ADITYA ENGINEERING COLLEGE

An Autonomous Institutuion

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Department of Computer Science and Engineering

M.Tech (Computer Science and Engineering) - AR19 - Course Articulation Matrix

Note: Correlation Levels are 1 or 2 or 3. Where 1 Slight(Low), 2 Moderate(Medium), 3 Substantial (High).

	CO Statements	POs											PSOs	
I SEM														
Course Code	**192CS1T01 - Mathematical Foundations of Computer Science**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	Apply the basic rules and theorems of probability theory such as Baye's Theorem, to determine probabilities that help to solve engineering problems and to determine the expectation and variance of a random variable from its distribution.	**1**	**2**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**
CO2	Apply sampling, means, proportions, variances and estimates the maximum likelihood based on population parameters.	**1**	**2**	**1**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**
CO3	Analyze how to formulate and test hypotheses about sample means, variances and proportions and to draw conclusions based on the results of statistical tests.	**2**	**3**	**2**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**
CO4	Apply the principles of number theory to design various ciphers.	**1**	**2**	**1**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO5	Apply graph theory for the real time problems like network routing problem.	**1**	**2**	**1**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Course Code	**192CS1T02 - Advanced Data Structures & Algorithms**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	Demonstrate the concepts of Linked lists, Stack and Queue.	**3**	**2**	**1**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**1**
CO2	Summarize various searching and sorting techniques.	**3**	**1**	**1**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**1**
CO3	Make use of different traversals of Binary Trees and Graphs to solve real time problems.	**3**	**3**	**3**	**3**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**
CO4	Illustrate the concepts of Dictionaries.	**3**	**2**	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**1**
CO5	Explain the concept of Priority Queues using Heaps.	**3**	**2**	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**1**
CO6	Analyse various Search Trees with its time complexities	**3**	**3**	**3**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**
Course Code	**192CS1E01 - Big Data Analytics**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	Illustrate on big data and its use cases from selected business domains.	**2**	**1**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**
CO2	Summarize on No SQL, Cassandra.	**2**	**1**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**

	CO Statements	POs											PSOs	
CO3	Analyze the HADOOP and Map Reduce technologies associated with big data analytics and explore on Big Data applications Using Hive.	**3**	**3**	**2**	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**
CO4	Make use of Apache Spark, RDDs etc. to work with datasets.	**3**	**2**	**-**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**2**
CO5	Assess real time processing with Spark Streaming.	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**
Course Code	**192CS1E02 - DIGITAL IMAGE PROCESSING (Professional Elective-I)**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	Demonstrate the components of image processing.	**-**	**1**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO2	Summarize various filtration techniques.	**2**	**1**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**-**
CO3	Apply image compression techniques to real time applications.	**-**	**-**	**1**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**
CO4	Discuss the concepts of wavelet transforms.	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**
CO5	Analyze the concept of morphological image processing.	**-**	**-**	**-**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**
Course Code	**192CS1E03 - ADVANCED OPERATING SYSTEMS (Professional Elective-I)**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	Illustrate on the fundamental concepts of distributed operating systems, its architecture and distributed mutual exclusion.	**1**	**2**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**2**
CO2	Analyze on deadlock detection algorithms and agreement protocols.	**3**	**3**	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**
CO3	Make use of algorithms for implementing DSM and its scheduling.	**3**	**3**	**2**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**
CO4	Apply protection and security in distributed operating systems.	**2**	**2**	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**
CO5	Elaborate on concurrency control mechanisms in distributed database systems.	**2**	**2**	**1**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**
Course Code	**192CS1E04 - ADVANCED COMPUTER NETWORKS (Professional Elective-II)**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	Illustrate reference models with layers, protocols and interfaces.	**1**	**2**	**1**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**
CO2	Describe the routing algorithms, congestion control algorithms, Sub netting and Addressing of IPV4and IPV6.	**1**	**2**	**1**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**
CO3	Explain TCP/UDP protocols and how they can be used to assist in network design and implementation.	**1**	**2**	**1**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**
CO4	Summarize the concepts Wireless LANS, WIMAX, IEEE 802.11, Cellular telephony and Satellite networks	**1**	**2**	**1**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**
CO5	Extend the emerging trends in networks-MANETS and WSN	**1**	**2**	**1**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**
Course Code	**192CS1E05 - INTERNET OF THINGS (Professional Elective-II)**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	Summarize on the term 'internet of things' in different contexts.	**3**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO2	Analyze various protocols for IoT.	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**2**
CO3	Design a PoC of an IoT system using Rasperry Pi/Arduino.	**3**	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**
CO4	Apply data analytics and use cloud offerings related to IoT.	**3**	**3**	**1**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**1**

