Terna Engineering College, Nerul, Navi Mumbai
IT Department

SEMESTER	SUBJECT CODE	SUBJECT	CO/LO	CO / LO STATEMENT
SEM III	ITC301	Applied Mathematics III	CO1	Apply the Set theory and Relation concepts.
			CO2	Apply the Functions and define the recursive functions.
			CO3	Apply Laplace transform to different applications.
			CO4	Apply Inverse Laplace transform to different applications
			CO5	Identify the permutations and combinations
			CO6	Define variable and also identify the mapping.
	ITC302	Logic Design	CO1	Understand the concepts of various components to design stable analog circuits.
			CO2	Represent numbers and perform arithmetic operations.
			CO3	Minimize the Boolean expression using Boolean algebra and design it using logic gates
			CO4	Analyze and design combinational circuit
			CO5	Design and develop sequential circuits
			CO6	Translate real world problems into digital logic formulations using VHDL.
	ITC303	Data Structures & Analysis	CO1	Select appropriate data structures as applied to specified problem definition.
			CO2	structures.
			CO3	Students will be able to implement Linear and Non-Linear data structures.
			CO4	Implement appropriate sorting/searching technique for given problem.
			CO5	Design advance data structure using Non-Linear data structure.
			CO6	Determine and analyze the complexity of given Algorithms.
	ITC304	Database Management Systems	CO1	Explain the features of database management systems and Relational database
			CO2	Design conceptual models of a database using ER modeling for real life applications and also construct queries in Relational Algebra
			CO3	Create and populate a RDBMS for a real life application, with constraints and keys, using SQL.
			CO4	Retrieve any type of information from a data base by formulating complex queries in SQL.
			CO5	Analyze the existing design of a database schema and apply concepts of normalization to design an optimal database.
			CO6	Build indexing mechanisms for efficient retrieval of information from a database
	ITC305	Principle of Communications	CO1	Differentiate analog and digital communication systems
			CO2	domain to quantify bandwidth requirement of variety of analog and digital communication systems.
			CO3	Design generation & detection AM, DSB, SSB, FM transmitter and receiver.
			CO4	Apply sampling theorem to quantify the fundamental relationship between channel bandwidth, digital symbol rate and bit rate
			CO5	Explain different types of line coding techniques for generation and detection of signals.
			CO6	Describe Electromagnetic Radiation and propagation of waves
SEM -IV	ITC401	Applied Mathematics IV	CO1	Apply the Number Theory to different applications using theorem.
			CO2	Apply probability and understand PDF
			CO3	Understand sampling theory and correlation
			CO4	Apply the graphs and trees concepts to different applications.
			CO5	Understand group's theory
			CO6	Understand the Lattice theory
	ITC402	Computer Networks	CO1	Describe the functions of each layer in OSI and TCP/IP model.
			CO2	Explain the functions of Application layer and Presentation layer paradigms and Protocols.
			CO3	Describe the Session layer design issues and Transport layer services.
			CO4	Classify the routing protocols and analyze how to assign the IP addresses for the given network.
			CO5	Describe the functions of data link layer and explain the protocols.
			CO6	Explain the types of transmission media with real time applications
	ITC403	Operating System	CO1	Describe the important computer system resources and the role of operating system in their management policies and algorithms.
			CO2	Understand the process management policies and scheduling of processes by CPU
			CO3	Evaluate the requirement for process synchronization and coordination handled by operating system
			CO4	Describe and analyze the memory management and its allocation policies.
			CO5	Identify use and evaluate the storage management policies with respect to different storage management technologies.
			CO6	Identify the need to create the special purpose operating system.
		Computer	CO1	Describe basic organization of computer and the architecture of 8086 microprocessor.
			CO2	Implement assembly language program for given task for 8086 microprocessor.
			CO3	Demonstrate control unit operations and conceptualize instruction level parallelism.

	ITC404	Organization and Architecture	CO4	Demonstrate and perform computer arithmetic operations on integer and real numbers.
			CO5	Categorize memory organization and explain the function of each element of a memory hierarchy.
			CO6	Identify and compare different methods for computer I/O mechanisms.
	ITC405	Automata Theory	CO1	Understand, design, construct, analyze and interpret Regular languages, Expression and Grammars.
			CO2	Design different types of Finite Automata and Machines as Acceptor, Verifier and Translator.
			CO3	Understand, design, analyze and interpret Context Free languages, Expression and Grammars.
			CO4	Design different types of Push down Automata as Simple Parser.
