VARDHAMAN COLLEGE OF ENGINEERING, HYDERABAD

Autonomous institute affiliated to JNTUH

B.Tech (COMPUTER SCIENCE AND ENGINEERING)

Course Outcomes:

Course Outcomes for Second Year First Semester Course		
Course Title with Code	**#**	**Statement**
DESIGN AND ANALYSIS OF ALGORITHMS (A3506)	CO1	Demonstrate the importance various algorithmic notations and their usage to give asymptotic upper, lower bounds on time and space complexity of algorithms.
	CO2	Apply divide and conquer strategy to solve various computing problems.
	CO3	Estimate all feasible solutions using greedy strategy and recite an algorithm that employs this strategy.
	CO4	Construct algorithms for solving real world problems using dynamic programming
	CO5	Apply fundamental graph traversal techniques to solve various applications using backtracking.
	CO6	Analyze Branch and Bound techniques and explain the significance of NP Completeness.
COMPUTER ORGANIZATION AND MICROPROCESSORS (A3507)	CO1	Comprehend the basic organization of modern computer systems.
	CO2	Analyze an instruction-set architecture, propose a suitable data path and control unit implementation.
	CO3	Analyze the operation of fixed and floating point arithmetic units.
	CO4	Understand and apply the internal working flow of 8086microprocessor.
	CO5	Apply assembly language programming in design of microprocessor based system.
	CO6	Design and analyze the memory, I/ O peripheral interfacing process with 8086.
OBJECT ORIENTED PROGRAMMING (A3509)	CO1	Use various programming constructs of object oriented language.
	CO2	Apply principles of object oriented programming to model/design real world problems.
	CO3	Use exception handling mechanism to develop fault tolerant applications.

	CO4	Analyze the concepts of multi threaded programming and synchronization.
	CO5	Use GUI controls and event handling mechanism to develop interactive window/desktop applications.
	CO6	Analyze need of applets, swings to develop simple web application.
COMPUTER ORGANIZATION AND MICROPROCESSORS LAB (A3510)	CO1	Show the interaction between CPU, memory and I/O ports by implementing programs.
	CO2	Program a microprocessor using instruction set of 8086.
	CO3	Master the assembly level programming using 8086 instruction set.
	CO4	Distinguish how different I/O devices can be interfaced to processor and will explore several techniques of interfacing.
	CO5	Demonstrate is clear understanding of the interaction for data transfer between CPU, memory and I/O ports
OBJECT ORIENTED PROGRAMMING THROUGH JAVA LAB (A3511)	CO1	Use various constructs of object orient programming
	CO2	Write programs using string API.
	CO3	Analyze the need of object oriented programming principles.
	CO4	Apply exception handling mechanism to overcome run-time errors.
	CO5	Prepare for writing multi threaded applications.
	CO6	Use event handling and AWT to design GUI applications.

Course Outcomes for Second Year Second Semester Course		
PRINCIPLES OF PROGRAMMING LANGUAGES (A3512)	CO1	Analyze the designing criteria of different programming languages to choose appropriate language for implementation of real time applications.
	CO2	Identify appropriate primitive/user defined data types for increasing program efficiency.
	CO3	Apply sub program concepts to improve the readability of the program.
	CO4	Analyze different object oriented programming features and to apply in developing efficient web programs with concurrent ability.
	CO5	Apply exception handling techniques to develop robust programs to sustain against all runtime exceptions.
FORMAL LANGUAGES AND AUTOMATA THEORY (A3513)	CO1	Acquire a fundamental understanding of the core concepts in automata theory and formal languages.
	CO2	Design grammars and automata (recognizers) for different language classes.
	CO3	Identify formal language classes and prove language

		membership properties.
	CO4	Prove and disprove theorems establishing key properties of formal languages and automata.
	CO5	Acquire a fundamental understanding of core concepts relating to the theory of computation and computational models including (but not limited to) decidability and intractability.
SOFTWARE ENGINEERING (A3514)	CO1	Identify the right process model to develop a software system.
	CO2	Gather requirements and analyze them scientifically in order to develop the right product, besides authoring software requirements document.
	CO3	Propose design as per functional and non-functional requirements using design principles.
	CO4	Propose testing strategies for application being developed.
	CO5	Identify right set of umbrella activities for quality management and assurance.
OPERATING SYSTEMS (A3515)	CO1	Analyze the concept of Process management, Synchronization and Concurrency control.
	CO2	Examine Deadlock handling methods.
	CO3	Apply the concepts of Memory management techniques.
	CO4	Use File and Disk Management Schemes for effective Storage.
	CO5	Examine different Protection and Security principles associated with Operating Systems.
	CO6	Use simple utilities and system calls for accessing Operating System Services.
DATABASE MANAGEMENT SYSTEMS (A3516)	CO1	CO1.Design and implement a database schema for a given problem domain.
	CO2	CO2.Construct Queries in Relational algebra, relational calculus and SQL.
	CO3	CO3.Apply Normalization techniques to reduce data redundancy in data base.
	CO4	CO4.Analyze various transaction control and recovery methods to keep data base consistent.
	CO5	CO5.Construct the file of data records by using appropriate storage and access structure.
OPERATING SYSTEMS LAB (A3517)	CO1	Use file handling utilities / commands of UNIX operating system.
	CO2	Apply inter process communication mechanisms of UNIX.
	CO3	Compare various CPU scheduling algorithms

