irregulares). Uso del POR y PARA. Competencia Escrita: Traducción ingles a español y español a Ingles. Comprensión - Los textos y Videos						
Module:2	Las ropas, colores y tamaños. Costar, valer, descuentos y rebajas	8 hours				
Competencia Gramática: Pronombres objetivos directos e indirectos. El verbo Gustar y Disgustar. Competencia Escrita: Traducción ingles a español y español a Ingles. Comprensión - Los textos y Videos						
Module:3	Escribir un Correo electrónico formal e informal.	7 hours				
Competencia Gramática: Imperativos formales e informales. Pretérito perfecto. Competencia Escrita: Traducción ingles a español y español a Ingles. Comprensión - Los textos y Videos						

Module:4	Currículo Vitae. Presentarse en una entrevista informal.	6 hours
Competencia Gramática: Pretérito imperfecto. Pretérito indefinido. Competencia Escrita: Traducción inglés a español y español a Inglés. Comprensión - Los textos y Videos		
Module:5	Introducción personal, Expresar los planes futuros.	5 hours
Comprensión oral: Introducción personal, Expresar los planes futuros. ¿Qué vas a hacer en las próximas vacaciones? Comprensión auditiva: Las preguntas sobre un cuento auditivo. Relacionar el audio con las imágenes. Las preguntas basadas en canciones. Medio de transporte: Comprar y Reservar billetes.		
Module:6	Diálogos entre dos	5 hours
Comprensión oral: Diálogos entre dos (cliente y tendero de ropas, pasajero y empleado, en un restaurante, Reservación de habitación en un hotel). Presentación en una entrevista. Comprensión auditiva: Las preguntas basadas en canciones. Las preguntas basadas en diálogos.		
Module:7	Presentación de los países hispánicos.	5 hours
Comprensión oral: Dialogo entre un médico y paciente. Presentación de los países hispánicos. Describir su infancia. Describir vacaciones últimas o las actividades de último fin de semana. Comprensión auditiva: Rellenar los blancos del cuento en pasado. Las preguntas basadas en el cuento. Las preguntas basadas en un anuncio		
Module:8	Guest Lectures/ Native Speakers	2 hours
Total Lecture hours:		45 hours
Text Book(s)		
1.	“Aula Internacional 1”, Jaime Corpas, Eva Garcia, Agustin Garmendia, Carmen Soriano Goyal Publication; reprinted Edition, Delhi (2010)	
Reference Books		
1.	“¡AcciónGramática!” , Phil Turk and Mike Zollo, Hodder Murray, London 2006.	
2.	“Practice makes perfect: Spanish Vocabulary”, Dorothy Richmond, McGraw Hill Contemporary, USA,2012.	
3.	“Practice makes perfect: Basic Spanish”, Dorothy Richmond, McGraw Hill Contemporary, USA 2009.	
4.	“Pasaporte A1 Foundation”, Matilde Cerrolaza Aragón, Óscar Cerrolaza Gili, Begoña Llovet Barquero, Edelsa Grupo, España, 2010.	
	Authors, book title, year of publication, edition number, press, place	
Recommended by Board of Studies		DD-MM-YYYY
Approved by Academic Council		No.41 Date 17.06.2016

FRE1001	FRANÇAIS QUOTIDIEN	L	T	P	J	C
		2	0	0	0	2
Pre-requisite	NIL	Syllabus version				
		1.0				
Course Objectives:						
The course gives students the necessary background to:						
<ol style="list-style-type: none"> 1. Learn the basics of French language and to communicate effectively in French in their day to day life. 2. Achieve functional proficiency in listening, speaking, reading and writing 3. Recognize culture-specific perspectives and values embedded in French language. 						
Expected Course Outcome:						
The students will be able to :						
<ol style="list-style-type: none"> 1. Identify in French language the daily life communicative situations via personal pronouns, emphatic pronouns, salutations, negations and interrogations. 2. Communicate effectively in French language via regular / irregular verbs. 3. Demonstrate comprehension of the spoken / written language in translating simple sentences. 4. Understand and demonstrate the comprehension of some particular new range of unseen written materials 5. Demonstrate a clear understanding of the French culture through the language studied 						
Module: 1	Expressions simples					3 hours
Les Salutations, Les nombres (1-100), Les jours de la semaine, Les mois de l'année, Les Pronoms Sujets, Les Pronoms Toniques, La conjugaison des verbes irréguliers- avoir / être / aller / venir / faire etc.						
Savoir-faire pour: Saluer, Se présenter, Présenter quelqu'un, Etablir des contacts						
Module: 2	La conjugaison des verbes réguliers					3 hours
La conjugaison des verbes réguliers, La conjugaison des verbes pronominaux, La Négation, L'interrogation avec 'Est-ce que ou sans Est-ce que'.						
Savoir-faire pour: Chercher un(e) correspondant(e), Demander des nouvelles d'une personne.						
Module: 3	La Nationalité du Pays, L'article (défini/ indéfini), Les prépositions					6 hours
La Nationalité du Pays, L'article (défini/ indéfini), Les prépositions (à/en/au/aux/sur/dans/avec etc.), L'article contracté, Les heures en français, L'adjectif (La Couleur, L'adjectif possessif, L'adjectif démonstratif/ L'adjectif interrogatif (quel/quelles/quelle/quelles), L'accord des adjectifs avec le nom, L'interrogation avec Comment/ Combien / Où etc.						
Savoir-faire pour: Poser des questions, Dire la date et les heures en français,						
Module: 4	La traduction simple					4 hours
La traduction simple :(français-anglais / anglais –français), Savoir-faire pour : Faire des achats, Comprendre un texte court, Demander et indiquer le chemin.						
Module: 5	L'article Partitif, Mettez les phrases aux pluriels					5 hours
L'article Partitif, Mettez les phrases aux pluriels, Faites une phrase avec les mots donnés, Trouvez les questions. Savoir-faire pour :						
Répondez aux questions générales en français, Exprimez les phrases données au Masculin ou au Féminin, Associez les phrases.						
Module: 6	Décrivez :					3 hours

Décrivez: La Famille / La Maison / L'université / Les Loisirs / La Vie quotidienne etc.			
Module: 7	Dialogue		4 hours
Dialogue:			
1. Décrire une personne.			
2. Des conversations à la cafeteria.			
3. Des conversations avec les membres de la famille			
4. Des dialogues entre les amis.			
Module: 8	Guest lectures		2 hours
Guest lectures / Natives speakers			
Total Lecture hours			30 hours
Text Book(s)			
1.	Fréquence jeunes-1, Méthode de français, G. Capelle et N.Gidon, Hachette, Paris, 2010.		
2.	Fréquence jeunes-1, Cahier d'exercices, G. Capelle et N.Gidon, Hachette, Paris, 2010.		
Reference Books			
1.	CONNEXIONS 1, Méthode de français, Régine Mérieux, Yves Loiseau, Les Éditions Didier, 2010.		
2.	CONNEXIONS 1, Le cahier d'exercices, Régine Mérieux, Yves Loiseau, Les Éditions Didier, 2010		
3.	ALTER EGO 1, Méthode de français, Annie Berthet, Catherine Hugo, Véronique M. Kizirian, Béatrix Sampsonis, Monique Waendendries, Hachette livre Paris 2011		
4.	ALTER EGO 1, Le cahier d'activités, Annie Berthet, Catherine Hugo, Béatrix Sampsonis, Monique Waendendries, Hachette livre, Paris 2011		
Mode of Evaluation: CAT / Assignment / Quiz / Seminar / FAT			
Recommended by Board of Studies		26.02.2016	
Approved by Academic Council		41 st ACM	Date 17.06.2016

FRE2001	Français Progressif	L	T	P	J	C
		2	0	1	0	3
Pre-requisite	Français quotidien	Syllabus version				
		1.0				
Course Objectives:						
The course gives students the necessary background to:						
<ol style="list-style-type: none"> 1. understand isolated sentences and frequently used expressions in relation to immediate priority areas (personal or family information, shopping, close environment, work). 2. communicate in simple and routine tasks requiring only a simple and direct exchange of information on familiar and habitual topics. 3. enable students to describe with simple means his training, his immediate environment and evoke familiar and habitual subjects, evoke subjects that correspond to immediate needs. 						
Expected Course Outcome:						
The students will be able to :						
<ol style="list-style-type: none"> 1. understand expressions in French. 2. create sentences by using frequent lexicon related to himself, his family, his close environment (family, shopping, work, school, etc). 3. understand simple, clear messages on internet, authentic documents. 4. analyse predictable information in common documents, such as advertisements, flyers, menus, schedules, simple personal letters. 5. create simple and routine tasks. 6. create simple and direct exchange of information on familiar activities and topics. 						
Module:1	Expressions simples	8 hours				
La vie quotidiennes - Le verbe pronominal - Le passé composé avec l'auxiliaire - avoir et être- le passé récent : venir de + infinitif - Le comparatif - Le superlatif - Les mots interrogatifs (les trois formes)						
Savoir-faire pour : Faire des achats, faire des commandes dans un restaurant, poser des questions.						
Module:2	Les activités quotidiennes	6 hours				
La vie privée et publique (Les achats, Les voyages, les transports-La nourriture, etc.) - Les lieux de la ville - Les mots du savoir-vivre - Les pronoms indéfinis - Les pronoms démonstratifs - Les pronoms compléments objets directs/ indirects - La formation du future simple et future proche						
Savoir-faire pour : Réserver les billets pour le voyage, réserver les chambres dans un hôtel, S'informer sur les lieux de la ville, indiquer la direction à un étranger.						
Module:3	Les activités de loisirs	7 hours				
Les loisirs (sports/spectacles/activités) - Les moments de la journée, de l'année- La fête indienne et française - Les goûts - L'impératif - La négation de l'impératif-La place du pronom à l'impératif avec un verbe pronominal.						
Savoir-faire pour : Parler de ses goûts, raconter les vacances, formuler des phrases plus compliquées, Raconter les souvenirs de l'enfance, parler sur la tradition de son pays natal.						

Module:4	La Francophonie	7 hours	
L'espace francophone - Première approche de la société française – La consommation alimentaire – caractériser un objet – décrire une tenue - Le pronom relatif (qui/que/dont/où)			
Savoir-faire pour :			
Articles de la presse-Portrait d'une personne-Cartes et messages d'invitation, d'acceptation ou de refus - Article de presse - rédaction d'un événement.			
Module:5	La culture française	5 hours	
Parler de ses activités quotidiennes - les fêtes en France – Parler de sa famille – réserver un billet à l'agence - la gastronomie française			
Module:6	La description	5 hours	
Décrire physiquement une personne – les vacances – les achats – réserver une chambre dans un hôtel – les plus grands français - raconter des événements passés			
Module:7	S'exprimer	5 hours	
Parler du climat - parcours francophone – placer une commande au restaurant -- la mode - parler de son projet d'avenir.			
Module:8	Guest lectures	2 hours	
Guest lectures/ Natives speakers			
		Total Lecture hours:	45 hours
Text Book(s)			
1.	Alter Ego 1, Méthode de français, Annie Berthet, Hachette, Paris 2010.		
2.	Alter Ego 1, Cahier d'exercices, Annie Berthet, Hachette, Paris 2010.		
Reference Books			
1.	CONNEXIONS 1, Méthode de français, Régine Mérieux, Yves Loiseau, Les Éditions Didier, 2010.		
2.	CONNEXIONS 1, Le cahier d'exercices, Régine Mérieux, Yves Loiseau, Les Éditions Didier, 2010		
3.	Fréquence jeunes-1, Méthode de français, G. Capelle et N.Gidon, Hachette, Paris, 2010.		
Mode of Evaluation: CAT / Assignment / Quiz / FAT / Project / Seminar			
Recommended by Board of Studies			
Approved by Academic Council		No.41	Date 17.06.2016

GRE1001	Modern Greek				L	T	P	J	C
		2	0	0	0	0	0	2	
Pre-requisite	NIL				Syllabus version				
					1.0				
Course Objectives:									
<ol style="list-style-type: none"> 1. To master the Greek terminology widely used in their subjects of specialization 2. To communicate in Modern Greek in their day to day life 3. To provide general information about Greece (e.g. geography, weather, food etc.) 									
Expected Course Outcomes:									
Students will be able:									
<ol style="list-style-type: none"> 1. To correctly pronounce Greek symbols and words, being more conscious and confident in the usage of their English vocabulary derived from Greek. 2. To make use of Modern Greek language in simple everyday conversation. 3. To understand contents from scientific texts that make use of Greek symbols and words, becoming familiar with fundamental linguistic aspects of the International Scientific Vocabulary as well as becoming able to formulate hypotheses about unknown compound words derived from Greek. 4. To be more aware about the evolution of Modern European languages, understanding the important connections between English and Greek/Neo-Latin languages. 5. To understand important socio-economic issues in contemporary Europe, developing their aptitude for critical thinking. 									
Programme Outcomes :				2, 11					
Module:1	Greek Alphabet: Correct usage and Pronunciation of Greek symbols			4 hours	2				
Module content: vowels and phonetic rules of diphthongs: alpha-iota / epsilon-iota / omicron-iota / and upsilon / epsilon-upsilon; consonants and their correct pronunciation; double consonants and digraphs.									
alpha- Grammar skills: correct pronunciation of the 24 Greek letters; correct pronunciation of diphthongs digraphs.									
Module:2	Greetings, introducing oneself; Proper Nouns and Proper Greek Names			3 hours	2, 11				
Communicative functions: using formal and informal greetings; introducing oneself using affirmative form.									
Grammar skills: nominative case and vocative case (singular), personal pronouns, verbs είμαι (to be) and μελένε (to be called).									
Written communication skills: introducing oneself using Greek letters and words.									
Module:3	Nationality and Provenance			5 hours	2, 11				
Communicative functions: providing personal details such as nationality, address and telephone number; Being able to name a few relevant landmarks in a city.									
Grammar skills: Common nouns (masculine in -ος/-ης/-ας; feminine in -α/-η; neuter in -ο/-ι); από / σε + accusative case; cardinal numerals from 1 to 10; verb μένω (simple present).									
Written communication skills: introducing oneself providing specific details about country and city of origin, address, telephone number.									
Module:4	Family			5 hours	2, 11				
Communicative functions: describing one's family and describing elementary physical traits (μικρός/μεγάλος – μελαχρινός/ξανθός – ψηλός/κοντός).									
Grammar skills: possessive pronouns (singular/plural); word accent									
Written communication skills: describing family and family members.									