			CO5	Design different types of Turing Machines as Acceptor, Verifier, Translator and Basic computing machine.
			CO6	Compare, understand and analyze different languages, grammars, Automata and Machines and appreciate their power and convert Automata to Programs and Functions
	ITL401	Networking Lab	CO1	Execute and evaluate network administration commands and demonstrate their use in different network scenarios
			CO2	Demonstrate the installation and configuration of network simulator.
			CO3	Demonstrate and measure different network scenarios and their performance behavior.
			CO4	Analyze the contents the packet contents of different protocols.
			CO5	Implement the socket programming for client server architecture.
			CO6	Design and setup a organization network using packet tracer.
	ITL402	Unix Lab	CO1	Identify the basic Unix general purpose commands.
			CO2	Apply and change the ownership and file permissions using advance Unix commands.
			CO3	Use the awk, grep, perl scripts.
			CO4	Implement shell scripts and sed.
			CO5	Apply basic of administrative task.
			CO6	Apply networking Unix commands.
	ITL403	Microprocessor Programming Lab	CO1	Apply the fundamentals of assembly level programming of microprocessors.
			CO2	Build a program on a microprocessor using arithmetic & logical instruction set of 8086.
			CO3	Develop the assembly level programming using 8086 loop instruction set.
			CO4	Write programs based on string and procedure for 8086 microprocessor.
			CO5	Analyze abstract problems and apply a combination of hardware and software to address the problem
			CO6	Make use of standard test and measurement equipment to evaluate digital interfaces.
	ITL404	Python lab	CO1	Describe the Numbers, Math functions, Strings, List, Tuples and Dictionaries in Python
			CO2	Express different Decision Making statements and Functions
			CO3	Interpret Object oriented programming in Python
			CO4	Interpret Object oriented programming in Python
			CO5	Explain how to design GUI Applications in Python and evaluate different database operations
			CO6	Design and develop Client Server network applications using Python
SEM -V	ITC501	Microcontroller and Embedded Programming	CO1	Explain the embedded system concepts and architecture of embedded systems
			CO2	Describe the architecture of 8051 microcontroller and write embedded program for 8051 microcontrolle
			CO3	Design the interfacing for 8051 microcontroller.
			CO4	Understand the concepts of ARM architecture.
			CO5	Demonstrate the open source RTOS and solve the design issues for the same
			CO6	Select elements for an embedded systems tool.
	ITC502	Internet Programming	CO1	Implement interactive web page(s) using HTML,CSS and JavaScript.
			CO2	Design a responsive web site using HTML5 and CSS3.
			CO3	Demonstrate Rich Internet Application .
			CO4	Build Dynamic web site using server side PHP Programming and Database connectivity.
			CO5	Describe and differentiate different Web Extensions and Web Services.
			CO6	Demonstrate web application using Python web Framework-Django
	ITC503	Advanced Data Management Technology	CO1	Implement simple query optimizers and design alternate efficient paths for query execution.
			CO2	Simulate the working of concurrency protocols, recovery mechanisms in a database
			CO3	Design applications using advanced models like mobile, spatial databases.
			CO4	Implement a distributed database and understand its query processing and transaction processing mechanisms
			CO5	Build a data warehouse
			CO6	Analyze data using OLAP operations so as to take strategic decisions.
			CO1	Identify information security goals, classical encryption techniques and acquire fundamental knowledge on the concepts of finite fields and number theory.
			CO2	Understand, compare and apply different encryption and decryption techniques to solve problems related to confidentiality and authentication

	ITC504	Cryptography & Network Security	CO3	Apply the knowledge of cryptographic checksums and evaluate the performance of different message digest algorithms for verifying the integrity of varying message sizes
			CO4	Apply different digital signature algorithms to achieve authentication and create secure applications
			CO5	Apply network security basics, analyze different attacks on networks and evaluate the performance of firewalls and security protocols like SSL, IPSec, and PGP.
			CO6	Apply the knowledge of cryptographic utilities and authentication mechanisms to design secure applications.
	ITL501	Internet Programming Lab	CO1	To orient students to Web Programming fundamental.
			CO2	To expose students to JavaScript to develop interactive web page development
			CO3	To orient students to Basics of REACT along with installation
			CO4	To expose students to Advanced concepts in REACT
			CO5	To orient students to Fundamentals of node.js
			CO6	To expose students to node.js applications using express framework.