		performance.
	CO4	Analyze whether a system is in safe state or not using deadlock avoidance algorithm.
	CO5	Apply memory management strategies.
	CO6	Use file management system calls to simulate UNIX commands.
DATABASE MANAGEMENT SYSTEMS LAB (A3518)	CO1	Design and implement a database schema for a given problem domain.
	CO2	Formulate a query to retrieve information from database.
	CO3	To implement database security and maintenance.
	CO4	Normalize a database.
	CO5	Applying enforce integrity constraints on a database.

Course Outcomes for Third Year Second Semester Course		
COMPUTER GRAPHICS (A3602)	CO1	Identify computer graphics applications, computer graphics Hardware and software.
	CO2	Extend basic geometric primitives algorithms for producing custom shapes and Compute 2D or 3D transformations for doing manipulations on objects.
	CO3	Combine basic transformations to produce composite transformations and compare the 2D, 3D viewing process and can select the appropriate clipping techniques for producing view of objects.
	CO4	Analyze the curve generation techniques and Illustrate 3D rendering process, various types of projection methods available.
	CO5	Utilize the efficient visible surface detection algorithms, projection concepts in rendering a view of scene of objects.
WEB TECHNOLOGIES (A3601)	CO1	CO1.Apply various HTML tags used to design static web pages.
	CO2	CO2.Apply CSS and JavaScript Constructs to perform Client side validation and designing of dynamic web pages.
	CO3	CO3.Apply various PHP construct to develop server side applications and also familiar of transporting data among applications using XML.
	CO4	CO4.Understand how to configure Web servers and deployment of applications.
	CO5	CO5.Design server side; Database and MVC based applications using Servlet, JSP and JDBC.
	CO6	CO6. Understand Handling of asynchronous requests using AJAX programming.

SOFTWARE TESTING METHODOLOGIES (A3612)	CO1	To understand the purpose of testing, types of errors, fault models and various test process.
	CO2	To understand adequacy assessment using control flow and path testing techniques.
	CO3	Analyze various transactions, data and domain test strategies to work with various functionalities and various paths and path expressions to reduce the computational cost.
	CO4	Analyze various states, transitions and graph matrices regarding to state and graph matrices.
	CO5	Design test cases for the real world problems effectively by following standards. CO6. Apply appropriate software testing tools, techniques and methods for more effective systems during test planning and execution phases of software development project and risk analysis.
	CO6	To understand the purpose of testing, types of errors, fault models and various test process.
COMPUTER NETWORKS (A3519)	CO1	To understands the terminology and concepts of OSI reference model and the TCP/IP reference model and functions of each layer.
	CO2	To identify the different types of network topologies, protocols, network devices and their functions within a network
	CO3	To master the concepts of protocols, networks interfaces, and design/performance issues in LAN and WAN
	CO4	To understand and building the skills of sub netting and routing mechanisms, familiarity with basic protocols of computer networks and how they can be used to assist in network design and implementation
	CO5	Specify and identify deficiencies in existing protocols, and then go on to formulate new and better protocols.
COMPILER DESIGN (A3520)	CO1	Design and implement lexical Analyzer for a simple programming language.
	CO2	Design and implement syntax Analyzer using top down or bottom up techniques. CO3.Analyze semantic analyzer for a simple programming language.
	CO3	Compare different intermediate code generation forms.
	CO4	Analyze machine dependent and independent code optimizer techniques.
	CO5	Design and implement lexical Analyzer for a simple programming language.
OBJECT ORIENTED ANALYSIS AND DESIGN (A3607)	CO1	Possess an ability to practically apply knowledge software engineering methods, such as object - oriented analysis and design methods with a clear emphasis on UML

	CO2	Have a working ability and grasping attitude to design and conduct object oriented analysis and design experiments using UML, as well as to analyze and evaluate their models
	CO3	Have a capacity to analyze and design software systems, components to meet desired needs
	CO4	Show ability to form and work on multi-disciplinary teams that are able to perform multiple - faceted tasks from domain analysis and understanding to design and develop software systems based on object-oriented thinking
	CO5	Display an ability to identify, formulate and solve software development problems: software requirements, specification (problem space), software design, and implementation (solution space)
WEB TECHNOLOGIES LAB (A3603)	CO1	Analyze and create web pages using languages like HTML, DHTML, CSS, PHP and JavaScript
	CO2	Design XML Schema and create XML documents and Java Beans
	CO3	Use server side components like Servlets to build dynamic websites
	CO4	Create websites using server-side components using JSP
	CO5	Design and construct various data base tables using JDBC and produce various results based on given query
CASE TOOLS LAB (A3609)	CO1	Master key principles in OO analysis design and development
	CO2	Be familiar with the application of the Unified Modeling Language (UML) towards analysis and design
	CO3	Be familiar with alternative development processes
	CO4	Apply design principles
	CO5	Identify and apply key principles, rules, and heuristics in OO analysis and design apply UML 2.0
	CO6	Have a deep knowledge of the principles of object-oriented design