Module:5	In the classroom: introducing others, languages and nationality adjectives	4 hours	2, 11
Communicative functions: introducing others by providing information on their nationality and spoken language(s); naming the objects in a classroom.			
Grammar skills: verb μιλάω (simple present); nationality adjectives.			
Written communication skills: introducing friends and relatives providing specific information about the language they speak.			
Module:6	Months and seasons of the year; days of the week; time and weather	4 hours	2
Communicative functions: defining time and date; talking about weather conditions.			
Grammar skills: cardinal numerals from 11 to 100; interrogative pronoun (ποιος-ποια-ποιο/τι); time adverbials (τώρα, σήμερα, χθες, αύριο, φέτος, πέρσι, του χρόνου, πότε); syntax: υποκείμενο/άμεσο αντικείμενο			
Written communication skills: describing weather conditions, defining time and date.			
Module:7	Daily routine	3 hours	2, 11
Module content: communicative functions: describing one's daily routine and activities/hobbies.			
Grammar skills: verbs πάω, ακούω, λέω, τρώω, μπορώ (simple present); plural nouns (nominative case).			
Written communication skills: writing a simple letter describing a daily routine.			
Module:8	Contemporary issues:	2 hours	2, 11
Social and Economic aspects of the 2009-2017 Greek government-debt crisis and of the 2015-2018 European Refugee Crisis.			
Total Lecture hours:		30 hours	
Text Book(s):			
1.	Maria Karakirgiou, V. Panagiotidou, Jay Schwartz, <i>Kliksta Ellinika (A1)</i> , Center for the Greek Language Publishing, Thessaloniki & Athens, 2014.		
Reference Book(s):			
1.	Maria Kaliambou (Yale University, USA), <i>The Routledge Modern Greek Reader</i> , Routledge 2015.		
2.	E. Georgantzi, E. Raftopoulou, <i>Greek for You</i> (Greek – English bilingual edition), Neohel, Athens, 2016.		
Recommended by Board of Studies		31.10.2018	
Approved by Academic Council		No. 53	Date 13.12.18

JAP1001	JAPANESE FOR BEGINNERS	L	T	P	J	C
		2	0	0	0	2
Pre-requisite	Nil	Syllabus version				
		1.0				
Course Objectives:						
The course gives students the necessary background to:						
<ol style="list-style-type: none"> 1. Develop four basic skills related to reading, listening, speaking and writing Japanese language. 2. Instill in learners an interest in Japanese language by teaching them culture and general etiquettes. 3. Recognize, read and write Hiragana and Katakana. 						
Expected Course Outcomes:						
Students will be able to:						
<ol style="list-style-type: none"> 1. Remember Japanese alphabets and greet in Japanese. 2. Understand pronouns, verbs form, adjectives and conjunctions in Japanese. 3. Remember time and dates related vocabularies and express them in Japanese. 4. Create simple questions and its answers in Japanese. 5. Understand the Japanese culture and etiquettes. 						
Module: 1	Introduction to Japanese syllables and Greetings					4 hours
Introduction of Japanese language, alphabets; Hiragana, katakana, and Kanji Pronunciation, vowels and consonants.						
Hiragana – writing and reading; Vocabulary: 50 Nouns and 20 pronouns, Greetings.						
Module: 2	Demonstrative Pronouns					4 hours
Grammar: N1 wa N2 desu, Japanese Numerals, Demonstrative pronoun - Kore, Sore, Are and Dore (This, That, Over there, which) Kono, sono, Ano and Dono (this, that, over there, which) Kochira, Sochira, Achira and Dochira. this way...) Koko, Soko, Asoko and Doko (Here, There.... location)						
Module: 3	Verbs and Sentence formation					4 hours
Classification of verbs Be verb desu Present and Present negative Basic structure of sentence (Subject+ Object+ Verb) Katakana-reading and writing						
Module: 4	Conjunction and Adjectives					4 hours
Conjunction - Ya.....nado Classification of Adjectives 'I' and 'na' - ending Set phrase – Onegaishimasu – Sumimasen, wakarimasen Particle –Wa, Particle - Ni 'Ga imasu' and 'Ga arimasu' for Existence of living things and non-living things Particle - Ka, Ni, Ga						
Module: 5	Vocabulary and its Meaning					4 hours
Days/ Months /Year/Week (Current, Previous, Next, Next to Next) ; Nation, People and Language Relationship of family (look and learn); Simple kanji recognition						
Module: 6	Forming questions and giving answers					4 hours
Classification of Question words (Dare, Nani, Itsu, Doyatte, dooshite, Ikutsu, Ikura); Classification of Te forms, Polite form of verbs						
Module: 7	Expressing time, position and directions					4 hours

Classification of question words (Doko, Dore, Dono, Dochira); Time expressions (Jikan), Number of hours, Number of months, calendar of a month; Visit the departmental store, railway stations, Hospital (Byoki), office and University			
Module: 8	Guest Lecture by Experts		2 hours
Total Lecture hours			30 hours
Text Book(s):			
1.	The Japan Foundation (2017), Marugoto Japanese Language and Culture Starter A1 Coursebook For Communicative Language Competences, New Delhi: Goyal Publishers (9788183078047)		
2.	Banno, Eri et al (2011), Genki: An Integrated Course in Elementary Japanese I [Second Edition], Japan: The Japan Times.		
Reference Book(s):			
1.	Japanese for Busy people (2011) video CD, AJALT, Japan.		
2.	Carol and Nobuo Akiyama (2010), The Fast and Fun Way, New Delhi: Barron's Publication		
Mode of Evaluation: CAT , Quiz and Digital Assignments			
Recommended by Board of Studies		24.10.2018	
Approved by Academic Council		53 rd ACM	Date 13.12.2018

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: <ol style="list-style-type: none"> 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 Publishers, U.S.A.		
4.	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

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:									
<ol style="list-style-type: none"> 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:									
<ol style="list-style-type: none"> 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 the mail. 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 post man 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 with a 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 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 edge is added between two nodes (variables) t1 and t2 if they are live simultaneously at some point in the program. During register allocation, two temporaries 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	15 hours				

	registers required to store the variables and speed up the code execution	
5.	<p>Selective Job Scheduling Problem</p> <p>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 software resources 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 implement the time Schedule Server and memory Schedule Server. The Time Schedule Server arranges jobs based on time required for execution in ascending order whereas memory Schedule Server arranges jobs based on memory required for execution in ascending order</p>	15 hours
6.	<p>Fragment Assembly in DNA Sequencing</p> <p>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), and thymine (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, given a 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.</p>	15 hours
7.	<p>House Wiring</p> <p>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 and the distances between them, implement an algorithm to find the minimum cable required.</p>	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 Education, 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

MGT1022	Lean Start up Management	L	T	P	J	C
		1	0	0	4	2
Pre-requisite	Nil	Syllabus version				
		v.1.0				
Course Objectives: To develop the ability to						
<ol style="list-style-type: none"> 1. Learn methods of company formation and management. 2. Gain practical skills in and experience of stating of business using pre-set collection of business ideas. 3. Learn basics of entrepreneurial skills. 						
Expected Course Outcome: On the completion of this course the student will be able to:						
<ol style="list-style-type: none"> 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 Foreseeing and quantifying business and financial risks						
Module:1		2 Hours				
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		3 Hours				
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		3 Hours				
Legal, Regulatory, CSR, Standards, Taxes						
Module:6		2 Hours				
Lectures by Entrepreneurs						
		Total Lecture				15 hours
Text Book(s)						
1.	The Startup Owner's Manual: The Step-By-Step Guide for Building a Great Company, Steve Blank, K & S Ranch; 1 st edition (March 1, 2012)					
2	The Four Steps to the Epiphany, Steve Blank, K&S Ranch; 2 nd edition (July 17, 2013)					
3	The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses, Eric Ries, Crown Business; (13 September 2011)					
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 T Ulrich, SD Eppinger, McGraw Hill					
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, SVPG Press; 1st edition (June 18, 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		
Mode of Evaluation: 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	37	Date	16-06-2015
Total Practical Hours			60 hours
Mode of evaluation: Mini Project, Flipped Class Room, Lecture, PPT's, Role play, Assignments Class/Virtual Presentations, Report and beyond the classroom activities			
Recommended by Board of Studies	22-07-2017		
Approved by Academic Council	No. 47	Date	24.08.2017

CSE1901	Technical Answers for Real World Problems (TARP)	L	T	P	J	C
		1	0	0	4	2
Pre-requisite	PHY1999 and 115 Credits Earned	Syllabus version				
		1.0				
Course Objectives:						
<ul style="list-style-type: none"> • 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 of the prototypes / products • To make the students learn to 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						
<ol style="list-style-type: none"> 1. Identify real life problems related to society 2. Apply appropriate technology(ies) to address the identified problems using engineering principles and arrive at innovative solutions 						
Module:1						
						15 hours
<ol style="list-style-type: none"> 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:						
<ol style="list-style-type: none"> 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	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						
<ol style="list-style-type: none"> 1. Formulate specific problem statements for ill-defined real life problems with reasonable assumptions and constraints. 2. Perform literature search and /or patent search in the area of interest. 3. Conduct experiments / Design and Analysis / solution iterations and document the 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						
<ol style="list-style-type: none"> 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		37 th AC	Date	16.06.2015		

STS1001	Introduction to Soft skills	L	T	P	J	C
		3	0	0	0	1
Pre-requisite	None	Syllabus version				
		2.0				
Course Objectives:						
<ol style="list-style-type: none"> 1. To enhance the ability to plan better and work as a team effectively 2. To boost the learning ability and to acquire analytical and research skills 3. To educate the habits required to achieve success 						
Expected Course Outcome:						
1. Enabling students to know themselves and interact better with self and environment						
Module:1	Lessons on excellence	10 hours				
Ethics and integrity Importance of ethics in life, Intuitionism vs Consequentialism, Non-consequentialism, Virtue ethics vs situation ethics, Integrity - listen to conscience, Stand up for what is right Change management Who moved my cheese?, Tolerance of change and uncertainty, Joining the bandwagon, Adapting change for growth - overcoming inhibition How to pick up skills faster? Knowledge vs skill, Skill introspection, Skill acquisition, "10,000 hours rule" and the converse Habit formation Know your habits, How habits work? - The scientific approach, How habits work? - The psychological approach, Habits and professional success, "The Habit Loop", Domino effect, Unlearning a bad habit Analytic and research skills. Focused and targeted information seeking, How to make Google work for you, Data assimilation						
Module:2	Team skills	11 hours				
Goal setting SMART goals, Action plans, Obstacles -Failure management Motivation Rewards and other motivational factors, Maslow's hierarchy of needs, Internal and external motivation Facilitation Planning and sequencing, Challenge by choice, Full Value Contract (FVC), Experiential learning cycle, Facilitating the Debrief Introspection Identify your USP, Recognize your strengths and weakness, Nurture strengths, Fixing weakness, Overcoming your complex, Confidence building Trust and collaboration Virtual Team building, Flexibility, Delegating, Shouldering responsibilities						
Module:3	Emotional Intelligence	12 hours				

Transactional Analysis Introduction, Contracting, Ego states, Life positions			
Brain storming Individual Brainstorming, Group Brainstorming, Stepladder Technique, Brain writing, Crawford's Slip writing approach, Reverse brainstorming, Star bursting, Charlette procedure, Round robin brainstorming			
Psychometric Analysis Skill Test, Personality Test			
Rebus Puzzles/Problem Solving More than one answer, Unique ways			
<hr/>			
Module:4	Adaptability		12 hours
Theatrix Motion Picture, Drama, Role Play, Different kinds of expressions			
Creative expression Writing, Graphic Arts, Music, Art and Dance			
Flexibility of thought The 5'P' framework (Profiling, prioritizing, problem analysis, problem solving, planning)			
Adapt to changes(tolerance of change and uncertainty) Adaptability Curve , Survivor syndrome			
<hr/>			
	Total Lecture hours:	45 hours	
Text Book(s)			
1.	<u>Chip Heath</u> , <u>How to Change Things When Change Is Hard (Hardcover)</u> ,2010,First Edition,Crown Business.		
2.	<u>Karen Kindrachuk</u> , Introspection, 2010, 1 st Edition.		
3.	<u>Karen Hough</u> , The Improvisation Edge: Secrets to Building Trust and Radical Collaboration at Work, 2011, Berrett-Koehler Publishers		
Reference Books			
1.	<u>Gideon Mellenbergh</u> , A Conceptual Introduction to Psychometrics: Development, Analysis and Application of Psychological and Educational Tests,2011, Boom Eleven International.		
2.	<u>Phil Lapworth</u> , An Introduction to Transactional Analysis, 2011, Sage Publications (CA)		
Mode of Evaluation: FAT, Assignments, Projects, Case studies, Role plays,3 Assessments with Term End FAT (Computer Based Test)			
Recommended by Board of Studies		09/06/2017	
Approved by Academic Council		No. 45 th AC	Date 15/06/2017

STS1002	Introduction to Business Communication	L	T	P	J	C
		3	0	0	0	1
Pre-requisite	None	Syllabus version				
		2.0				
Course Objectives:						
1. To provide an overview of Prerequisites to Business Communication 2. To enhance the problem solving skills and improve the basic mathematical skills 3. To organize the thoughts and develop effective writing skills						
Expected Course Outcome:						
1. Enabling students enhance knowledge of relevant topics and evaluate the information						
Module:1	Study skills	10 hours				
Memory techniques						
Relation between memory and brain, Story line technique, Learning by mistake, Image-name association, Sharing knowledge, Visualization						
Concept map						
Mind Map, Algorithm Mapping, Top down and Bottom Up Approach						
Time management skills						
Prioritization - Time Busters, Procrastination, Scheduling, Multitasking, Monitoring						
6. Working under pressure and adhering to deadlines						
Module:2	Emotional Intelligence (Self Esteem)	6 hours				
Empathy						
Affective Empathy and Cognitive Empathy						
Sympathy						
Level of sympathy (Spatial proximity, Social Proximity, Compassion fatigue)						
Module:3	Business Etiquette	9 hours				
Social and Cultural Etiquette						
Value, Manners, Customs, Language, Tradition						
Writing Company Blogs						
Building a blog, Developing brand message, FAQs', Assessing Competition						
Internal Communications						
Open and objective Communication, Two way dialogue, Understanding the audience						
Planning						
Identifying, Gathering Information, Analysis, Determining, Selecting plan, Progress check, Types of planning						
Writing press release and meeting notes						
Write a short, catchy headline, Get to the Point –summarize your subject in the first paragraph, Body – Make it relevant to your audience						

Module:4	Quantitative Ability	4 hours
Numeracy concepts Fractions, Decimals, Bodmas, Simplifications, HCF, LCM, Tests of divisibility Beginning to Think without Ink Problems solving using techniques such as: Percentage, Proportionality, Support of answer choices, Substitution of convenient values, Bottom-up approach etc. Math Magic Puzzles and brain teasers involving mathematical concepts Speed Calculations Square roots, Cube roots, Squaring numbers, Vedic maths techniques		
Module:5	Reasoning Ability	3 hours
Interpreting Diagramming and sequencing information Picture analogy, Odd picture, Picture sequence, Picture formation, Mirror image and water image Logical Links Logic based questions-based on numbers and alphabets		
Module:6	Verbal Ability	3 hours
Strengthening Grammar Fundamentals Parts of speech, Tenses, Verbs(Gerunds and infinitives) Reinforcements of Grammar concepts Subject Verb Agreement, Active and Passive Voice, Reported Speech		
Module:7	Communication and Attitude	10 hours
Writing Writing formal & informal letters, How to write a blog & knowing the format, Effective ways of writing a blog, How to write an articles & knowing the format, Effective ways of writing an articles, Designing a brochures Speaking skills How to present a JAM, Public speaking Self managing Concepts of self management and self motivation, Greet and Know, Choice of words, Giving feedback, Taking criticism		
	Total Lecture hours:	45 hours
Text Book(s)		
1.	FACE, Aptipedia, Aptitude Encyclopedia, 2016, First Edition, Wiley Publications, Delhi.	
2.	ETHNUS, Aptimithra, 2013, First Edition, McGraw-Hill Education Pvt. Ltd.	
Reference Books		
1.	Alan Bond and Nancy Schuman, 300+ Successful Business Letters for All Occasions, 2010, Third Edition, Barron's Educational Series, New York.	