	ITL502	Security Lab	CO1	Apply the knowledge of symmetric cryptography to implement simple ciphers
			CO2	Analyze and implement public key algorithms like RSA and El Gamal
			CO3	Analyze and evaluate performance of hashing algorithms
			CO4	Explore the different network reconnaissance tools to gather information about networks
			CO5	Use tools like sniffers, port scanners and other related tools for analyzing packets in a network.
			CO6	security.
	ITL503	OLAP Lab	CO1	Implement simple query optimizers and design alternate efficient paths for query execution.
			CO2	Simulate the working of concurrency protocols, recovery mechanisms in a database
			CO3	Design applications using advanced models like mobile, spatial databases.
			CO4	mechanisms.
			CO5	Build a data warehouse
			CO6	Analyze data using OLAP operations so as to take strategic decisions.
	ITL504	IOT (Mini Project) Lab	CO1	Identify the requirements for the real world problems.
			CO2	Conduct a survey of several available literatures in the preferred field of study.
			CO3	Study and enhance software/ hardware skills.
			CO4	Demonstrate and build the project successfully by hardware requirements, coding, emulating and testing.
			CO5	To report and present the findings of the study conducted in the preferred domain
			CO6	Demonstrate an ability to work in teams and manage the conduct of the research study.
	ITL505	Business Communication and Ethics	CO1	Design a technical document using precise language, suitable vocabulary and apt style.
			CO2	Develop the life skills/ interpersonal skills to progress professionally by building stronger relationships.
			CO3	. Demonstrate awareness of contemporary issues knowledge of professional and ethical responsibilities.
			CO4	Apply the traits of a suitable candidate for a job/higher education, upon being trained in the techniques of holding a group discussion, facing interviews and writing resume/SOP.
			CO5	Deliver formal presentations effectively implementing the verbal and non-verbal skills.
SEM-VI	ITC601	Software Engineering with Project Management	CO1	development.
			CO2	Explain needs for software specifications also they can classify different types of software requirements and their gathering techniques.
			CO3	Convert the requirements model into the design model and demonstrate use of software and user-interface design principles.
			CO4	Distinguish among SCM and SQA and can classify different testing strategies and tactics and compare them.
			CO5	Justify role of SDLC in Software Project Development and they can evaluate importance of Software Engineering in PLC.
			CO6	Generate project schedule and can construct, design and develop network diagram for different type of Projects. They can also organize different activities of project as per Risk impact factor.
	ITC602	Data Mining and Business Intelligence	CO1	Demonstrate an understanding of the importance of data mining and the principles of business intelligence
			CO2	Organize and Prepare the data needed for data mining using pre preprocessing techniques
			CO3	Perform exploratory analysis of the data to be used for mining.
			CO4	Implement the appropriate data mining methods like classification, clustering or Frequent Pattern mining on large data sets.
			CO5	Define and apply metrics to measure the performance of various data mining algorithms.
			CO6	Apply BI to solve practical problems : Analyze the problem domain, use the data collected in enterprise apply the appropriate data mining technique, interpret and visualize the results and provide decision support.
			CO1	Define Cloud Computing and memorize the different Cloud service and deployment models
			CO2	Describe importance of virtualization along with their technologies.
			CO3	Use and Examine different cloud computing services
			CO4	Analyze the components of open stack & Google Cloud platform and understand Mobile Cloud Computing.

	ITC603	Cloud Computing & Services	CO5	Describe the key components of Amazon web Service
			CO6	Design & develop backup strategies for cloud data based on features.
	ITC604	Wireless Networks	CO1	Explain the basic concepts of wireless network and wireless generations.
			CO2	Demonstrate the different wireless technologies such as CDMA, GSM, GPRS etc
			CO3	Appraise the importance of Ad-hoc networks such as MANET and VANET and Wireless Sensor networks.
			CO4	Describe and judge the emerging wireless technologies standards such as WLL,WLAN, WPAN, WMAN.
			CO5	Explain the design considerations for deploying the wireless network infrastructure.
			CO6	Differentiate and support the security measures, standards. Services and layer wise security considerations.
	ITL601	Software Design lab	LO1	1.Sketch a Modeling with UML.
			LO2	2. Deploy Structural Modeling.
			LO3	3. Deploy Behavioral Modeling.
			LO4	4. Deploy Architectural Modeling.
			LO5	5. Examine estimation about schedule and cost for project development.
			LO6	6.Identify and analyze risk of project and prepare RMMM plan.
	ITL602	Business Intelligence Lab	LO1	Demonstrate an understanding of the importance of data mining and the principles of business intelligence
			LO2	Organize and Prepare the data needed for data mining using pre preprocessing techniques
			LO3	Perform exploratory analysis of the data to be used for mining.