Course Outcomes for Third Year Second Semester Course		
WIRELESS AND MOBILE COMPUTING (A3521)	CO1	Demonstrate the basic concepts and principles in mobile computing
	CO2	Distinguish the structure and components for Mobile IP and Mobility Management
	CO3	Compare the positioning techniques and location-based services and applications
	CO4	Analyze the technical challenges posed by current mobile devices and wireless communications
	CO5	Identify software tools and APIs for mobile applications and hence be aware of their scope and limitations
INFORMATION SECURITY	CO1	Analyze the different Security Attacks, Services, and Mechanisms work security models

(A3608)	CO2	Apply classical encryption algorithms (Substitution and Transposition ciphers) and DES algorithms to encrypt plaintext (Apply)
	CO3	Distinguish the modern Cryptography algorithm such as DES, AES, double DES, Triple DES, RC4 algorithm and analyze modern cryptanalysis techniques
	CO4	Solve the problem on Number theory, public key cryptography techniques (RSA) and key management algorithms (Diffie-Hellman)
	CO5	Compare and contrast message authentication algorithms (SHA-512, MAC, and HMAC), symmetric and asymmetric encryption and authentication standards and protocols
DATA WAREHOUSING AND DATA MINING (A3522)	CO1	Apply preprocessing techniques on various data sets
	CO2	Develop data warehouse using various schemas for enterprise applications
	CO3	Apply supervised learning techniques on various data sets
	CO4	Apply unsupervised techniques on various data type
	CO5	Analyze various web mining technique
SOFTWARE ARCHITECTURE(A3652) (Professional Elective - I)	CO1	Demonstrate the importance and role of software architecture in large-scale software systems
	CO2	Design and Integrate software architecture for large-scale software systems
	CO3	Recognize major software architectural styles, design patterns, and frameworks
	CO4	Generate architectural alternatives for a problem and selection among them
	CO5	Identify and assess the quality attributes of a system at the architectural level
ADVANCED COMPUTER ARCHITECTURE (A3551) (Professional Elective - I)	CO1	Describe the principles of computer design
	CO2	Classify instruction set architectures
	CO3	Analyze the operation of performance enhancements such as pipelines, caches, shared memory
	CO4	Describe modern architectures such as RISC, VLIW (very large instruction word) and multi-cpu systems
	CO5	Compare the performance of different architectures
DISTRIBUTED DATABASES (A3552) (Professional Elective - I)	CO1	Apply Top-Down Design Process, Distributed Database Design Issues, Fragmentation, Allocation, and Database Integration-Bottom-up approach

	CO2	Analysis of Query Decomposition Normalization, Primary Horizontal, Vertical, derived and Hybrid Fragmentation
	CO3	Examine of Query optimization, Concurrency Control and Deadlock Management
	CO4	Use Query Parallelism, Parallel Query Optimization and Load Balancing
	CO5	Interpret Distributed Object Storage, Object Query Processing and Transaction Management
ARTIFICIAL INTELLIGENCE AND NEURAL NETWORKS (A3553) (Professional Elective - I)	CO1	Analyze and apply the basic the concepts of artificial intelligence and the use of agents into the real world scenario
	CO2	Identify, analyze, formulate and solve complex problems by using various search techniques
	CO3	Explore with a better understanding of logic programming skills and resolve problems related to reasoning
	CO4	Design, construct and evaluate a neural network based system, with various learning process models
	CO5	Plan and design an expert system
IMAGE PROCESSING (A3554)(Professional Elective - II)	CO1	Know and understand the basics and fundamentals of digital signal and image processing, such as digitization, sampling, quantization, and 2D-transforms
	CO2	Operate on images using the processing techniques of smoothing, sharpening, enhancing, reconstructing geometrical alterations, filtering, restoration, segmentation, features extraction, compression, encoding and color /multichannel
	CO3	Manipulate images using the computer: reading, writing, printing, and operating on them
	CO4	Apply and relate the basic imaging techniques to practical cases, such as, multimedia, videoconferencing, pattern and object recognition
	CO5	Aware of the ethical and legal issues related to image processing, such as, copyright, security, privacy, pornography, electronic distribution, etc
STRUTS AND SPRING FRAMEWORK (A3555) (Professional Elective - II)	CO1	Build struts frame work and struts2 XML based validation application
	CO2	Develop spring applications using IDE, IOC Container
	CO3	Develop spring applications using JDBC
	CO4	Develop web applications using MVC architecture
	CO5	Use DAO design patterns in developing applications
HUMAN COMPUTER	CO1	Identify the elements of good user interface