2.	<u>Josh Kaufman, The First 20 Hours: How to Learn Anything ... Fast</u> , 2014, First Edition, Penguin Books, USA.		
Mode of Evaluation: FAT, Assignments, Projects, Case studies, Role plays, 3 Assessments with Term End FAT (Computer Based Test)			
Recommended by Board of Studies	09/06/2017		
Approved by Academic Council	No. 45 th AC	Date	15/06/2017

STS1101	Fundamentals of Aptitude	L	T	P	J	C
		3	0	0	0	1
Pre-requisite	None	Syllabus version				
		1.0				
Course Objectives:						
<ol style="list-style-type: none"> 1. To enhance the logical reasoning skills of the students and improve the problem-solving abilities 2. To strengthen the ability to solve quantitative aptitude problems 3. To enrich the verbal ability of the students 						
Expected Course Outcome:						
<ol style="list-style-type: none"> 1. Students will be introduced to basic concepts of Quantitative Aptitude, Logical reasoning and Verbal ability 2. Students will be able to read and demonstrate good comprehension of text in areas of the student's interest 3. Students will be able to demonstrate the ability to resolve problems that occur in their field. 						
Module:1	Lessons on excellence	2hours				
Skill introspection, Skill acquisition, consistent practice						
Module:2	Logical Reasoning	16 hours				
Thinking Skill						
<ul style="list-style-type: none"> • Problem Solving • Critical Thinking • Lateral Thinking 						
Taught through thought-provoking word and rebus puzzles, and word-link builder questions						
Coding & decoding, Series, Analogy, Odd man out and Visual reasoning						
<ul style="list-style-type: none"> • Coding and Decoding • Series • Analogy • Odd Man Out • Visual Reasoning 						
Sudoku puzzles						
Solving introductory to moderate level sudoku puzzles to boost logical thinking and comfort with numbers						
Attention to detail						
Picture and word driven Qs to develop attention to detail as a skill						
Module:3	Quantitative Aptitude	14 hours				
Speed Maths						
<ul style="list-style-type: none"> • Addition and Subtraction of bigger numbers • Square and square roots • Cubes and cube roots • Vedic maths techniques • Multiplication Shortcuts • Multiplication of 3 and higher digit numbers 						

<ul style="list-style-type: none"> • Simplifications • Comparing fractions • Shortcuts to find HCF and LCM • Divisibility tests shortcuts 								
Algebra and functions								
Module:4	Recruitment Essentials				5hours			
Looking at an engineering career through the prism of an effective resume <ul style="list-style-type: none"> • Importance of a resume - the footprint of a person's career achievements • How a resume looks like? • An effective resume vs. a poor resume: what skills you must build starting today and how? Impression Management Getting it right for the interview: <ul style="list-style-type: none"> • Grooming, dressing • Body Language and other non-verbal signs • Displaying the right behaviour 								
Module:5	Verbal Ability				8hours			
Essential grammar for placements: <ul style="list-style-type: none"> • Nouns and Pronouns • Verbs • Subject-Verb Agreement • Pronoun-Antecedent Agreement • Punctuations Verbal Reasoning								
Total Lecture hours:				45 hours				
Mode of Evaluation: FAT, Assignments, 3 Assessments with Term End FAT (Computer Based Test)								
Text Book(s): <ol style="list-style-type: none"> 1. FACE, Aptipedia Aptitude Encyclopedia, 2016, 1stEdition, Wiley Publications, Delhi. 2. ETHNUS, Aptimithra, 2013, 1stEdition, McGraw-Hill Education Pvt.Ltd. 3. SMART, PlaceMentor, 2018, 1st Edition, Oxford University Press. 4. R S Aggarwal, Quantitative Aptitude For Competitive Examinations, 2017, 3rd Edition, S. Chand Publishing, Delhi. 								
Reference Book(s): Arun Sharma, Quantitative Aptitude, 2016, 7th Edition, McGraw Hill Education Pvt. Ltd.								
Recommended by Board of Studies								
Approved by Academic Council		No. 53 rd AC	Date	13.12.2018				
STS1102	Arithmetic Problem Solving			L	T	P	J	C
				3	0	0	0	1
Pre-requisite	None			Syllabus version				
				1.0				
Course Objectives:								

<ul style="list-style-type: none"> • To enhance the logical reasoning skills of the students and improve the problem-solving abilities • To strengthen the ability to solve quantitative aptitude problems • To enrich the verbal ability of the students for academic purpose 		
Expected course outcome:		
<ul style="list-style-type: none"> • Students will be able to show more confidence in solving problems of Quantitative Aptitude • Students will be able to show more confidence in solving problems of Logical Reasoning • Students will be able to show more confidence in understanding the questions of Verbal Ability 		
Module:1	Logical Reasoning	11 hours
Word group categorization questions Puzzle type class involving students grouping words into right group orders of logical sense Cryptarithmic Data arrangements and Blood relations <ul style="list-style-type: none"> • Linear Arrangement • Circular Arrangement • Multi-dimensional Arrangement • Blood Relations 		
Module:2	Quantitative Aptitude	18 hours
Ratio and Proportion <ul style="list-style-type: none"> • Ratio • Proportion • Variation • Simple equations • Problems on Ages • Mixtures and alligations Percentages, Simple and Compound Interest <ul style="list-style-type: none"> • Percentages as Fractions and Decimals • Percentage Increase / Decrease • Simple Interest • Compound Interest • Relation Between Simple and Compound Interest Number System <ul style="list-style-type: none"> • Number system • Power cycle • Remainder cycle • Factors, Multiples • HCF and LCM 		
Module:3	Verbal Ability	16hours

Essential grammar for placements

- Prepositions
- Adjectives and Adverbs
- Tenses
- Forms and Speech and Voice
- Idioms and Phrasal Verbs
- Collocations, Gerund and Infinitives

Reading Comprehension for placements

- Types of questions
- Comprehension strategies
- Practice exercises

Articles, Prepositions and Interrogatives

- Definite and Indefinite Articles
- Omission of Articles
- Prepositions
- Compound Prepositions and Prepositional Phrases
- Interrogatives

Vocabulary for placements

- Exposure to solving questions of
- Synonyms
- Antonyms
- Analogy
- Confusing words
- Spelling correctness

Total Lecture hours:**45 hours****Mode of Evaluation:** FAT, Assignments, 3 Assessments with Term End FAT (Computer Based Test)**Text Book(s):**

1. **FACE, Aptipedia Aptitude Encyclopedia, 2016, 1stEdition, Wiley Publications, Delhi.**
2. **ETHNUS, Aptimithra, 2013, 1stEdition, McGraw-Hill Education Pvt.Ltd.**
3. **SMART, PlaceMentor, 2018, 1st Edition, Oxford University Press.**
4. **R S Aggarwal, Quantitative Aptitude For Competitive Examinations, 2017, 3rd Edition, S. Chand Publishing, Delhi.**

Reference Book(s):**Arun Sharma, Quantitative Aptitude, 2016, 7th Edition, McGraw Hill Education Pvt. Ltd.**

Recommended by Board of Studies

Approved by Academic Council

No. 53rd AC

Date

13.12.2018

STS1201	Introduction to Problem Solving	L	T	P	J	C
		3	0	0	0	1
Pre-requisite	None	Syllabus version				
		1.0				
Course Objectives:						
<ul style="list-style-type: none"> • To enhance the logical reasoning skills of the students and improve the problem-solving abilities • To strengthen the ability to solve quantitative aptitude problems • To enrich the verbal ability of the students for academic purpose 						
Expected Course Outcome:						
<ul style="list-style-type: none"> • Students will be introduced to basic concepts of Quantitative Aptitude, Logical reasoning and Verbal ability • Students will be able to read and demonstrate good comprehension of text in areas of the student's interest • Students will be able to demonstrate the ability to resolve problems that occur in their field. 						
Module:1	Lessons on excellence	2hours				
Skill introspection, Skill acquisition, consistent practice						
Module:2	Logical Reasoning	18 hours				
Thinking Skill <ul style="list-style-type: none"> • Problem Solving • Critical Thinking • Lateral Thinking Taught through thought-provoking word and rebus puzzles, and word-link builder questions						
Coding & decoding, Series, Analogy, Odd man out and Visual reasoning <ul style="list-style-type: none"> • Coding and Decoding • Series • Analogy • Odd Man Out • Visual Reasoning 						
Sudoku puzzles Solving introductory to moderate level sudoku puzzles to boost logical thinking and comfort with numbers						
Attention to detail Picture and word driven Qs to develop attention to detail as a skill						
Module:3	Quantitative Aptitude	14 hours				

Speed Maths		
<ul style="list-style-type: none"> • Addition and Subtraction of bigger numbers • Square and square roots • Cubes and cube roots • Vedic maths techniques • Multiplication Shortcuts • Multiplication of 3 and higher digit numbers • Simplifications • Comparing fractions • Shortcuts to find HCF and LCM • Divisibility tests shortcuts 		
Algebra and functions		
Module:4	Recruitment Essentials	5hours
Looking at an engineering career through the prism of an effective resume		
<ul style="list-style-type: none"> • Importance of a resume - the footprint of a person's career achievements • How a resume looks like? • An effective resume vs. a poor resume: what skills you must build starting today and how? 		
Impression Management		
Getting it right for the interview:		
<ul style="list-style-type: none"> • Grooming, dressing • Body Language and other non-verbal signs • Displaying the right behaviour 		
Module:5	Verbal Ability	6hours
Grammar challenge		
A practice paper with sentence based and passage-based questions on grammar discussed. Topics covered in questions are Nouns and Pronouns, Verbs, Subject-Verb Agreement, Pronoun-Antecedent Agreement, Punctuations		
Verbal reasoning		
	Total Lecture hours:	45 hours
Mode of Evaluation: FAT, Assignments, 3 Assessments with Term End FAT (Computer Based Test)		
Text Book(s):		
<ol style="list-style-type: none"> 1. FACE, Aptipedia Aptitude Encyclopedia, 2016, 1stEdition, Wiley Publications, Delhi. 2. ETHNUS, Aptimithra, 2013, 1stEdition, McGraw-Hill Education Pvt.Ltd. 3. SMART, PlaceMentor, 2018, 1st Edition, Oxford University Press. 4. R S Aggarwal, Quantitative Aptitude For Competitive Examinations, 2017, 3rd Edition, 		

S. Chand Publishing, Delhi.

Reference Book(s):

Arun Sharma, Quantitative Aptitude, 2016, 7th Edition, McGraw Hill Education Pvt. Ltd.

Recommended by Board of Studies

Approved by Academic Council

No. 53rd AC

Date

13.12.2018

STS1202	Introduction to Quantitative, Logical and Verbal Ability	L	T	P	J	C
		3	0	0	0	1
Pre-requisite	None	Syllabus version				
Cleared the cut-off in end-of-sem 1 assessment		1.0				
Course Objectives:						
<ul style="list-style-type: none"> • To enhance the logical reasoning skills of the students and improve the problem-solving abilities • To strengthen the ability to solve quantitative aptitude problems • To enrich the verbal ability of the students for academic purpose 						
Expected Course Outcome:						
<ul style="list-style-type: none"> • Students will be able to show more confidence in solving problems of Quantitative Aptitude • Students will be able to show more confidence in solving problems of Logical Reasoning • Students will be able to show more confidence in understanding the questions of Verbal Ability 						
Module:1	Logical Reasoning	12 hours				
Word group categorization questions						
Puzzle type class involving students grouping words into right group orders of logical sense						
Cryptarithmic						
Data arrangements and Blood relations						
<ul style="list-style-type: none"> • Linear Arrangement • Circular Arrangement • Multi-dimensional Arrangement • Blood Relations 						
Module:2	Quantitative Aptitude	20 hours				
Ratio and Proportion						
<ul style="list-style-type: none"> • Ratio • Proportion • Variation • Simple equations • Problems on Ages • Mixtures and alligations: Problems involving multiple iterations of mixtures 						

Percentages, Simple and Compound Interest

- Percentages as Fractions and Decimals
- Percentage Increase / Decrease
- Simple Interest
- Compound Interest
- Relation Between Simple and Compound Interest

Number System

- Number system
- Power cycle
- Remainder cycle
- Factors, Multiples
- HCF and LCM

Module:3 | Verbal Ability**13 hours****Reading Comprehension – Advanced****Grammar - application and discussion**

A practice paper with sentence based and passage-based questions on grammar discussed. Topics covered in questions are Prepositions, Adjectives and Adverbs, Tenses, Forms and Speech and Voice, Idioms and Phrasal Verbs, Collocations, Gerund and Infinitives

Articles, Prepositions and Interrogatives

- Definite and Indefinite Articles
- Omission of Articles
- Prepositions
- Compound Prepositions and Prepositional Phrases
- Interrogatives

Vocabulary – Advanced

Exposure to challenging placement questions on vocabulary

Total Lecture hours:**45 hours****Mode of Evaluation:** FAT, Assignments, 3 Assessments with Term End FAT (Computer Based Test)**Text Book(s):**

1. FACE, Aptipedia Aptitude Encyclopedia, 2016, 1st Edition, Wiley Publications, Delhi.
2. ETHNUS, Aptimithra, 2013, 1st Edition, McGraw-Hill Education Pvt.Ltd.
3. **SMART, PlaceMentor, 2018, 1st Edition, Oxford University Press.**
4. R S Aggarwal, Quantitative Aptitude For Competitive Examinations, 2017, 3rd Edition, S. Chand Publishing, Delhi.