			LO4	Implement the appropriate data mining methods like classification, clustering or Frequent Pattern mining on large data sets.
			LO5	Define and apply metrics to measure the performance of various data mining algorithms.
			LO6	Apply BI to solve practical problems : Analyze the problem domain, use the data collected in enterprise apply the appropriate data mining technique, interpret and visualize the results and provide decision support.
	ITL603	Cloud Service design Lab	LO1	Define Cloud Computing and memorize the different Cloud service and deployment models
			LO2	Describe importance of virtualization along with their technologies.
			LO3	Use and Examine different cloud computing services
			LO4	Analyze the components of open stack & Google Cloud platform and understand Mobile Cloud Computing
			LO5	Describe the key components of Amazon web Service
			LO6	Design & develop backup strategies for cloud data based on features.
	ITL604	Sensor Network Lab	LO1	Identify the requirements for the real world problems.
			LO2	Conduct a survey of several available literatures in the preferred field of study.
			LO3	Study and enhance software/ hardware skills.
			LO4	Demonstrate and build the project successfully by hardware/sensor requirements, coding,emulating and testing.
			LO5	To report and present the findings of the study conducted in the preferred domain
			LO6	Demonstrate an ability to work in teams and manage the conduct of the research study.
	ITM605	Mini-project	LO1	Discover potential research areas in the field of IT
			LO2	Conduct a survey of several available literature in the preferred field of study
			LO3	Compare and contrast the several existing solutions for research challenge
			LO4	Demonstrate an ability to work in teams and manage the conduct of the research study.
			LO5	Formulate and propose a plan for creating a solution for the research plan identified
			LO6	To report and present the findings of the study conducted in the preferred domain
SEM VII	ITC701	Enterprise Network Design	CO1	Understand the customer requirements and Apply a Methodology to Network Design
			CO2	Structure and Modularize the Network
			CO3	Design Basic Campus and Data Center Network.
			CO4	Design Remote Connectivity
			CO5	Design IP Addressing and Select suitable Routing Protocols for the Network
			CO6	Compare Openflow controllers and switches with other enterprise networks.
	ITC702	Infrastructure security	CO1	Understand the concept of vulnerabilities, attacks and protection mechanisms
			CO2	Analyze and evaluate software vulnerabilities and attacks on databases and operating systems
			CO3	Explain the need for security protocols in the context of wireless communication
			CO4	Understand and explain various security solutions for Web and Cloud infrastructure
			CO5	Understand, and evaluate different attacks on Open Web Applications and Web services
			CO6	Design appropriate security policies to protect infrastructure components
			CO1	Demonstrate knowledge of the building blocks of AI as presented in terms of intelligent agents.

	ITC703	Artificial Intelligence	CO2	Analyze and formalize the problem as a state space, graph, design heuristics and select amongst different search or game based techniques to solve them.
			CO3	Develop intelligent algorithms for constraint satisfaction problems and also design intelligent systems for Game Playing.
			CO4	Attain the capability to represent various real life problem domains using logic based techniques and use this to perform inference or planning.
			CO5	Formulate and solve problems with uncertain information using Bayesian approaches.
			CO6	Apply concept Natural Language processing to problems leading to understanding of cognitive computing.
	ITL701	Network design Lab	LO1	Understand the requirements of an enterprise and outline its major design areas
			LO2	Identify functional areas to construct high level modules for enterprise architecture and analyzethem.
			LO3	Identify the networking devices, prepare a bill of materials and configure the devices as per theCore, Acess and Distribution layers
			LO4	Design the Server Farm for an enterprise network and discuss up gradations if needed.
			LO5	Identify and select the technology for Remote site Connectivity, suitable IP addressing plan and routing protocol for an enterprise network.
			LO6	Test and monitor the enterprise network using a tool
	ITL702	Advanced Security Lab	LO1	Implement and analyze program and database vulnerabilities Buffer overflow and SQL Injection.
			LO2	Explore and analyze different security tools to secure mobile devices, web browser, wireless network and router
			LO3	Explore reconnaissance, attack and forensics tools in Kali Linux
			LO4	Learn security of system using personal firewall installation
			LO5	Understand AAA using RADUIS
			LO6	Understand AAA using TACACS
	ITL703	Intelligence System Lab	LO1	Design the building blocks of an Intelligent Agent using PEAS representation .
			LO2	Analyze and formalize the problem as a state space, graph, design heuristics and select amongstdifferent search or game based techniques to solve them.