INTERACTION (A3556) (Professional Elective - II)		design and effective GUI
	CO2	Identify the importance of human characteristics and understanding business functions
	CO3	Analyze screen design principles for making good decisions based on technological Considerations in interface design.
	CO4	Select the window, device and screen based controls through navigation schemes
	CO5	Identify the basic components and interaction devices to interact with the computers
SEMANTIC WEB AND SOCIAL NETWORKS (A3557) (Professional Elective - II)	CO1	Able to understand the basics of Intelligent Web Applications and limitations
	CO2	Able to be proficient with Ontology's and their role in the semantic web and Ontology Languages like Resource Description Framework, RDF schema, Ontology Web Language (OWL)XML schema
	CO3	Able to understand and design current Semantic Web Applications, Services and Technologies to meet desired needs within realistic constraints
	CO4	Able to analyze and identify web searching problems and apply the semantic searching techniques and applications for obtaining its solution
	CO5	Demonstrate knowledge of professional, ethical, legal, security and social issues and responsibilities in designing Semantic web and social Networks
NETWORK SIMULATION LAB (A3523)	CO1	Develop their own commands and systems calls in UNIX
	CO2	Use modeling and simulation as a tool for the evaluation of communication protocols and networks
	CO3	Build various simulation models
	CO4	Create and analyze the network traffic between two systems
	CO5	Become proficient in network simulation tools
DATA WAREHOUSING AND DATA MINING LAB (A3524)	CO1	Apply various preprocessing Techniques using WEKA tool for the given datasets
	CO2	Develop various data integration and transformations using Kettle Pentaho tool
	CO3	Build data Cubes and perform OLAP Operations
	CO4	Apply appropriate association and classification techniques to interpret data and provide valid conclusions
	CO5	Apply clustering techniques, compare the results and write effective reports
Course Outcomes for Fourth Year First Semester Course		
OPEN SOURCE TECHNOLOGIES (A3604)	CO1	Solve computer software problems by using PHP and MySQL

	CO2	Familiarize and define the programming syntax and constructs of different open source programming languages
	CO3	Analyze and implement Scripting applications using Python
	CO4	Demonstrate ability to exhibit knowledge of developing applications using Python
	CO5	Ability to write scripts using AngularJS and Jquery
CLOUD COMPUTING (A3525)	CO1	Know and understand the basic ideas of Cloud Computing
	CO2	Understand the architecture, deployment models, and infrastructure models of Cloud Computing
	CO3	Ability to understand distributed storage and performance
	CO4	Familiarity with the cloud computing security, federation, presence, identity, and privacy
	CO5	Be familiar with disaster recovery in cloud computing
	CO6	Be familiar with open source cloud computing software, and free/commercial cloud services
MOBILE APPLICATION DEVELOPMENT (A3611)	CO1	Analyze architecture, the ecosystem, features and tools to design mobile applications
	CO2	Create effective user interfaces that leverage evolving mobile device capabilities
	CO3	Design, customize and enhance mobile applications with various widgets
	CO4	Experiment with different application components to design various user friendly mobile applications
	CO5	Build database and server-side applications to provide complete mobile development solutions
DESIGN PATTERNS (A3655) (Professional Elective - III)	CO1	Identify the appropriate design patterns to solve object oriented design problems
	CO2	Apply design solutions using creational patterns
	CO3	Apply structural patterns to solve design problems
	CO4	Apply design solutions by using behavioural patterns
DISTRIBUTED OPERATING SYSTEMS (A3558) (Professional Elective - III)	CO1	Comprehend the issues of terms of scheduling for user level processes/threads
	CO2	Understand the concepts of deadlock in operating systems and how they can be managed / avoided. Design and implement network computational techniques using distributed operating system
	CO3	Classify the types of security problems faced by operating systems and how to minimize these problems