Reference Book(s): Arun Sharma, Quantitative Aptitude, 2016, 7 th Edition, McGraw Hill Education Pvt. Ltd.			
Recommended by Board of Studies			
Approved by Academic Council	No. 53 rd AC	Date	13.12.2018

STS2001	Reasoning Skill Enhancement	L	T	P	J	C
		3	0	0	0	1
Pre-requisite	None	Syllabus version				
		2.0				
Course Objectives:						
<ol style="list-style-type: none"> 1. To strengthen the social network by the effective use of social media and social interactions. 2. To identify own true potential and build a very good personal branding 3. To enhance the Analytical and reasoning skills. 						
Expected Course Outcome:						
<ol style="list-style-type: none"> 1. Understanding the various strategies of conflict resolution among peers and supervisors and respond appropriately 						
Module:1	Social Interaction and Social Media	6 hours				
<p>Effective use of social media Types of social media, Moderating personal information, Social media for job/profession, Communicating diplomatically</p> <p>Networking on social media Maximizing network with social media, How to advertise on social media</p> <p>Event management Event management methods, Effective techniques for better event management</p> <p>Influencing How to win friends and influence people, Building relationships, Persistence and resilience, Tools for talking when stakes are high</p> <p>Conflict resolution Definition and strategies ,Styles of conflict resolution</p>						
Module:2	Non Verbal Communication	6 hours				
<p>Proximecs Types of proximecs, Rapport building</p> <p>Reports and Data Transcoding Types of reports</p> <p>Negotiation Skill Effective negotiation strategies</p> <p>Conflict Resolution Types of conflicts</p>						
Module:3	Interpersonal Skill	8 hours				
Social Interaction						

Interpersonal Communication, Peer Communication, Bonding, Types of social interaction		
Responsibility		
Types of responsibilities, Moral and personal responsibilities		
Networking		
Competition, Collaboration, Content sharing		
Personal Branding		
Image Building, Grooming, Using social media for branding		
Delegation and compliance		
Assignment and responsibility, Grant of authority, Creation of accountability		
<hr/>		
Module:4	Quantitative Ability	10 hours
Number properties		
Number of factors, Factorials, Remainder Theorem, Unit digit position, Tens digit position		
Averages		
Averages, Weighted Average		
Progressions		
Arithmetic Progression, Geometric Progression, Harmonic Progression		
Percentages		
Increase & Decrease or successive increase		
Ratios		
Types of ratios and proportions		
<hr/>		
Module:5	Reasoning Ability	8 hours
Analytical Reasoning		
Data Arrangement (Linear and circular & Cross Variable Relationship), Blood Relations, Ordering/ranking/grouping, Puzzle test, Selection Decision table		
<hr/>		
Module:6	Verbal Ability	7 hours
Vocabulary Building		
Synonyms & Antonyms, One word substitutes, Word Pairs, Spellings, Idioms, Sentence completion, Analogies		
Total Lecture hours:		45 hours
Text Book(s)		
1.	FACE, Aptipedia Aptitude Encyclopedia, 2016, First Edition, Wiley Publications, Delhi.	
2.	ETHNUS, Aptimithra, 2013, First Edition, McGraw-Hill Education Pvt. Ltd.	
3.	Mark G. Frank , David Matsumoto , Hyi Sung Hwang , Nonverbal Communication: Science and Applications, 2012, 1 st Edition, Sage Publications, New York.	
Reference Books		
1.	Arun Sharma, Quantitative aptitude, 2016, 7 th edition, McGraw Hill Education Pvt. Ltd.	

2.	Kerry Patterson, Joseph Grenny, Ron McMillan, Al Switzler, Crucial Conversations: Tools for Talking When Stakes are High, 2001, 1 st edition McGraw Hill Contemporary, Bangalore.		
3.	Dale Carnegie, How to Win Friends and Influence People, Latest Edition, 2016. Gallery Books, New York.		
Mode of evaluation: FAT, Assignments, Projects, Case studies, Role plays, 3 Assessments with Term End FAT (Computer Based Test)			
Recommended by Board of Studies		09/06/2017	
Approved by Academic Council		No. 45 th AC	Date 15/06/2017

STS2002	Introduction to Etiquette	L	T	P	J	C
		3	0	0	0	1
Pre-requisite	None	Syllabus version				
		2.0				
Course Objectives:						
<p>1. To analyze social psychological phenomena in terms of impression management.</p> <p>2. To control or influence other people's perceptions.</p> <p>3. To enhance the problem solving skills</p>						
Expected Course Outcome:						
Creating in the students an understanding of decision making models and generating alternatives using appropriate expressions.						
Module:1	Impression Management	8 hours				
<p>Types and techniques Importance of impression management, Types of impression management, Techniques and case studies, Making a good first impression in an interview (TEDOS technique) , How to recover from a bad impressions/experience, Making a good first impression online</p> <p>Non-verbal communication and body language Dressing, Appearance and Grooming, Facial expression and Gestures, Body language (Kinesics), Keywords to be used, Voice elements (tone, pitch and pace)</p>						
Module:2	Thinking Skills	4 hours				
<p>Introduction to problem solving process Steps to solve the problem, Simplex process</p> <p>Introduction to decision making and decision making process Steps involved from identification to implementation, Decision making model</p>						

Module:3	Beyond Structure		4 hours
Art of questioning How to frame questions, Blooms questioning pyramid, Purpose of questions Etiquette Business, Telephone etiquette, Cafeteria etiquette, Elevator etiquette, Email etiquette, Social media etiquette			
Module:4	Quantitative Ability		9 hours
Profit and Loss Cost Price & Selling Price, Margins & Markup Interest Calculations Simple Interest, Compound Interest, Recurring Mixtures and solutions Ratio & Averages, Proportions Time and Work Pipes & Cisterns, Man Day concept, Division Wages Time Speed and Distance Average speed, Relative speed, Boats and streams. Proportions & Variations			
Module:5	Reasoning Ability		11 hours
Logical Reasoning Sequence and series, Coding and decoding, Directions Visual Reasoning Abstract Reasoning, Input Type Diagrammatic Reasoning, Spatial reasoning, Cubes Data Analysis And Interpretation DI-Tables/Charts/Text			
Module:6	Verbal Ability		9 hours
Grammar Spot the Errors, Sentence Correction, Gap Filling Exercise, Sentence Improvisations, Misc. Grammar Exercise			

	Total Lecture hours:	45 hours	
Text Book(s)			
1.	Micheal Kallet, Think Smarter: Critical Thinking to Improve Problem-Solving and Decision-Making Skills, April 7, 2014, 1st Edition, Wiley, New Jersey.		
2.	MK Sehgal, Business Communication, 2008, 1 st Edition, Excel Books, India.		
3.	FACE, Aptipedia Aptitude Encyclopedia, 2016, First Edition, Wiley Publications, Delhi.		
4.	ETHNUS, Aptimithra, 2013, First edition, McGraw-Hill Education Pvt. Ltd, Banglore.		
Reference Books			
1.	Andrew J. DuBrin, Impression Management in the Workplace: Research, Theory and Practice, 2010, 1 st edition, Routledge.		
2.	Arun Sharma, Manorama Sharma, Quantitative aptitude, 2016, 7 th edition, McGraw Hill Education Pvt. Ltd, Banglore.		
3.	M. Neil Browne, Stuart M. Keeley, Asking the right questions, 2014, 11 th Edition, Pearson, London.		
Mode of Evaluation: FAT, Assignments, Projects, Case studies, Role plays, 3 Assessments with Term End FAT (Computer Based Test)			
Recommended by Board of Studies		09/06/2017	
Approved by Academic Council		No. 45 th AC	Date 15/06/2017

STS2101	Getting Started to Skill Enhancement	L	T	P	J	C
		3	0	0	0	1
Pre-requisite	None	Syllabus version				
		1.0				
Course Objectives:						
<ul style="list-style-type: none"> • To develop the students' logical thinking skills and apply it in the real-life scenarios • To learn the strategies of solving quantitative ability problems • To enrich the verbal ability of the students 						
Expected Course Outcome:						
<ul style="list-style-type: none"> • Students will be able to demonstrate critical thinking skills, such as problem solving related to their subject matters • Students will be able to demonstrate competency in verbal, quantitative and reasoning aptitude • Students will be able to perform good written communication skills 						
Module:1	Logical Reasoning	11 hours				
Clocks, calendars, Direction sense and Cubes						
<ul style="list-style-type: none"> • Clocks • Calendars • Direction Sense • Cubes 						
Data interpretation and Data sufficiency						
<ul style="list-style-type: none"> • Data Interpretation – Tables • Data Interpretation - Pie Chart • Data Interpretation - Bar Graph • Data Sufficiency 						
Module:2	Quantitative Aptitude	18 hours				
Time and work						
<ul style="list-style-type: none"> • Work with different efficiencies • Pipes and cisterns • Work equivalence • Division of wages 						
Time, Speed and Distance						
<ul style="list-style-type: none"> • Basics of time, speed and distance • Relative speed • Problems based on trains • Problems based on boats and streams 						

<ul style="list-style-type: none"> • Problems based on races <p>Profit and loss, Partnerships and averages</p> <ul style="list-style-type: none"> • Basic terminologies in profit and loss • Partnership • Averages • Weighted average 		
Module:3	Verbal Ability	13hours
<p>Sentence Correction</p> <ul style="list-style-type: none"> • Subject-Verb Agreement • Modifiers • Parallelism • Pronoun-Antecedent Agreement • Verb Time Sequences • Comparisons • Prepositions • Determiners <p>Sentence Completion and Para-jumbles</p> <ul style="list-style-type: none"> • Pro-active thinking • Reactive thinking (signpost words, root words, prefix suffix, sentence structure clues) • Fixed jumbles • Anchored jumbles 		
Module:4	Writing skills for placements	3 hours
<p>Essay writing</p> <ul style="list-style-type: none"> • Idea generation for topics • Best practices • Practice and feedback 		
Total Lecture hours:		45 hours
Mode of Evaluation: FAT, Assignments, 3 Assessments with Term End FAT (Computer Based Test)		
<p>Text Book(s):</p> <ol style="list-style-type: none"> 1. FACE, Aptipedia Aptitude Encyclopedia, 2016, 1st Edition, Wiley Publications, Delhi. 2. ETHNUS, Aptimithra, 2013, 1st Edition, McGraw-Hill Education Pvt.Ltd. 3. SMART, PlaceMentor, 2018, 1st Edition, Oxford University Press. 4. R S Aggarwal, Quantitative Aptitude For Competitive Examinations, 2017, 3rd Edition, S. Chand Publishing, Delhi. 		
<p>Reference Book(s):</p> <p>Arun Sharma, Quantitative Aptitude, 2016, 7th Edition, McGraw Hill Education Pvt. Ltd.</p>		

Recommended by Board of Studies			
Approved by Academic Council	No. 53 rd AC	Date	13.12.2018

STS2102	Enhancing Problem Solving Skills	L	T	P	J	C
		3	0	0	0	1
Pre-requisite	None	Syllabus version				
		1.0				
Course Objectives:						
<ul style="list-style-type: none"> • To develop the students' logical thinking skills and apply it in the real-life scenarios • To learn the strategies of solving quantitative ability problems • To enrich the verbal ability of the students • To strengthen the basic programming skills for placements 						
Expected Course Outcome:						
<ul style="list-style-type: none"> • The students will be able to interact confidently and use decision making models effectively • The students will be able to deliver impactful presentations • The students will be able to be proficient in solving quantitative aptitude and verbal ability questions effortlessly 						
Module:1	Logical Reasoning	5 hours				
Logical connectives, Syllogism and Venn diagrams <ul style="list-style-type: none"> • Logical Connectives • Syllogisms • Venn Diagrams – Interpretation Venn Diagrams – Solving						
Module:2	Quantitative Aptitude	11 hours				
Logarithms, Progressions, Geometry and Quadratic equations						
<ul style="list-style-type: none"> • Logarithm • Arithmetic Progression • Geometric Progression • Geometry • Mensuration • Coded inequalities • Quadratic Equations 						
Permutation, Combination and Probability						
<ul style="list-style-type: none"> • Fundamental Counting Principle • Permutation and Combination • Computation of Permutation • Circular Permutations • Computation of Combination Probability						

Module:3	Verbal Ability					4 hours
<p>Critical Reasoning</p> <ul style="list-style-type: none"> • Argument – Identifying the Different Parts (Premise, assumption, conclusion) • Strengthening statement • Weakening statement • Mimic the pattern 						
Module:4	Recruitment Essentials					7 hours
<p>Cracking interviews - demonstration through a few mocks Sample mock interviews to demonstrate how to crack the:</p> <ul style="list-style-type: none"> • HR interview • MR interview • Technical interview <p>Cracking other kinds of interviews</p> <ul style="list-style-type: none"> • Skype/ Telephonic interviews • Panel interviews • Stress interviews <p>Resume building – workshop A workshop to make students write an accurate resume</p>						
Module:5	Problem solving and Algorithmic skills					18 hours
<ul style="list-style-type: none"> • Logical methods to solve problem statements in Programming • Basic algorithms introduced 						
Total Lecture hours:					45 hours	
Mode of Evaluation: FAT, Assignments, Mock interviews, 3 Assessments with Term End FAT (Computer Based Test)						
Text Book(s):						
<ol style="list-style-type: none"> 1. FACE, Aptipedia Aptitude Encyclopedia, 2016, 1st Edition, Wiley Publications, Delhi. 2. ETHNUS, Aptimithra, 2013, 1st Edition, McGraw-Hill Education Pvt.Ltd. 3. SMART, PlaceMentor, 2018, 1st Edition, Oxford University Press. 4. R S Aggarwal, Quantitative Aptitude For Competitive Examinations, 2017, 3rd Edition, S. Chand Publishing, Delhi. 						
Reference Book(s):						
Arun Sharma, Quantitative Aptitude, 2016, 7 th Edition, McGraw Hill Education Pvt. Ltd.						
Recommended by Board of Studies						
Approved by Academic Council		No. 53 rd AC	Date	13.12.2018		