			LO3	Develop intelligent algorithms for constraint satisfaction problems and also design intelligent systems for Game Playing
			LO4	Attain the capability to represent various real life problem domains using logic based techniques and use this to perform inference or planning.
			LO5	Formulate and solve problems with uncertain information using Bayesian approaches.
			LO6	Apply concept Natural Language processing and cognitive computing for creation of domain specific ChatBots.
	ITL704	Android Apps Development Lab	LO1	Experiment on Integrated Development Environment for Android Application Development.
			LO2	Design and Implement User Interfaces and Layouts of Android App.
			LO3	Use Intents for activity and broadcasting data in Android App.
			LO4	Design and Implement Database Application and Content Providers.
			LO5	Experiment with Camera and Location Based service.
			LO6	Develop Android App with Security features.
	ITM705	Project-1	LO1	Discover potential research areas in the field of IT
			LO2	Conduct a survey of several available literature in the preferred field of study
			LO3	Compare and contrast the several existing solutions for research challenge
			LO4	Demonstrate an ability to work in teams and manage the conduct of the research study.
			LO5	Formulate and propose a plan for creating a solution for the research plan identified
			LO6	To report and present the findings of the study conducted in the preferred domain
SEM VIII	ITC801	Big Data Analytics	CO1	Explain the motivation for big data systems and identify the main sources of Big Data in the real world.
			CO2	Demonstrate an ability to use frameworks like Hadoop, NOSQL to efficiently store retrieve and process Big Data for Analytics.
			CO3	Implement several Data Intensive tasks using the Map Reduce Paradigm
			CO4	Apply several newer algorithms for Clustering Classifying and finding associations in Big Data
			CO5	Design algorithms to analyze Big data like streams, Web Graphs and Social Media data.
			CO6	Design and implement successful Recommendation engines for enterprises.
	ITC802	Internet Of Everything	CO1	Apply the concepts of IOT.
			CO2	Identify the different technology.
			CO3	Apply IOT to different applications.
			CO4	Analysis and evaluate protocols used in IOT.
			CO5	Design and develop smart city in IOT.
			CO6	Analysis and evaluate the data received through sensors in IOT.
			LO1	Demonstrate capability to use Big Data Frameworks like Hadoop
			LO2	Program applications using tools like Hive, pig, , NO SQL and MongoDB for Big data Applications.
			LO3	Construct scalable algorithms for large Datasets using Map Reduce techniques

	ITL801	Big Data Lab	LO4	Implement algorithms for Clustering, Classifying and finding associations in Big Data
			LO5	Design and implement algorithms to analyze Big data like streams, Web Graphs and Social Media data and construct recommendation systems.
			LO6	Apply the knowledge of Big Data gained to fully develop a BDA applications for real life applications.
	ITL802	Internet Of Everything Lab	LO1	Identify the requirements for the real world problems.
			LO2	Conduct a survey of several available literatures in the preferred field of study.
			LO3	Study and enhance software/ hardware skills.
			LO4	Demonstrate and build the project successfully by hardware/sensor requirements, coding, emulating and testing.
			LO5	To report and present the findings of the study conducted in the preferred domain
			LO6	Demonstrate an ability to work in teams and manage the conduct of the research study.
	ITL803	DevOps Lab	LO1	Remember the importance of DevOps tools used in software development life cycle
			LO2	Understand the importance of Jenkins to Build, Deploy and Test Software Applications
			LO3	Examine the different Version Control strategies
			LO4	Analyze & Illustrate the Containerization of OS images and deployment of applications over Docker
			LO5	Summarize the importance of Software Configuration Management in DevOps
			LO6	Synthesize the provisioning using Chef/Puppet/Ansible or Saltstack.
	ITL804	R Programming Lab	LO1	Install and use R for simple programming tasks.
			LO2	Extend the functionality of R by using add-on packages
			LO3	Extract data from files and other sources and perform various data manipulation tasks on them.
			LO4	Code statistical functions in R.
			LO5	Apply the knowledge of R gained to data Analytics for real life applications.
			LO6	Apply the knowledge of R gained to data Analytics for real life applications.
	ITM805	Project-II	LO1	Discover potential research areas in the field of IT
			LO2	Conduct a survey of several available literature in the preferred field of study
			LO3	Compare and contrast the several existing solutions for research challenge
			LO4	Demonstrate an ability to work in teams and manage the conduct of the research study.
			LO5	Formulate and propose a plan for creating a solution for the research plan identified
			LO6	To report and present the findings of the study conducted in the preferred domain