	CO4	Understand the organization and synchronization of distributed operating systems
	CO5	Apply the knowledge of communication in distributed systems and how it can be used in remote procedure calls, remote objects and message-oriented communication
	CO6	Understand organizing principles for distributed systems through selection algorithms
INFORMATION RETRIEVAL SYSTEMS (A3559) (Professional Elective - III)	CO1	Implements algorithms like clustering, pattern searching, stemming algorithms and etc
	CO2	Understand the internal architecture of search engine
	CO3	Generate classification among the web pages using clustering techniques
	CO4	Help the student to understand the challenges over information retrieval systems by exploring functional difficulties over multimedia search and based rapid growing web content
	CO5	Design new algorithms based on existing challenges over web search and can able to develop modern digital libraries
AD-HOC AND SENSOR NETWORKS (A3560) (Professional Elective - III)	CO1	Explain the concepts, network architectures and applications of ad hoc and wireless Sensor networks
	CO2	Analyze the protocol design issues of ad hoc and sensor networks
	CO3	Design routing protocols for ad hoc and wireless sensor networks with respect to some protocol design issues
	CO4	Evaluate the QoS related performance measurements of ad hoc and sensor networks
COMPUTER VISION (A3561) (Professional Elective - IV)	CO1	Implement fundamental image processing techniques required for computer vision
	CO2	Perform shape analysis and implement boundary tracking techniques
	CO3	Chain codes and other region descriptors
	CO4	Apply Hough Transform for line, circle, and ellipse detections
	CO5	Adopt 3D vision techniques and implement motion related techniques
	CO6	Develop applications using computer vision techniques
HIBERNATE FRAMEWORK (A3562) (Professional Elective - IV)	CO1	Object-relational mapping concepts and the various issues and options available in Java to address Object persistence
	CO2	Details of Hibernate mapping, queries, transactions, and concurrency
	CO3	Problem of storing and retrieving objects to a relational database has its own name –

		impedance mismatch
	CO4	To build faster, more flexible and easier to maintain application persistence layers
USER EXPERIENCE ENGINEERING (A3563)(Professional Elective - IV)	CO1	Understand importance of User Experience (UX)
	CO2	Gain and apply knowledge of the theoretical frameworks, methodological approaches, and problems solving techniques related to user experience design
	CO3	Criticize existing interface designs, and improve them
	CO4	Design complete application with end-to-end understanding of current UXE best practices and processes
WEB SERVICES(A3654) (Professional Elective - IV)	CO1	Understand and write well-formed xml documents
	CO2	Format xml data to the desired format
	CO3	Develop web service enabled applications using soap, wsdl & udder
	CO4	Create, deploy, and call web services using java
	CO5	Understand the importance of distributed client-server applications
MOBILE APPLICATION DEVELOPMENT LAB (A3614)	CO1	Install and configure Android application development tools, Apply Java programming concepts to Android application development
	CO2	Design and develop user Interfaces for the Android platform
	CO3	Understand the technical challenges posed by current mobile devices and wireless communications; be able to evaluate and select appropriate solutions
	CO4	Select and evaluate suitable software tools and APIs for the development of a particular mobile application and understand their strengths, scope and limitations
	CO5	The students will be able to develop mobile applications with underlying database supports
	CO6	Develop and apply current standard-compliant scripting/programming techniques for the successful deployment of mobile applications targeting a variety of android supported devices
OPEN SOURCE TECHNOLOGIES LAB (A3606)	CO1	Demonstrate an ability to design and develop Web based programs, analyze, and interpret object oriented data and report results
	CO2	Develop confidence for self-education and ability for life-long learning needed for other open source languages and can participate and succeed in competitive examinations like Engineering services, exit interviews etc
	CO3	Solve computer software problems by writing customized programs in an efficient way using

		python Language
	CO4	Demonstrate an ability to design and develop PHP based novel products
	CO5	Exhibit profound knowledge to create, debug, and execute scripting programs using JQuery, AngularJS
Course Outcomes for Fourth Year Second Semester Course		
SOFTWARE PROJECT MANAGEMENT(A3661) (Professional Elective - V)	CO1	Develop Strategy to achieve the concurrence among stakeholders at every stage in the life cycle known by the student
	CO2	Capability to reach company goals and customer strategic objectives in every possible way
	CO3	Ability to approval the necessary management and executive review and approval points and practices per type of project
	CO4	Ability to organize the software lifecycle such that it will assure the predictability of the project
BIG DATA ANALYTICS(A3564) (Professional Elective - V)	CO1	Apply the statistical analysis methods
	CO2	Compare and contrast various soft computing frameworks
	CO3	Design distributed file systems
	CO4	Apply Stream data model
	CO5	Use visualization techniques
CYBER SECURITY(A3656) (Professional Elective - IV)	CO1	Analyze cyber-attack on different online web applications
	CO2	Apply different techniques to classify different types of cybercrimes
	CO3	Get an understanding over different government cyber laws and cyber for ensics techniques
	CO4	Understand how to protect them self and ultimately society from cyber-attacks
	CO5	Understanding cybercrime investigating methods using previous case studies
PATTERN RECOGNITION(A3565) (Professional Elective - V)	CO1	Classify the data and identify the patterns
	CO2	Extract feature set and select the features from given data set
	CO3	Explore different classification models
	CO4	Use concepts fuzzy pattern classifiers and perception
FUNDAMENTALS OF DATABASE MANAGEMENT SYSTEMS(A3576) (Open Elective)	CO1	Design a model for database base on given problem
	CO2	Formulate a query to retrieve information from database
	CO3	Implement security and maintenance using consistency and recovery mechanism
	CO4	Normalize a database
FUNDAMENTALS OF IMAGE PROCESSING(A3577)(Open Elective)	CO1	Have an appreciation of the fundamentals of digital image processing and pattern recognition including the topics such as filtering, transforms,