STS2201	Numerical Ability and Cognitive Intelligence	L	T	P	J	C
		3	0	0	0	1
Pre-requisite	None	Syllabus version				

		1.0
Course Objectives:		
<ul style="list-style-type: none"> • To develop the students' logical thinking skills and apply it in the real-life scenarios • To learn the strategies of solving quantitative ability problems • To enrich the verbal ability of the students 		
Expected Course Outcome:		
<ul style="list-style-type: none"> • Students will be able to demonstrate critical thinking skills, such as problem solving related to their subject matters • Students will be able to demonstrate competency in verbal, quantitative and reasoning aptitude • Students will be able to perform good written communication skills 		
Module:1	Logical Reasoning	10 hours
Clocks, calendars, Direction sense and Cubes		
<ul style="list-style-type: none"> • Clocks • Calendars • Direction Sense • Cubes <p>Practice on advanced problems</p>		
Data interpretation and Data sufficiency - Advanced		
<ul style="list-style-type: none"> • Advanced Data Interpretation and Data Sufficiency questions of CAT level • Multiple chart problems • Caselet problems 		
Module:2	Quantitative Aptitude	19 hours
Time and work – Advanced		
<ul style="list-style-type: none"> • Work with different efficiencies • Pipes and cisterns: Multiple pipe problems • Work equivalence • Division of wages • Advanced application problems with complexity in calculating total work 		
Time, Speed and Distance - Advanced		
<ul style="list-style-type: none"> • Relative speed • Advanced Problems based on trains • Advanced Problems based on boats and streams • Advanced Problems based on races 		

Profit and loss, Partnerships and averages - Advanced			
<ul style="list-style-type: none"> • Partnership • Averages • Weighted average 			
Advanced problems discussed			
Number system - Advanced			
Advanced application problems on Numbers involving HCF, LCM, divisibility tests, remainder and power cycles.			
<hr/>			
Module:3	Verbal Ability		13 hours
Sentence Correction - Advanced			
<ul style="list-style-type: none"> • Subject-Verb Agreement • Modifiers • Parallelism • Pronoun-Antecedent Agreement • Verb Time Sequences • Comparisons • Prepositions • Determiners 			
Quick introduction to 8 types of errors followed by exposure to GMAT level questions			
Sentence Completion and Para-jumbles - Advanced			
<ul style="list-style-type: none"> • Pro-active thinking • Reactive thinking (signpost words, root words, prefix suffix, sentence structure clues) • Fixed jumbles • Anchored jumbles 			
Practice on advanced GRE/ GMAT level questions			
Reading Comprehension – Advanced			
Exposure to difficult foreign subject-based RCs of the level of GRE/ GMAT			
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Module:4	Writing skills for placements	3 hours	
Essay writing			
<ul style="list-style-type: none"> • Idea generation for topics • Best practices • Practice and feedback 			
	Total Lecture hours:		45 hours
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Mode of Evaluation: FAT, Assignments, 3 Assessments with Term End FAT (Computer Based Test)			

Text Book(s):			
<ol style="list-style-type: none"> 1. FACE, Aptipedia Aptitude Encyclopedia, 2016, 1stEdition, Wiley Publications, Delhi. 2. ETHNUS, Aptimithra, 2013, 1stEdition, McGraw-Hill Education Pvt.Ltd. 3. SMART, PlaceMentor, 2018, 1st Edition, Oxford University Press. 4. R S Aggarwal, Quantitative Aptitude For Competitive Examinations, 2017, 3rd Edition, S. Chand Publishing, Delhi. 			
Reference Book(s):			
Arun Sharma, Quantitative Aptitude, 2016, 7 th Edition, McGraw Hill Education Pvt. Ltd.			
Recommended by Board of Studies			
Approved by Academic Council	No. 53 rd AC	Date	13.12.2018

STS2202	Advanced Aptitude and Reasoning Skills	L	T	P	J	C
		3	0	0	0	1
Pre-requisite	None	Syllabus version				
		1.0				
Course Objectives:						
<ol style="list-style-type: none"> 1. To develop the students' logical thinking skills and apply it in the real-life scenarios 2. To learn the strategies of solving quantitative ability problems 3. To enrich the verbal ability of the students 4. To strengthen the basic programming skills for placements 						
Expected Course Outcome:						
<ul style="list-style-type: none"> • The students will be able to interact confidently and use decision making models effectively • The students will be able to deliver impactful presentations • The students will be able to be proficient in solving quantitative aptitude and verbal ability questions effortlessly 						
Module:1	Logical Reasoning	4 hours				
Logical Reasoning puzzles - Advanced						
Advanced puzzles:						
<ol style="list-style-type: none"> 1. Sudoku 2. Mind-bender style word statement puzzles 3. Anagrams 4. Rebus puzzles 						
Logical connectives, Syllogism and Venn diagrams						
<ol style="list-style-type: none"> 1. Logical Connectives 2. Advanced Syllogisms - 4, 5, 6 and other multiple statement problems 3. Challenging Venn Diagram questions: Set theory 						
Module:2	Quantitative Aptitude	10 hours				
Logarithms, Progressions, Geometry and Quadratic equations - Advanced						
<ol style="list-style-type: none"> 1. Logarithm 2. Arithmetic Progression 3. Geometric Progression 4. Geometry 5. Mensuration 6. Coded inequalities 7. Quadratic Equations 						
Concepts followed by advanced questions of CAT level						
Permutation, Combination and Probability - Advanced						

<ul style="list-style-type: none"> • Fundamental Counting Principle • Permutation and Combination • Computation of Permutation - Advanced problems • Circular Permutations • Computation of Combination - Advanced problems • Advanced probability 		
Module:3	Verbal Ability	5 hours
<p>Image interpretation</p> <ol style="list-style-type: none"> 1. Image interpretation: Methods 2. Exposure to image interpretation questions through brainstorming and practice <p>Critical Reasoning - Advanced</p> <ol style="list-style-type: none"> 1. Concepts of Critical Reasoning 2. Exposure to advanced questions of GMAT level 		
Module:4	Recruitment Essentials	8 hours
<p>Mock interviews</p> <p>Cracking other kinds of interviews</p> <p>Skype/ Telephonic interviews</p> <p>Panel interviews</p> <p>Stress interviews</p> <p>Guesstimation</p> <ol style="list-style-type: none"> 1. Best methods to approach guesstimation questions 2. Practice with impromptu interview on guesstimation questions <p>Case studies/ situational interview</p> <ol style="list-style-type: none"> 1. Scientific strategies to answer case study and situational interview questions 2. Best ways to present cases 3. Practice on presenting cases and answering situational interviews asked in recruitment rounds 		
Module:5	Problem solving and Algorithmic skills	18 hours
<ol style="list-style-type: none"> 1. Logical methods to solve problem statements in Programming 2. Basic algorithms introduced 		
Total Lecture hours:		45 hours
<p>Mode of Evaluation: FAT, Assignments, Mock interviews, 3 Assessments with Term End FAT (Computer Based Test)</p>		
<p>Text Book(s):</p> <ol style="list-style-type: none"> 1. FACE, Aptipedia Aptitude Encyclopedia, 2016, 1stEdition, Wiley Publications, Delhi. 		

2. ETHNUS, Aptimithra, 2013, 1st Edition, McGraw-Hill Education Pvt.Ltd.
3. **SMART, PlaceMentor, 2018, 1st Edition, Oxford University Press.**
4. R S Aggarwal, Quantitative Aptitude For Competitive Examinations, 2017, 3rd Edition, S. Chand Publishing, Delhi.

Reference Book(s):

Arun Sharma, Quantitative Aptitude, 2016, 7th Edition, McGraw Hill Education Pvt. Ltd.

Recommended by Board of Studies			
Approved by Academic Council	No. 53 rd AC	Date	13.12.2018

STS3001	Preparedness for External Opportunities	L	T	P	J	C
		3	0	0	0	1
Pre-requisite	None	Syllabus version				
		2.0				
Course Objectives:						
<p>1. To effectively tackle the interview process, and leave a positive impression with your prospective employer by reinforcing your strength, experience and appropriateness for the job.</p> <p>2. To check if candidates have the adequate writing skills that are needed in an organization.</p> <p>3. To enhance the problem solving skills.</p>						
Expected Course Outcome:						
1. Enabling students acquire skills for preparing for interviews, presentations and higher education						
Module:1	Interview Skills	3 hours				
<p>Types of interview Structured and unstructured interview orientation, Closed questions and hypothetical questions, Interviewers' perspective, Questions to ask/not ask during an interview</p> <p>Techniques to face remote interviews Video interview, Recorded feedback , Phone interview preparation</p> <p>Mock Interview Tips to customize preparation for personal interview, Practice rounds</p>						
Module:2	Resume Skills	2 hours				
<p>Resume Template Structure of a standard resume, Content, color, font</p> <p>Use of power verbs Introduction to Power verbs and Write up</p> <p>Types of resume Quiz on types of resume</p> <p>Customizing resume Frequent mistakes in customizing resume, Layout - Understanding different company's requirement, Digitizing career portfolio</p>						
Module:3	Presentation Skills	6 hours				
<p>Preparing presentation 10 tips to prepare PowerPoint presentation, Outlining the content, Passing the Elevator Test</p> <p>Organizing materials Blue sky thinking, Introduction , body and conclusion, Use of Font, Use of Color, Strategic presentation</p> <p>Maintaining and preparing visual aids</p>						

Importance and types of visual aids, Animation to captivate your audience, Design of posters		
Dealing with questions		
Setting out the ground rules, Dealing with interruptions, Staying in control of the questions, Handling difficult questions		
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Module:4	Quantative Ability	14 hours
Permutation-Combinations		
Counting, Grouping, Linear Arrangement, Circular Arrangements		
Probability		
Conditional Probability, Independent and Dependent Events		
Geometry and Mensuration		
Properties of Polygon, 2D & 3D Figures, Area & Volumes		
Trigonometry		
Heights and distances, Simple trigonometric functions		
Logarithms		
Introduction, Basic rules		
Functions		
Introduction, Basic rules		
Quadratic Equations		
Understanding Quadratic Equations, Rules & probabilities of Quadratic Equations		
Set Theory		
Basic concepts of Venn Diagram		
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Module:5	Reasoning Ability	7 hours
Logical reasoning		
Syllogisms, Binary logic, Sequential output tracing, Crypto arithmetic		
Data Analysis and Interpretation		
Data Sufficiency		
Data interpretation-Advanced Interpretation tables, pie charts & bar chats		
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Module:6	Verbal Ability	8 hours
Comprehension and Logic		
Reading comprehension		
Para Jumbles		
Critical Reasoning :		
Premise and Conclusion, Assumption & Inference, Strengthening & Weakening an Argument		
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Module:7	Writing Skills	5 hours
Note making		
What is note making, Different ways of note making		
Report writing		

What is report writing, How to write a report, Writing a report & work sheet			
Product description			
Designing a product, Understanding it's features, Writing a product description			
Research paper			
Research and its importance, Writing sample research paper			
		Total Lecture hours:	45 hours
Text Book(s)			
1.	Michael Farra, Quick Resume & Cover letter Book, 2011, 1 st Edition, JIST Editors, Saint Paul.		
2.	Daniel Flage, An Introduction to Critical Thinking, 2002, 1 st Edition, Pearson, London.		
Reference Books			
1.	FACE, Aptipedia Aptitude Encyclopedia, 2016, 1 st Edition, Wiley Publications, Delhi.		
2.	ETHNUS, Aptimithra, 2013, 1 st Edition, McGraw-Hill Education Pvt. Ltd.		
Mode of Evaluation: FAT, Assignments, Projects, Case studies, Role plays, 3 Assessments with Term End FAT (Computer Based Test)			
Recommended by Board of Studies		09/06/2017	
Approved by Academic Council		No. 45 th AC	Date 15/06/2017

STS3004	Data Structures and Algorithms				L	T	P	J	C
					3	0	0	0	1
Pre-requisite	None				Syllabus version				
					1.0				
Course Objectives:									
1. To assess how the choice of data structures and algorithm design methods impacts the performance of programs.									
2. To develop logics which will help them to create programs, applications in C.									
3. To learn how to design a graphical user interface (GUI) with Java Swing.									
Expected Course Outcome:									
1. Clear knowledge about problem solving skills in DS & Algorithms concepts									
Module:1	Data Structures				10 hours				
Introduction to data structures, Array, Linked List, Stack, Queue, Trees.									
Module:2	Algorithms				15 hours				
Introduction to Algorithms, Searching Algorithms, Sorting Algorithms, Greedy Algorithm, Divide and Conquer, Analysis of Algorithm.									
Module:3	C Programming				10 hours				
Introduction to C, Execution and Structure of a C Program, Data Types and Operators, Control Statements, Looping, Arrays, Structure, Pointers, Memory Management in C, Functions									
Module:4	C++ Programming				5 hours				
Introduction to C++, Need for OOP, Class & Objects, Create C++ & Java class and show the similarity Encapsulation, Access Specifiers, Relationship, Polymorphism, Exception Handling, Abstract Classes.									
Module:5	JAVA				5 hours				
Introduction to Java, Data Types and Operators, Control Statements, Looping, Arrays, Need for OOP, Class & Objects, Create C++ & Java class and show the similarity Encapsulation, Access Specifiers, Relationship, Polymorphism, Exception Handling, Abstract Classes, Interfaces.									
		Total Lecture hours:		45 hours					
Reference Books									
1.	Data Structures and Algorithms: https://ece.uwaterloo.ca/~dwharder/aads/Lecture_materials/ : University of waterloo								
2.	C Programming: C Programming Absolute Beginner's Guide (3rd Edition) by Greg Perry, Dean Miller								
3.	Java: Thinking in Java, 4th Edition								
Mode of Evaluation: FAT, Assignments, Projects, 3 Assessments with Term End FAT (Computer Based Test)									
Recommended by Board of Studies				09/06/2017					
Approved by Academic Council				No. 45 th AC		Date		15/06/2017	