		morphology, image analysis, compression, clustering, etc
	CO2	Be able to implement basic image processing algorithms in MATLAB and/or OpenCV (Python)
	CO3	Have the skill base necessary to further explore advanced topics of digital image processing and pattern recognition
	CO4	Be in a position to make a positive professional contribution in the field of digital image processing and pattern recognition
OPERATING SYSTEM FUNDAMENTALS(A3578) (Open Elective)	CO1	Understand the basic concepts of operating systems, Process Management and Synchronization
	CO2	Use Deadlock handling methods
	CO3	Understand the concepts of Memory and Storage management
	CO4	Apply File, Directory and disk management methods
	CO5	Understand Protection and Security principles and methods to handle
JAVA PROGRAMMING(A3579) (Open Elective)	CO1	Use various programming constructs of object oriented language
	CO2	Apply principles of object oriented programming to model/design real world problems
	CO3	Use exception handling mechanism to develop fault tolerant applications
	CO4	Analyze the concepts of multi-threaded programming and synchronization
	CO5	Use GUI controls and event handling mechanism to develop interactive window/desktop applications
	CO6	Analyze need of applets, swings to develop simple web application
CYBER LAWS(A3676) (Open Elective)	CO1	Analyze cyber-attack on different online web applications
	CO2	Apply different techniques to classify different types of cyber crimes
	CO3	Understand different government cyber laws and cyber forensics techniques and how to protect themselves and society from cyber-attacks
	CO4	Describe and analyze the hardware, software, components of a network and the interrelations
	CO5	Illustrate the concepts of confidentiality, availability and integrity in Information Assurance, including physical, software, devices, policies and people
E-COMMERCE	CO1	Elaborate the components and roles of the E-

TRENDS(A3677) (Open Elective)		Commerce environment
	CO2	Explain how to sell products and services on the web as well as to meet the needs of web site visitors
	CO3	Analyze e-commerce payment systems
	CO4	Identify and reach customers on the web
	CO5	Understand legal and ethical issues related to E-Commerce and web marketing approaches
PRINCIPLES OF SOFTWARE ENGINEERING (A3678)(Open Elective)	CO1	Identify the right process model to develop the right software system
	CO2	Gather requirements and analyze them scientifically in order to develop the right product, besides authoring software requirements document
	CO3	Propose design as per functional and non-functional requirements using design principles
	CO4	Apply testing strategies for application being developed
	CO5	Find right set of umbrella activities for quality management and assurance
	CO6	Understand metrics in the process and projects domains
SCRIPTING LANGUAGES(A3679) (Open Elective)	CO1	Demonstrate knowledge about the advanced concepts of Linux OS like scheduling, cloning, signals
	CO2	Show skills to write PHP based GUI applications connecting to MYSQL
	CO3	Familiarize and define the programming syntax and constructs of LDAP connectivity in MySQL
	CO4	Analyze and implement Scripting applications using tuples, dictionaries and lists using Python
	CO5	Develop the ability to exhibit knowledge of writing packages and modules using Perl
DIGITAL ELECTRONICS(A3476) (Open Elective)	CO1	Perform arithmetic operations on different number systems and to apply the principles of Boolean algebra to minimize logic expressions
	CO2	Use K-map and Tabulation method to minimize and optimize two-level logic functions up to five variables
	CO3	Analyze some basic components used in digital systems such as adder and subtractor, decoder, encoder, multiplexer, flip-flops
	CO4	Design various combinational PLDs such as ROMs, PALs, PALs and PROMs
	CO5	Develop digital systems using registers and counters such as shift registers, Ripple counters, synchronous counters
PRINCIPLES OF ANALOG AND DIGITAL COMMUNICATIONS(A3477)	CO1	Analyze linear and non - linear modulators and demodulators in time as well as frequency domain