STS3005	Code Mithra				L	T	P	J	C
					3	0	0	0	1
Pre-requisite	None				Syllabus version				
					1.0				
Course Objectives:									
<p>1. To develop logics which will help them to create programs, applications in C.</p> <p>2. To learn how to design a graphical user interface (GUI) with Java Swing.</p> <p>3. To present an introduction to database management systems, with an emphasis on how to organize, maintain and retrieve - efficiently, and effectively.</p>									
Expected Course Outcome:									
1. Enabling students to write coding in C,C++,Java and DBMS concepts									
Module:1	C Programming				15 hours				
Introduction to C, Execution and Structure of a C Program, Data Types and Operators, Control Statements, Looping, Arrays, Structure, Pointers, Memory Management in C, Functions.									
Module:2	C++ Programming				15 hours				
Introduction to C++, Need for OOP, Class & Objects, Create C++ & Java class and show the similarity Encapsulation, Access Specifiers, Relationship, Polymorphism, Exception Handling, Abstract Classes, Interfaces.									
Module:3	JAVA				10 hours				
Introduction to Java, Data Types and Operators, Control Statements, Looping, Arrays, Need for OOP, Class & Objects, Create C++ & Java class and show the similarity Encapsulation, Access Specifiers, Relationship, Polymorphism, Exception Handling, Abstract Classes, Interfaces.									
Module:4	Database				5 hours				
Introduction to database, DDL, Data Manipulation, SELECT, Joins.									
				Total Lecture hours:	45 hours				
Reference Books									
1.	Data Structures and Algorithms: https://ece.uwaterloo.ca/~dwharder/aads/Lecture_materials/								
2.	C Programming: C Programming Absolute Beginner's Guide (3rd Edition) by Greg Perry, Dean Miller								
3.	Java: Thinking in Java, 4th Edition								
4.	Websites: www.eguru.ooo								
Mode of Evaluation: FAT, Assignments, Projects 3 Assessments with Term End FAT (Computer Based Test)									

Recommended by Board of Studies	09/06/2017		
Approved by Academic Council	No.45 th AC	Date	15/06/2017

STS3006	Preparedness for External Opportunities	L	T	P	J	C
		3	0	0	0	1
Pre-requisite	None	Syllabus version				
		1.0				
Course Objectives:						
1.To enhance the problem solving skills.						
2.To check if candidates have the adequate writing skills that are needed in an organization.						
3. To reason, model, and draw conclusions or make decisions with mathematical, statistical, and quantitative information.						
Expected Course Outcome:						
1. Students will be able to solve mathematical, reasoning and verbal questionnaires						
Module:1	Quantitative Ability	12 hours				
Time and Work, Time Speed and Distance, Number System, Equations, Percentages, Profit and Loss, Permutation and Combination, Probability, Geometry and Mensuration, Averages, Progression, Allegations and Mixtures, Ages						
Module:2	Reasoning Ability	12 hours				
Data Arrangement - Linear, Circular and Cross Variable Relationship, Data Sufficiency, Data Interpretation-Advanced Interpretation Tables, Coding and Decoding, Abstract Reasoning, Input Type Diagrammatic Reasoning, Spatial Reasoning, Cubes, Clocks and Calendar						
Module:3	Verbal Ability	21 hours				
Vocabulary Building						
Synonyms & Antonyms, One word substitutes, Word Pairs, Spellings, Idioms, Sentence completion, Analogies, Cloze Test.						
Comprehension and Logic						
Reading comprehension						
Para Jumbles						
Critical Reasoning						
Premise and Conclusion, Assumption & Inference, Strengthening & Weakening an Argument.						
Sentence Correction						
Modifiers, parallelism, Verb time sequences, Comparison, Determiners.						
Building personal lexicon						
Benefits of becoming a logophile, Etymology – Root words, Prefix and suffix.						
Grammar						
Spot the Errors, Sentence Correction, Gap Filling Exercise.						
Text Book(s)						
1.	FACE, Aptipedia Aptitude Encyclopedia, 2016, 1 st Edition, Wiley Publications, Delhi.					
2.	ETHNUS, Aptimithra, 2013, 1 st Edition, McGraw-Hill Education Pvt.Ltd.					

3.	R S Aggarwal, Quantitative Aptitude For Competitive Examinations, 2017, 3 rd Edition, S. Chand Publishing, Delhi.		
Reference Books			
1.	Arun Sharma, Quantitative Aptitude, 2016, 7 th Edition, McGraw Hill Education Pvt. Ltd.		
Mode of evaluation: Assignments, Projects, Case studies, FAT (Computer Based Test)			
Recommended by Board of Studies			
Approved by Academic Council	No.49	Date	15/03/2018

STS3007	Preparedness for Career Opportunities	L	T	P	J	C
		3	0	0	0	1
Pre-requisite	None	Syllabus version				
		1.0				
Course Objectives:						
1. To enrich the logical thinking ability for better analysis and decision making 2. To hone the competence in solving problems and reasoning skills 3. To build a good vocabulary and use it in effective communication						
Expected Course Outcome:						
1. Students will be able to solve mathematical, reasoning and verbal questionnaires						
Module:1	Quantitative Ability	15 hours				
Time and Work, Time Speed and Distance, Number System, Equations, Percentages, Profit and Loss, Permutation and Combination, Probability, Geometry and Mensuration, Averages, Progression, Allegations and Mixtures, Ages						
Module:2	Reasoning Ability	12 hours				
Data Arrangement - Linear, Circular and Cross Variable Relationship, Data Sufficiency, Data Interpretation-Advanced Interpretation Tables, Coding and Decoding, Abstract Reasoning, Input Type Diagrammatic Reasoning, Spatial Reasoning, Cubes, Clocks and Calendar						
Module:3	Verbal Ability	18 hours				
Vocabulary Building Synonyms & Antonyms, One word substitutes, Word Pairs, Spellings, Idioms, Sentence completion, Analogies, Cloze Test. Comprehension and Logic Reading comprehension Para Jumbles Critical Reasoning : Premise and Conclusion, Assumption & Inference, Strengthening & Weakening an Argument. Sentence Correction Modifiers, parallelism, Verb time sequences, Comparison, Determiners. Building personal lexicon Benefits of becoming a logophile, Etymology – Root words, Prefix and suffix.						
Text Book(s)						
1.	FACE, Aptipedia Aptitude Encyclopedia, 2016, 1 st Edition, Wiley Publications, Delhi.					
2.	ETHNUS, Aptimithra, 2013, 1 st Edition, McGraw-Hill Education Pvt.Ltd.					
3.	R S Aggarwal, Quantitative Aptitude For Competitive Examinations, 2017, 3 rd Edition, S. Chand Publishing, Delhi.					

Reference Books			
1.	Arun Sharma, Quantitative Aptitude, 2016, 7 th Edition, McGraw Hill Education Pvt. Ltd.		
Mode of evaluation: Assignments, Projects, Case studies, FAT (Computer Based Test)			
Recommended by Board of Studies			
Approved by Academic Council	No.49	Date	15/03/2018

STS3101	Introduction to Programming Skills	L	T	P	J	C
		3	0	0	0	1
Pre-requisite	None	Syllabus version				
		1.0				
Course Objectives:						
<ul style="list-style-type: none"> • Ability to translate vast data into abstract concepts and to understand JAVA concepts • To have a clear understanding of subject related concepts • To develop computational ability in Java programming language 						
Expected Course Outcome:						
<ul style="list-style-type: none"> • Clear Knowledge about problem solving skills in JAVA concepts • Students will be able to write codes in Java 						
Module:1	Object and Class, Data types	8 hours				
Types of programming Disadvantages of functional programming Class & Objects Attributes Methods Objects Solving MCQs based on Objects and Classes Solving tricky questions based on encapsulation Solving frequently asked object-based questions Data types Data Why data type Variables Available data types Numeric – int, float, double Character – char, string Solving MCQs based on type casting, data types Solving debugging based MCQs						
Module:2	Basic I / O, Decision Making, Loop Control	8 hours				
Printing Getting input from user during run time Command line arguments Solving programming questions based on CLA Solving MCQs questions based on CLA						

<p>Need for control statement if..else if..else if..else Nested if..else Switch case Common mistakes with control statements (like using = instead of ==) Solving frequently asked questions on decision making</p> <p>Types of looping statements Entry Controlled For While Exit Controlled do while break and continue Demo on looping Common mistakes with looping statements (like using; at the end of the loop) Solving pattern programming problems, series problems Solving predict the output questions</p>		
Module:3	String, Date, Array	10 hours
<p>String handling, date handling Solving problems based on arrays like searching, sorting, rearranging, iteration) Multi-dimensional arrays Solving pattern problems using 2D arrays Real time application based on 2D arrays</p>		
Module:4	Inheritance, Aggregation & Associations	12 hours
<p>Need Is A – Inheritance Types of inheritance supported Diagrammatic representation Demo on inheritance Has A – Aggregation Diagrammatic representation Demo on aggregation Uses A - Association Diagrammatic representation Demo on association Assignment on relationships Solving MCQs based on relationships between classes</p>		
Module:5	Modifiers, Interface & Abstract classes (Java specific), Packages	7 hours
<p>Types of access specifiers Demo on access specifiers</p>		

Assignment on access modifiers Instance Members Solving MCQs based on modifiers Abstract Classes Need Abstract Classes Abstract Methods Interfaces Assignment on abstract classes and interface Need for packages Access specifiers & packages Import classes from other packages			
		Total Lecture hours:	45 hours
Reference Books			
1.	Java The Complete Reference, 2014, 9th Edition by By Herbert Schildt, McGraw-Hill Education Pvt Ltd		
2.	Introduction to Programming with Java: A Problem-Solving Approach by John Dean		
Mode of Evaluation: FAT, Assignments, 3 Assessments with Term End FAT (Computer Based Test)			
Recommended by Board of Studies			
Approved by Academic Council	No. 53 rd AC	Date	13.12.2018

STS3104	Enhancing Programming Ability	L	T	P	J	C
		3	0	0	0	1
Pre-requisite	None	Syllabus version				
		1.0				
Course Objectives:						
<ul style="list-style-type: none"> • Ability to translate vast data into abstract concepts and to understand JAVA concepts • To have a clear understanding of subject related concepts • To develop computational ability in Java programming language 						
Expected Course Outcome:						
<ul style="list-style-type: none"> • Clear Knowledge about problem solving skills in JAVA concepts • Students will be able to write codes in Java 						
Module:1	Collections	12 hours				
ArrayList, LinkedList, List Interface, HashSet, Map Interface, HashMap, Set Programming questions based on collections Real world problems based on data structure						
Module:2	Threads, Exceptions, LinkedList, Arrays	6 hours				
Need of threads Creating threads Wait Sleep Thread execution Need for exception handling try, catch, throw, throws Creating own exception (Java, Python) Handling own exceptions Solving programming questions based on linked list and arrays						
Module:3	Stack and Queue, Trees	7 hours				
Solving programming questions based on stacks and queues How to implement a stack using queue? How to implement a queue using stack? Solving programming questions based on trees, binary trees, binary search trees						
Module:4	JDBC Connectivity, JDBC Data	10 hours				
JDBC Overview Database Setup						

Install the MySQL Database Create New Database User in MySQL Workbench Selecting data from tables Inserting Data into the Database Updating Data in the Database Deleting Data from the Database Creating Prepared Statements			
Module:5	Networking with Java	10 hours	
Working with URLs Sending HTTP Requests Processing JSON data using Java Processing XML data using Java			
		Total Lecture hours:	45 hours
Reference Books			
1.	Java The Complete Reference, 2014, 9th Edition by By Herbert Schildt, McGraw-Hill Education Pvt Ltd		
2.	Introduction to Programming with Java: A Problem-Solving Approach by John Dean		
Mode of Evaluation: FAT, Assignments, 3 Assessments with Term End FAT (Computer Based Test)			
Recommended by Board of Studies			
Approved by Academic Council	No. 53 rd AC	Date	13.12.2018

STS3105	Computational Thinking	L	T	P	J	C
		3	0	0	0	1
Pre-requisite	None	Syllabus version				
		1.0				
Course Objectives:						
<ul style="list-style-type: none"> • Ability to translate vast data into abstract concepts and to understand JAVA concepts • To have a clear understanding of subject related concepts • To develop computational ability in Java programming language 						
Expected Course Outcome:						
<ul style="list-style-type: none"> • Clear Knowledge about problem solving skills in JAVA concepts • Students will be able to write codes in Java 						
Module:1	Date, Array	10 hours				
date handling Solving problems based on arrays like searching, sorting, rearranging, iteration) Multi-dimensional arrays Solving pattern problems using 2D arrays Real time application based on 2D arrays						
Module:2	Inheritance, Aggregation & Associations	15 hours				
Need Is A – Inheritance Types of inheritance supported Diagrammatic representation Demo on inheritance Has A – Aggregation Diagrammatic representation Demo on aggregation Uses A - Association Diagrammatic representation Demo on association Assignment on relationships Solving MCQs based on relationships between classes						
Module:3	Modifiers, Interface & Abstract classes (Java specific)	10 hours				
Types of access specifiers Demo on access specifiers Assignment on access modifiers Instance Members Solving MCQs based on modifiers						

Abstract Classes Need Abstract Classes Abstract Methods Interfaces Assignment on abstract classes and interface			
Module:4	Packages	5 hours	
Need for packages Access specifiers & packages Import classes from other packages			
Module:5	Exceptions	5 hours	
Need for exception handling try, catch, throw, throws Creating own exception (Java, Python) Handling own exceptions			
		Total Lecture hours:	45 hours
Reference Books			
1.	Java The Complete Reference, 2014, 9th Edition by By Herbert Schildt, McGraw-Hill Education Pvt Ltd		
2.	Introduction to Programming with Java: A Problem-Solving Approach by John Dean		
Mode of Evaluation: FAT, Assignments, 3 Assessments with Term End FAT (Computer Based Test)			
Recommended by Board of Studies			
Approved by Academic Council	No. 53 rd AC	Date	13.12.2018