(Open Elective)	CO2	Design a linear and non linear modulators and demodulators for the analog signals
	CO3	Outline the basic concepts of digital communications with an insight into practical applications and Differentiate between PCM and DM and identify the applications of these modulation schemes in base band transmission
	CO4	Estimate overall digital communication system for the improvement of the system performance
	CO5	Analyze the performance of a digital communication system by introducing various spread spectrum modulation techniques
TRANSDUCERS AND MEASUREMENTS(A3478) (Open Elective)	CO1	Aware the basic concepts of measurement parameters as well as instrument standards, characteristics and errors
	CO2	Construct and design various measuring devices like voltmeters, Ammeters, Ohmmeters, analog, digital multi-meters and analyze different types of cathode ray oscilloscopes
	CO3	Design different bridge networks and analyze balanced condition for finding out values of resistance, capacitance and inductance
	CO4	Analyze different physical parameters like pressure, force, velocity, acceleration, sound, torque, strain and stress etc
	CO5	Apply the principles and practice for instrument design and develop for real world problems
INTERNET OF THINGS(A3479) (Open Elective)	CO1	Explain the definition and usage of the term “The Internet of Things” in different contexts
	CO2	Understand where the IoT concept fits within the broader ICT industry and possible future trends
	CO3	Differentiate between the levels of the IoT stack and be familiar with the key technologies and protocols employed at each layer of the stack
	CO4	Design a simple IoT system comprising sensors, edge devices, wireless network connections and data analytics capabilities
	CO5	Use the knowledge and skills acquired during the course to build and test a complete, working IoT system involving prototyping, programming and data analysis
NANO TECHNOLOGY APPLICATIONS TO ELECTRICAL ENGINEERING(A3276) (OpenElective)	CO1	Analyze the different forms of energy conversion methods conventional energy sources and sustainable renewable energy sources
	CO2	Investigate different Nano materials and characteristics and applications in electrical energy storage and electrical energy applications
	CO3	Evaluate micro fluid devices, Nano-engines, and energy conversion systems

	CO4	Explore hydrogen storage systems
INDUSTRIAL ELECTRONICS(A3277) (Open Elective)	CO1	Apply the knowledge of electronics in developing the controllers for industrial applications
	CO2	Interpret system drawings, and design simple systems for sequential control systems involving valves and cylinders
	CO3	Evaluate the operational characteristics the electrical and mechanical actuation systems CO4
SOLAR ENERGY AND APPLICATIONS(A3278) (Open Elective)	CO1	Compare the present and future available electrical power from solar energy in the world based on the knowledge of global solar horizontal irradiation
	CO2	Assimilate and acquire the skills for design and engineering of solar thermal and solar photovoltaic technology and systems
	CO3	Identify simple to complex problems involved in solar thermal energy conversion technique used in the liquid based solar heating and cooling systems for buildings/societal needs
	CO4	Examine a solar PV(Photo Voltaic) system components and their function by utilizing the previous literature knowledge on different Photovoltaic solar cells like crystalline, Multi-Crystalline, Amorphous and thin film
	CO5	Analyze the techno economics interaction of developments in the solar energy systems
ENERGY MANAGEMENT AND AUDIT(A3279) (Open Elective)	CO1	Analyze the influence of energy availability on the development of Industries and various other organizations
	CO2	Discuss the concepts and technologies used for energy conservation
	CO3	Develop methods for evaluating worth of project
	CO4	Investigate the schemes for demand side management
	CO5	Evaluate the VAR requirements for effective voltage control
ELEMENTS OF MECHANICAL ENGINEERING(A3376) (Open Elective)	CO1	Distinguish renewable and non-renewable energy sources and the associated environmental issues
	CO2	Classify hydraulic turbines and gas turbines based on working principles
	CO3	Apply metal removal and joining processes to get the designed shape and size of products in manufacturing
	CO4	Make use of engineering materials such as ferrous & non-ferrous metals, alloys, composite for different applications
	CO5	Explain the basic concepts of refrigerants, refrigeration, air-condition system

BASIC THERMODYNAMICS AND HEAT TRANSFER(A3377) (Open Elective)	CO1	Define the laws of thermodynamics and heat transfer
	CO2	Explain the basic concepts of thermodynamics and heat transfer
	CO3	Solve the problems by applying the knowledge of thermodynamic and heat transfer laws
	CO4	Evaluate the performance of thermodynamic cycles, heat engines and heat pumps
	CO5	Analyze heat transfer due to conduction, convection and radiation
MECHANICAL MEASUREMENTS AND INSTRUMENTATION(A3378) (Open Elective)	CO1	Identify the functional elements of generalized measuring system and the errors occurring in Instrumentation and provide the remedial measures
	CO2	List various pressure measuring instruments and applications in real life
	CO3	Evaluate the measuring instruments and to trace the standards used to the ultimate standards
	CO4	Analyze the measuring system for the measurement of Displacement, Temperature, Flow, Liquid level, Stress, Strain and humidity
	CO5	Classify the various types of humidity, acceleration and vibration measurements
ENGINEERING OPTIMIZATION(A3379) (Open Elective)	CO1	Explain various optimization techniques
	CO2	Solve problems involving single variable and multi variables under constrained or unconstrained environments
	CO3	Examine the impact of various factors affecting the Linear programming problem and solution using sensitivity (Post Optimality) analysis, with the aid of Simplex Method, Revised Simplex Method, Dual Simplex Method etc
	CO4	Apply dynamic programming technique to find optimum solution for inventory, capital budgeting, resource allocation, Production planning and control problems etc
	CO5	Solve quadratic, geometric and non-linear programming problems using different methods
ENVIRONMENTAL POLLUTION AND MANAGEMENT(A3176) (Open Elective)	CO1	Distinguish between various modes of air pollution and their characteristic
	CO2	Examine air pollution sampling and classify its level
	CO3	Evaluate water quality and propose necessary measures
	CO4	List different standards laid by governing authorities
	CO5	Summarize functions carried out by controlling bodies
REMOTE SENSING AND GIS(A3177) (Open Elective)	CO1	Explain basics of Aerial Photography, Remote sensing and GIS