STS3201	Programming Skills for Employment	L	T	P	J	C
		3	0	0	0	1
Pre-requisite	None	Syllabus version				
		1.0				
Course Objectives:						
<ul style="list-style-type: none"> • Ability to translate vast data into abstract concepts and to understand JAVA concepts • To have a clear understanding of subject related concepts • To develop computational ability in Java programming language 						
Expected Course Outcome:						
<ul style="list-style-type: none"> • Clear Knowledge about problem solving skills in JAVA concepts • Students will be able to write codes in Java 						
Module:1	Object and Class, Data types, Basic I / O	8 hours				
Types of programming Disadvantages of functional programming Class & Objects Attributes Methods Objects Solving MCQs based on Objects and Classes Solving tricky questions based on encapsulation Solving frequently asked object based questions Data types Data Why data type Variables Available data types Numeric – int, float, double Character – char, string Solving MCQs based on type casting, data types Solving debugging based MCQs Printing Getting input from user during run time Command line arguments Solving programming questions based on CLA Solving MCQs questions based on CLA						

Module:2	Decision Making, Loop Control, String, Date, Array	10 hours
<p>Need for control statement if..else if..else if..else Nested if..else Switch case Common mistakes with control statements (like using = instead of ==) Solving frequently asked questions on decision making</p> <p>Types of looping statements Entry Controlled For While Exit Controlled do while break and continue Demo on looping Common mistakes with looping statements (like using ; at the end of the loop) Solving pattern programming problems, series problems Solving predict the output questions</p> <p>String handling, date handling Solving problems based on arrays like searching, sorting, rearranging, iteration) Multi-dimensional arrays Solving pattern problems using 2D arrays Real time application based on 2D arrays</p>		
Module:3	Inheritance, Aggregation & Associations	10 hours
<p>Need Is A – Inheritance Types of inheritance supported Diagrammatic representation Demo on inheritance Has A – Aggregation Diagrammatic representation Demo on aggregation Uses A - Association Diagrammatic representation Demo on association Assignment on relationships Solving MCQs based on relationships between classes</p>		
Module:4	Modifiers, Interface & Abstract classes (Java specific), Packages	7 hours
Types of access specifiers		

Demo on access specifiers Assignment on access modifiers Instance Members Solving MCQs based on modifiers Abstract Classes Need Abstract Classes Abstract Methods Interfaces Assignment on abstract classes and interface Need for packages Access specifiers & packages Import classes from other packages			
Module:5	Collections		10 hours
ArrayList, LinkedList, List Interface, HashSet, Map Interface, HashMap, Set Programming questions based on collections Real world problems based on data structure			
		Total Lecture hours:	45 hours
Reference Books			
1.	Java The Complete Reference, 2014, 9th Edition by By Herbert Schildt, McGraw-Hill Education Pvt Ltd		
2.	Introduction to Programming with Java: A Problem-Solving Approach by John Dean		
Mode of Evaluation: FAT, Assignments, 3 Assessments with Term End FAT (Computer Based Test)			
Recommended by Board of Studies			
Approved by Academic Council	No. 53 rd AC	Date	13.12.2018

STS3204	JAVA Programming and Software Engineering Fundamentals	L	T	P	J	C
		3	0	0	0	1
Pre-requisite	None	Syllabus version				
		1.0				
Course Objectives:						
<ul style="list-style-type: none"> • Ability to translate vast data into abstract concepts and to understand JAVA concepts • To have a clear understanding of subject related concepts • To develop computational ability in Java programming language 						
Expected Course Outcome:						
<ul style="list-style-type: none"> • Clear Knowledge about problem solving skills in JAVA concepts • Students will be able to write codes in Java 						
Module:1	Threads, Exceptions, LinkedList, Arrays, Stack and Queue	8 hours				
<p>Need of threads Creating threads Wait Sleep Thread execution</p> <p>Need for exception handling try, catch, throw, throws Creating own exception (Java, Python) Handling own exceptions</p> <p>Solving programming questions based on linked list and arrays</p> <p>Solving programming questions based on stacks and queues How to implement a stack using queue? How to implement a queue using stack?</p>						
Module:2	Trees, JDBC Connectivity	7 hours				
<p>Solving programming questions based on trees, binary trees, binary search trees JDBC Overview Database Setup Install the MySQL Database Create New Database User in MySQL Workbench</p>						
Module:3	JDBC Data	6 hours				

Selecting data from tables Inserting Data into the Database Updating Data in the Database Deleting Data from the Database Creating Prepared Statements			
Module:4	Networking with Java	12 hours	
Working with URLs Sending HTTP Requests Processing JSON data using Java Processing XML data using Java			
Module:5	Advanced programming	12 hours	
File Operations CSV Operations Encoder & Decoders Encryption & Decryption Hashes Loggers			
		Total Lecture hours:	45 hours
Reference Books			
1.	Java The Complete Reference, 2014, 9th Edition by By Herbert Schildt, McGraw-Hill Education Pvt Ltd		
2.	Introduction to Programming with Java: A Problem-Solving Approach by John Dean		
Mode of Evaluation: FAT, Assignments, 3 Assessments with Term End FAT (Computer Based Test)			
Recommended by Board of Studies			
Approved by Academic Council	No. 53 rd AC	Date	13.12.2018

STS3205	Advanced JAVA Programming	L	T	P	J	C
		3	0	0	0	1
Pre-requisite	None	Syllabus version				
		1.0				
Course Objectives:						
<ul style="list-style-type: none"> • Ability to translate vast data into abstract concepts and to understand JAVA concepts • To have a clear understanding of subject related concepts • To develop computational ability in Java programming language 						
Expected Course Outcome:						
<ul style="list-style-type: none"> • Clear Knowledge about problem solving skills in JAVA concepts • Students will be able to write codes in Java 						
Module:1	Associations, Modifiers	9 hours				
<p>Uses A - Association Diagrammatic representation Demo on association Assignment on relationships Solving MCQs based on relationships between classes</p> <p>Types of access specifiers Demo on access specifiers Assignment on access modifiers Instance Members Solving MCQs based on modifiers</p>						
Module:2	Interface & Abstract classes (Java specific), Packages	10 hours				
<p>Abstract Classes Need Abstract Classes Abstract Methods Interfaces Assignment on abstract classes and interface</p> <p>Need for packages Access specifiers & packages Import classes from other packages</p>						
Module:3	Exceptions	7 hours				
<p>Need for exception handling try, catch, throw, throws</p>						

Creating own exception (Java, Python) Handling own exceptions			
Module:4	Collections	15 hours	
ArrayList, LinkedList, List Interface, HashSet, Map Interface, HashMap, Set Programming questions based on collections Real world problems based on data structure			
Module:5	LinkedList, Arrays	4 hours	
Solving programming questions based on linked list and arrays			
Total Lecture hours:			45 hours
Reference Books			
1.	Java The Complete Reference, 2014, 9th Edition by By Herbert Schildt, McGraw-Hill Education Pvt Ltd		
2.	Introduction to Programming with Java: A Problem-Solving Approach by John Dean		
Mode of Evaluation: FAT, Assignments, 3 Assessments with Term End FAT (Computer Based Test)			
Recommended by Board of Studies			
Approved by Academic Council	No. 53 rd AC	Date	13.12.2018

STS3301	JAVA for Beginners	L	T	P	J	C
		3	0	0	0	1
Pre-requisite	None	Syllabus version				
		1.0				
Course Objectives:						
<ul style="list-style-type: none"> • Ability to translate vast data into abstract concepts and to understand JAVA concepts • To have a clear understanding of subject related concepts • To develop computational ability in Java programming language 						
Expected Course Outcome:						
<ul style="list-style-type: none"> • Clear Knowledge about problem solving skills in JAVA concepts • Students will be able to write codes in Java 						
Module:1	Introduction to Programming	10 hours				
Introduction to Flow Charts Pseudo code Program Development Steps & Algorithms Computer Operations & Data Types Comparison Operators Single Selection Dual Selection Three or More Choices Nested Ifs Boolean Operators Loops						
Module:2	Object and Class	10 hours				
Types of programming Disadvantages of functional programming Class & Objects Attributes Methods Objects Solving MCQs based on Objects and Classes Solving tricky questions based on encapsulation Solving frequently asked object based questions						
Module:3	Data types, Basic I / O	10 hours				
Data types Data Why data type						

Variables Available data types Numeric – int, float, double Character – char, string Solving MCQs based on type casting, data types Solving debugging based MCQs Printing Getting input from user during run time Command line arguments Solving programming questions based on CLA Solving MCQs questions based on CLA		
Module:4	Decision Making, Loop Control	10 hours
Need for control statement if..else if..else if..else Nested if..else Switch case Common mistakes with control statements (like using = instead of ==) Solving frequently asked questions on decision making Types of looping statements Entry Controlled For While Exit Controlled do while break and continue Demo on looping Common mistakes with looping statements (like using ; at the end of the loop) Solving pattern programming problems, series problems Solving predict the output questions		
Module:5	String	5 hours
String handling		
Total Lecture hours:		45 hours
Reference Books		
1.	Java The Complete Reference, 2014, 9th Edition by By Herbert Schildt, McGraw-Hill Education Pvt Ltd	
2.	Introduction to Programming with Java: A Problem-Solving Approach by John Dean	
Mode of Evaluation: FAT, Assignments, 3 Assessments with Term End FAT (Computer Based Test)		

Recommended by Board of Studies			
Approved by Academic Council	No. 53 rd AC	Date	13.12.2018

STS3401	Foundation to Programming Skills	L	T	P	J	C
		3	0	0	0	1
Pre-requisite	None	Syllabus version				
		1.0				
Course Objectives:						
<ul style="list-style-type: none"> • Ability to translate vast data into abstract concepts and to understand JAVA concepts • To have a clear understanding of subject related concepts • To develop computational ability in Java programming language 						
Expected Course Outcome:						
<ul style="list-style-type: none"> • Clear Knowledge about problem solving skills in JAVA concepts • Students will be able to write codes in Java 						
Module:1	Object and Class	8 hours				
Types of programming Disadvantages of functional programming Class & Objects Attributes Methods Objects Solving MCQs based on Objects and Classes Solving tricky questions based on encapsulation Solving frequently asked object based questions						
Module:2	Data types, Basic I / O	8 hours				
Data types Data Why data type Variables Available data types Numeric – int, float, double Character – char, string Solving MCQs based on type casting, data types Solving debugging based MCQs Printing Getting input from user during run time Command line arguments Solving programming questions based on CLA Solving MCQs questions based on CLA						

Module:3	Decision Making, Loop Control	9 hours
<p>Need for control statement if..else if..else if..else Nested if..else Switch case Common mistakes with control statements (like using = instead of ==) Solving frequently asked questions on decision making</p> <p>Types of looping statements Entry Controlled For While Exit Controlled do while break and continue Demo on looping Common mistakes with looping statements (like using ; at the end of the loop) Solving pattern programming problems, series problems Solving predict the output questions</p>		
Module:4	String, Date, Array	10 hours
<p>String handling, date handling Solving problems based on arrays like searching, sorting, rearranging, iteration) Multi-dimensional arrays Solving pattern problems using 2D arrays Real time application based on 2D arrays</p>		
Module:5	Inheritance, Aggregation	10 hours
<p>Need Is A – Inheritance Types of inheritance supported Diagrammatic representation Demo on inheritance Has A – Aggregation Diagrammatic representation Demo on aggregation Solving MCQs based on relationships between classes</p>		
Total Lecture hours:		45 hours
Reference Books		
1.	Java The Complete Reference, 2014, 9th Edition by By Herbert Schildt, McGraw-Hill Education Pvt Ltd	
2.	Introduction to Programming with Java: A Problem-Solving Approach by John Dean	

Mode of Evaluation: FAT, Assignments, 3 Assessments with Term End FAT (Computer Based Test)			
Recommended by Board of Studies			
Approved by Academic Council	No. 53 rd AC	Date	13.12.2018

STS5002	Preparing for Industry	L	T	P	J	C
		3	0	0	0	1
Pre-requisite		Syllabus version				
		2.0				
Course Objectives:						
<ol style="list-style-type: none"> 1. To develop the students' logical thinking skills 2. To learn the strategies of solving quantitative ability problems 3. To enrich the verbal ability of the students 4. To enhance critical thinking and innovative skills 						
Expected Course Outcome:						
<ol style="list-style-type: none"> 1. Enabling students to simplify, evaluate, analyze and use functions and expressions to simulate real situations to be industry ready. 						
Module:1	Interview skills – Types of interview and Techniques to face remote interviews and Mock Interview	3 hours				
Structured and unstructured interview orientation, Closed questions and hypothetical questions, Interviewers' perspective, Questions to ask/not ask during an interview, Video interview, Recorded feedback, Phone interview preparation, Tips to customize preparation for personal interview, Practice rounds						
Module:2	Resume skills – Resume Template and Use of power verbs and Types of resume and Customizing resume	2 hours				
Structure of a standard resume, Content, color, font, Introduction to Power verbs and Write up, Quiz on types of resume, Frequent mistakes in customizing resume, Layout - Understanding different company's requirement, Digitizing career portfolio						
Module:3	Emotional Intelligence - L1 – Transactional Analysis and Brain storming and Psychometric Analysis and Rebus Puzzles/Problem Solving	12 hours				
Introduction, Contracting, ego states, Life positions, Individual Brainstorming, Group Brainstorming, Stepladder Technique, Brain writing, Crawford's Slip writing approach, Reverse brainstorming, Star bursting, Charlette procedure, Round robin brainstorming, Skill Test, Personality Test, More than one answer, Unique ways						
Module:4	Quantitative Ability-L3 – Permutation-Combinations and Probability and Geometry	14 hours				

	and mensuration and Trigonometry and Logarithms and Functions and Quadratic Equations and Set Theory	
Counting, Grouping, Linear Arrangement, Circular Arrangements, Conditional Probability, Independent and Dependent Events, Properties of Polygon, 2D & 3D Figures, Area & Volumes, Heights and distances, Simple trigonometric functions, Introduction to logarithms, Basic rules of logarithms, Introduction to functions, Basic rules of functions, Understanding Quadratic Equations, Rules & probabilities of Quadratic Equations, Basic concepts of Venn Diagram		
Module:5	Reasoning ability-L3 – Logical reasoning and Data Analysis and Interpretation	7 hours
Syllogisms, Binary logic, Sequential output tracing, Crypto arithmetic, Data Sufficiency, Data interpretation-Advanced, Interpretation tables, pie charts & bar charts		
Module:6	Verbal Ability-L3 – Comprehension and Logic	7 hours
Reading comprehension, Para Jumbles, Critical Reasoning (a) Premise and Conclusion, (b) Assumption & Inference, (c) Strengthening & Weakening an Argument		
	Total Lecture hours:	45 hours
Reference Books		
1.	Michael Farra and JIST Editors(2011) Quick Resume & Cover Letter Book: Write and Use an Effective Resume in Just One Day. Saint Paul, Minnesota. Jist Works	
2.	Daniel Flage Ph.D(2003) The Art of Questioning: An Introduction to Critical Thinking. London. Pearson	
3.	David Allen(2002) Getting Things done : The Art of Stress -Free productivity. New York City. Penguin Books.	
4.	FACE(2016) Aptipedia Aptitude Encyclopedia.Delhi. Wiley publications	
5.	ETHNUS(2013) Aptimithra. Bangalore. McGraw-Hill Education Pvt. Ltd.	
Websites:		
1.	www.chalkstreet.com	
2.	www.skillsyouneed.com	
3.	www.mindtools.com	
4.	www.thebalance.com	

5.	www.eguru.ooo		
Mode of Evaluation: FAT, Assignments, Projects, Case studies, Role plays, 3 Assessments with Term End FAT (Computer Based Test)			
Recommended by Board of Studies		09/06/2017	
Approved by Academic Council		No. 45 th AC	Date 15/06/2017

STS1102	Arithmetic Problem Solving	L	T	P	J	C
		3	0	0	0	1
Pre-requisite	None	Syllabus version				
		1.0				
Course Objectives:						
<ul style="list-style-type: none"> • To enhance the logical reasoning skills of the students and improve the problem-solving abilities • To strengthen the ability to solve quantitative aptitude problems • To enrich the verbal ability of the students for academic purpose 						
Expected course outcome:						
<ul style="list-style-type: none"> • Students will be able to show more confidence in solving problems of Quantitative Aptitude • Students will be able to show more confidence in solving problems of Logical Reasoning • Students will be able to show more confidence in understanding the questions of Verbal Ability 						
Module:1	Logical Reasoning	11 hours				
Word group categorization questions						
Puzzle type class involving students grouping words into right group orders of logical sense						
Cryptarithmic						
Data arrangements and Blood relations						
<ul style="list-style-type: none"> • Linear Arrangement • Circular Arrangement • Multi-dimensional Arrangement • Blood Relations 						
Module:2	Quantitative Aptitude	18 hours				
Ratio and Proportion						
<ul style="list-style-type: none"> • Ratio • Proportion • Variation • Simple equations • Problems on Ages • Mixtures and alligations 						
Percentages, Simple and Compound Interest						
<ul style="list-style-type: none"> • Percentages as Fractions and Decimals 						

- Percentage Increase / Decrease
- Simple Interest
- Compound Interest
- Relation Between Simple and Compound Interest

Number System

- Number system
- Power cycle
- Remainder cycle
- Factors, Multiples
- HCF and LCM

Module:3	Verbal Ability	16hours
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Essential grammar for placements

- Prepositions
- Adjectives and Adverbs
- Tenses
- Forms and Speech and Voice
- Idioms and Phrasal Verbs
- Collocations, Gerund and Infinitives

Reading Comprehension for placements

- Types of questions
- Comprehension strategies
- Practice exercises

Articles, Prepositions and Interrogatives

- Definite and Indefinite Articles
- Omission of Articles
- Prepositions
- Compound Prepositions and Prepositional Phrases
- Interrogatives

Vocabulary for placements

- Exposure to solving questions of
- Synonyms
- Antonyms
- Analogy
- Confusing words
- Spelling correctness

	Total Lecture hours:	45 hours
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Mode of Evaluation: FAT, Assignments, 3 Assessments with Term End FAT (Computer Based Test)

Text Book(s):

1. FACE, Aptipedia Aptitude Encyclopedia, 2016, 1stEdition, Wiley Publications, Delhi.
2. ETHNUS, Aptimithra, 2013, 1stEdition, McGraw-Hill Education Pvt.Ltd.
- 3. SMART, PlaceMentor, 2018, 1st Edition, Oxford University Press.**
4. R S Aggarwal, Quantitative Aptitude For Competitive Examinations, 2017, 3rd Edition, S. Chand Publishing, Delhi.

Reference Book(s):

Arun Sharma, Quantitative Aptitude, 2016, 7th Edition, McGraw Hill Education Pvt. Ltd.

Recommended by Board of Studies

Approved by Academic Council

No. 53rd AC

Date

13.12.2018

STS2201	Numerical Ability and Cognitive Intelligence	L	T	P	J	C
		3	0	0	0	1
Pre-requisite	None	Syllabus version				
		1.0				
Course Objectives:						
<ul style="list-style-type: none"> To develop the students' logical thinking skills and apply it in the real-life scenarios To learn the strategies of solving quantitative ability problems To enrich the verbal ability of the students 						
Expected Course Outcome:						
<ul style="list-style-type: none"> Students will be able to demonstrate critical thinking skills, such as problem solving related to their subject matters Students will be able to demonstrate competency in verbal, quantitative and reasoning aptitude Students will be able to perform good written communication skills 						
Module:1	Logical Reasoning	10 hours				
Clocks, calendars, Direction sense and Cubes						
<ul style="list-style-type: none"> Clocks Calendars Direction Sense Cubes 						
Practice on advanced problems						
Data interpretation and Data sufficiency - Advanced						
<ul style="list-style-type: none"> Advanced Data Interpretation and Data Sufficiency questions of CAT level Multiple chart problems Caselet problems 						
Module:2	Quantitative Aptitude	19 hours				
Time and work – Advanced						
<ul style="list-style-type: none"> Work with different efficiencies Pipes and cisterns: Multiple pipe problems Work equivalence Division of wages Advanced application problems with complexity in calculating total work 						
Time, Speed and Distance - Advanced						
<ul style="list-style-type: none"> Relative speed Advanced Problems based on trains Advanced Problems based on boats and streams 						

- Advanced Problems based on races

Profit and loss, Partnerships and averages - Advanced

- Partnership
- Averages
- Weighted average

Advanced problems discussed

Number system - Advanced

Advanced application problems on Numbers involving HCF, LCM, divisibility tests, remainder and power cycles.

Module:3	Verbal Ability	13 hours
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Sentence Correction - Advanced

- Subject-Verb Agreement
- Modifiers
- Parallelism
- Pronoun-Antecedent Agreement
- Verb Time Sequences
- Comparisons
- Prepositions
- Determiners

Quick introduction to 8 types of errors followed by exposure to GMAT level questions

Sentence Completion and Para-jumbles - Advanced

- Pro-active thinking
- Reactive thinking (signpost words, root words, prefix suffix, sentence structure clues)
- Fixed jumbles
- Anchored jumbles

Practice on advanced GRE/ GMAT level questions

Reading Comprehension – Advanced

Exposure to difficult foreign subject-based RCs of the level of GRE/ GMAT

Module:4	Writing skills for placements	3 hours	
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Essay writing

- Idea generation for topics
- Best practices
- Practice and feedback

Total Lecture hours:	45 hours
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Mode of Evaluation: FAT, Assignments, 3 Assessments with Term End FAT (Computer Based Test)

Text Book(s):			
<ol style="list-style-type: none"> 1. FACE, Aptipedia Aptitude Encyclopedia, 2016, 1st Edition, Wiley Publications, Delhi. 2. ETHNUS, Aptimithra, 2013, 1st Edition, McGraw-Hill Education Pvt.Ltd. 3. SMART, PlaceMentor, 2018, 1st Edition, Oxford University Press. 4. R S Aggarwal, Quantitative Aptitude For Competitive Examinations, 2017, 3rd Edition, S. Chand Publishing, Delhi. 			
Reference Book(s):			
Arun Sharma, Quantitative Aptitude, 2016, 7 th Edition, McGraw Hill Education Pvt. Ltd.			
Recommended by Board of Studies			
Approved by Academic Council	No. 53 rd AC	Date	13.12.2018

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:						
<p>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.</p> <ol style="list-style-type: none"> To make students confident enough to handle the day to day issues. To develop the “Thinking Skill” of the students, especially Creative Thinking Skills To train the students to be innovative in all their activities 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						
<ol style="list-style-type: none"> Understand the various types of thinking skills. Enhance the innovative and creative ideas. Find out a suitable solution for socially relevant issues- J component 						
Module:1 A Self Confidence						
						1 hour
<p>Understanding self – Johari Window –SWOT Analysis – Self Esteem – Being a contributor – Case Study</p> <p>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)</p>						
Module:1 B Thinking Skill						
						1 hour
<p>Thinking and Behaviour – Types of thinking– Concrete – Abstract, Convergent, Divergent, Creative, Analytical, Sequential and Holistic thinking – Chunking Triangle – Context Grid – Examples – Case Study.</p> <p>Project : Meeting at least 50 people belonging to various strata of life and talk to them / make field visits to identify a min of 100 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)</p>						
Module:1 C Lateral Thinking Skill						
						1 hour
<p>Blooms Taxonomy – HOTS – Outof the box thinking – deBono lateral thinking model – Examples</p> <p>Project : Last weeks - incomplete portion to be done and uploaded</p>						
Module:2 A Creativity						
						1 hour
<p>Creativity Models – Walla – Barrons – Koberg & Begnall – Examples</p> <p>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)</p>						
Module:2 B Brainstorming						
						1 hour
<p>25 brainstorming techniques and examples</p> <p>Project : Brainstorm and come out with as many solutions as possible for the top 5 issues identified & upload . (4 non- contact hours)</p>						
Module:3 Mind Mapping						
						1 hour

Mind Mapping techniques and guidelines. Drawing a mind map Project : Using Mind Maps get another set of solutions for the next 5 issues (issue 6 – 10) . (4 non- contact hours)		
Module:4 A	Systems thinking	1 hour
Systems Thinking essentials – examples – Counter Intuitive condemnns 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 deBono, Vermilion 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 COURSES

Course Code	Course Title	L	T	P	J	C
CHY1002	Environmental Sciences	3	0	0	0	3
Pre-requisite	Chemistry of 12 th standard or equivalent	Syllabus version				
		v. 1.1				
Course Objectives:						
<ol style="list-style-type: none"> To make students understand and appreciate the unity of life in all its forms, the implications of life style on the environment. To understand the various causes for environmental degradation. To understand individuals contribution in the environmental pollution. To understand the impact of pollution at the global level and also in the local environment. 						
Expected Course Outcome:						
<p>Students will be able to</p> <ol style="list-style-type: none"> Students will recognize the environmental issues in a problem oriented interdisciplinary perspectives Students will understand the key environmental issues, the science behind those problems and potential solutions. Students will demonstrate the significance of biodiversity and its preservation Students will identify various environmental hazards Students will design various methods for the conservation of resources Students will formulate action plans for sustainable alternatives that incorporate science, humanity, and social aspects Students will have foundational knowledge enabling them to make sound life decisions as well 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, 15 th Edition, Cengage learning.		
2.	George Tyler Miller, Jr. and Scott Spoolman (2012), Living in the Environment – Principles, Connections and Solutions, 17 th 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:						
<ol style="list-style-type: none"> 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:						
<ol style="list-style-type: none"> 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				

<i>Wings of Fire</i> -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:						
<ol style="list-style-type: none"> 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:						
<ol style="list-style-type: none"> 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 <i>The Merchant of Venice</i> , Disguise Scene in <i>The Twelfth Night</i> , Death of Desdemona in <i>Othello</i> , Death scene in <i>Julius Caesar</i> and Balcony scene from <i>Romeo and Juliet</i>) 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, 2 nd 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

BRIDGE COURSES

ENG1002	Effective English	L	T	P	J	C
		0	0	4	0	2
Pre-requisite	Not cleared English Proficiency Test (EPT)	Syllabus version				
		v.2.0				
Course Objectives:						
1. To enable students develop basic proficiency in Language Skills 2. To help students overcome communication barriers 3. To facilitate students communicate effectively in academic and social contexts						
Expected Course Outcome:						
1. Speak fluently in academic and social contexts 2. Listen for global and specific comprehension to improve study skills like notetaking, summarizing, etc 3. Read and comprehend technical and general texts 4. Write grammatically correct creative and descriptive sentences and paragraphs in specific contexts 5. Enact on social contexts with a message, and communicate clearly and effectively in formal and informal contexts						
Mode of Evaluation: Online Quizzes, Presentation, Role play, Group Discussions, Assignments, Mini project.						
List of Challenging Experiments (Indicative)						
1.	Speaking: Introduce yourself using Temperament Sorter	8 hours				
2.	Reading: Loud Reading with focus on pronunciation	4 hours				
3.	Writing: Descriptive Writing – Process Compare & Contrast – Product description	6 hours				
4.	Speaking: Just a Minute / Activities through VIT Community Radio	6 hours				
5.	Writing: Travelogue Writing - 25+ FAQs (Wh-questions) on a place they have visited – Pair work	10 hours				
6.	Speaking: Discuss facts and opinions using question tags	6 hours				
7.	Writing: Formal Letter Writing focusing on Content	6 hours				
8.	Vocabulary: Correct spelling errors	4 hours				
9.	Speaking: Asking for and giving Directions/Instructions	6 hours				
10.	Writing: Story writing using prompts/pictures	4 hours				
Total Laboratory Hours						60 hours
Text Books						
1.	Lewis Lansford and Peter Astley. Oxford English for Careers: Engineering 1: Student's Book. 2013. USA: Oxford University Press.					
2.	Jaimie Scanlon. Q: Skills for Success 1 Listening & Speaking. 2015. [Second Revised Edition]. Oxford: Oxford University Press.					
Reference Books						

1.	Sanjay Kumar and Puspalata. Communication Skills. 2015. [Second Edition] Print. NewDelhi: Oxford University Press.		
2.	John Seely. Oxford Guide to Effective Writing and Speaking. 2013. [Third Edition].NewDelhi: Oxford University Press.		
3.	Meenakshi Raman. Communication Skills. 2011. [Second Edition]. New Delhi: Oxford University Press.		
4.	Terry O'Brien. Effective Speaking Skills. 2011. New Delhi: Rupa Publishers.		
5.	BarunMitra. Effective Technical Communication: A Guide for Scientists and Engineers. 2015. New Delhi: Oxford University Press.		
Mode of evaluation: Online Quizzes, Presentation, Role play, Group Discussions, Assignments, Mini project.			
Recommended by Board of Studies		22-07-2017	
Approved by Academic Council		No. 46	Date 24-08-2017