	CO2	Describe the working principle of interpretation of Aerial photographs and satellite
	CO3	Utilize knowledge about the principles and physics of Remote sensing and data acquisition
	CO4	Summarize the data types, data storage and carry out the analysis of spatial and attribute data
	CO5	Apply applications of remote sensing and GIS in various fields
DISASTER MANAGEMENT(A3178) (Open Elective)	CO1	List out different causes of Environmental hazards
	CO2	Classify environmental hazards and disasters, Endogenous hazards, exogenous hazards, infrequent events - Cumulative atmospheric hazards / disasters
	CO3	Explain different characteristics of hazards
	CO4	Develop Emerging approaches in Disaster management
CONSTRUCTING PLANNING AND MANAGEMENT(A3179) (Open Elective)	CO1	Improve business and management skills in positions within the construction industry
	CO2	Adapt technical skills and knowledge in mathematics, science, construction, and technology in support of planning, analysing , and solving construction problems
	CO3	Utilize industry resources including associations and organizations, professional publications, and governmental data to analyze, evaluate, and apply current trends within the industry
	CO4	Make use of decision-making in personal and professional endeavors
	CO5	Design a quality construction project from start to completion while maintaining budget, schedule, and safety requirements
BASIC PROGRAM IN ENTREPRENEURSHIP(A3081) (Open Elective)	CO1	Understand the role, characteristics, qualities, and functions of entrepreneur and use this knowledge to become future entrepreneurs
	CO2	Understand various Institutional support for setting up a business enterprise and apply this knowledge while approaching these institutions for financial support
	CO3	Understand role, importance and functions of women entrepreneur and use this knowledge to become future women entrepreneurs
	CO4	Understand the concept of Project Management and steps in Project development and apply this knowledge while taking future project assignments
	CO5	Understand training programs and different training institutions to impart training and apply this knowledge to train existing and future entrepreneurs

HUMAN RESOURCE MANAGEMENT(A3077) (Open Elective)	CO1	Identify functions of Human Resource Management
	CO2	Illustrate the process of Recruitment and selection
	CO3	Analyze the needs and methods for training
	CO4	Outline the functional relationship with performance and compensation
	CO5	Illustrate the importance of Industrial relations through collective bargaining, trade unions and industrial settlement machinery
ORGANIZATION BEHAVIOR(A3078) (Open Elective)	CO1	Understand approaches, opportunities and challenges of OB and use this knowledge to understand behaviour people in organizations
	CO2	Explain the importance of diversity in organizations as well as personality and perception of individual and apply this knowledge for better understanding of human beings in organizations
	CO3	Indicate the group behaviour and leadership styles exhibit by the managers and apply this knowledge to get the things done through subordinates efficiently and effectively
	CO4	Illustrate motivation theories and different Organization structures and apply this knowledge to create suitable organization structure for business as well as to get better work from employees
	CO5	Interpret the role of Conflict management, Stress management, Organization change and Self management and apply this knowledge for solving different problems of organizations
LOGISTICS AND SUPPLY CHAIN MANAGEMENT(A3079) (Open Elective)	CO1	Understand Supply chain management functions, drivers and different types of Logistics and apply the knowledge in business environment
	CO2	Illustrate the importance of Supply chain customer service and bench mark practices and apply them in business environment
	CO3	Explain the role of Sourcing and Distribution in supply chain and apply the knowledge in decision making process of organization
	CO4	Interpret the importance of Co-ordination in supply chain and role of Information Technology in supply chain and use this knowledge to run the organization successfully
	CO5	Classify Global logistics & Global supply chain processes and strategies and use this knowledge to understand Global supply chain and logistics environment
NATIONAL SERVICE SCHEME(A3080) (NSS) (Open	CO1	Contrast the different types of NSS activities and financial pattern of expenditure in Community

Elective)		service
	CO2	Enhance the concept of youth, as an agent in social change
	CO3	Classify and explain the working of organizational functionaries of NSS
	CO4	Design a system, component or process to meet the desired needs applicable to society, with realistic constraints such as economic, safety, manufacturability and sustainability etc
	CO5	Recognize the need for, and an ability to engage in society with lifelong learning capabilities with the concepts of volunteerism and its functions
PYTHON FOR DATA SCIENCE(A3680) (Open Elective)	CO1	Explore Python language fundamentals, including basic syntax, variables, and types
	CO2	Use and manipulate regular lists, functions and packages
	CO3	Build Numpy arrays, and perform interesting calculations
	CO4	Create and customize plots on real data
	CO5	Supercharge your scripts with control flow, and get to know the Pandas Data Frame