	CO Statements	POs											PSOs	
CO5	Analyze applications of IoT in real time scenario.	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**2**
Course Code	**192CS1E06 - OBJECT ORIENTED SOFTWARE ENGINEERING (Professional Elective-II)**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	Apply the Object Oriented Software-Development Process to design software	**2**	**2**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**1**
CO2	Analyze software requirements through a SRS documents.	**2**	**2**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**
CO3	Plan software solutions to problems using an object-oriented strategy.	**2**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**
CO4	Model the object oriented software systems using Unified Modeling Language (UML).	**2**	**2**	**1**	**1**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO5	Estimate the cost of constructing object oriented software.	**2**	**-**	**1**	**1**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**
Course Code	**192HS1T01 - Research Methodology and IP**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	Understand research problem formulation.	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO2	Analyze research related information.	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**
CO3	Demonstrate research ethics	**2**	**1**	**-**	**-**	**-**	**2**	**-**	**2**	**-**	**-**	**-**	**2**	**3**
CO4	Explain the today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, andcreativity.	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**-**	**-**	**-**	**-**	**2**	**2**
CO5	Discuss that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students ingeneral & engineering in particular.	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**	**-**	**3**	**3**
CO6	Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**	**-**	**3**	**-**
Course Code	**192CS1L01 - Advanced Data Structures & Algorithms Lab**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	Identify classes, objects, members of a class and relationships among them needed for a specific problem	**3**	**2**	**1**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**
CO2	Examine algorithms performance using Prior analysis and asymptotic notations.	**3**	**3**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**
CO3	Solve the complex problems using advanced data structures (like arrays,stacks, queues, linked lists, graphs and trees.)	**3**	**3**	**3**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**
CO4	Analyze the functions of Dictionary.	**3**	**3**	**3**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**
Course Code	**192CS1L02 - Advanced Computing Lab**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	Make use of various sensors like temperature, humidity, smoke, light, etc. and should be able to use control web camera, network, and relays connected to the Pi.	**1**	**2**	**1**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**3**	**3**

	CO Statements	POs											PSOs	
CO2	Develop and use of IoT technology in Societal and Industrial Applications.	**1**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**
CO3	Develop high quality academic and industrial research in Sensors and IoT.	**1**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**
CO4	Analyze Real World IOT Design Constraints, Industrial Automation in IoT.	**1**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**
II SEM														
Course Code	**192CS2T03 - MACHINE LEARNING**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	Domain Knowledge for Productive use of Machine Learning and Diversity of Data.	**3**	**2**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**
CO2	Demonstrate on Supervised and Computational Learning problems.	**3**	**2**	**1**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**
CO3	Analyze on Statistics in learning techniques and Logistic Regression	**3**	**2**	**1**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**
CO4	Illustrate on Support Vector Machines and Perceptron Algorithm	**3**	**2**	**1**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**
CO5	Design a Multilayer Perceptron Networks and classification of decision tree	**3**	**3**	**3**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**2**
Course Code	**192CS2T04 - MEAN STACK TECHNOLOGIES**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	Identify the Basic Concepts of Web & Markup Languages	**3**	**2**	**1**	**1**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**3**	**3**
CO2	Develop web Applications using Scripting Languages & Frameworks	**3**	**2**	**1**	**1**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**3**	**3**
CO3	Make use of Express JS and Node JS frameworks.	**3**	**2**	**1**	**1**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**3**	**3**
CO4	Illustrate the uses of web services concepts like restful, react js.	**2**	**1**	**-**	**-**	**2**	**2**	**3**	**-**	**-**	**-**	**-**	**2**	**2**
CO5	Adapt to Deployment Techniques & Working with cloud platform	**-**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**
Course Code	**192CS2E07 - ADVANCED DATABASES AND MINING (Professional Elective-III)**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	Analyze on normalization techniques	**3**	**2**	**1**	**1**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**2**	**3**
CO2	Elaborate on concurrency control techniques and query optimization	**3**	**2**	**1**	**1**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**3**	**-**
CO3	Summarize the concepts of data mining, data warehousing and data preprocessing strategies.	**3**	**2**	**1**	**1**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**3**	**-**
CO4	Apply data mining algorithms.	**2**	**1**	**-**	**-**	**2**	**2**	**3**	**-**	**-**	**-**	**-**	**3**	**-**
CO5	Assess various classification & cluster techniques.	**-**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**
Course Code	**192CS2E08 - AD HOC & SENSOR NETWORKS (Professional Elective-III)**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	Explain the Fundamental Concepts and applications of ad hoc and wirelesssensor networks.	**3**	**2**	**2**	**1**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**3**	**3**
CO2	Discuss the MAC protocol issues of ad hoc networks	**3**	**2**	**2**	**1**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**2**	**2**
CO3	Enumerate the concept of routing protocols for ad hoc wireless networkswith respect to TCP design issues	**3**	**2**	**1**	**1**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**3**	**3**

	CO Statements	POs											PSOs	
CO4	Analyze & Specify the concepts of network architecture and MAC layerprotocol for WSN.	**2**	**1**	**-**	**-**	**2**	**2**	**3**	**-**	**-**	**-**	**-**	**2**	**2**
CO5	Discuss the WSN routing issues by considering QoS measurements.	**-**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Course Code	**192CS2E09 - SOFT COMPUTING (Professional Elective-III)**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	Elaborate fuzzy logic and reasoning to handle uncertainty in engineeringproblems.	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**2**
CO2	Make use of genetic algorithms to combinatorial optimization problems.	**2**	**2**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**
CO3	Distinguish artificial intelligence techniques, including search heuristics,knowledge representation, planning and reasoning.	**1**	**2**	**1**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**
CO4	Formulate and apply the principles of self-adopting and self organizing neurofuzzy inference systems.	**2**	**1**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**
CO5	Evaluate and compare solutions by various soft computing approaches for agiven problem.	**2**	**2**	**1**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**1**	**-**
Course Code	**192CS2E10 - CLOUD COMPUTING (Professional Elective-IV)**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	Explain the basic issues and different systems in cloud computing.	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**2**
CO2	Examine the economics, financial, and technological implications forselecting cloud computing for own organization	**2**	**2**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**
CO3	Illustrate Virtualization and Resource management for Data - CenterAutomation.	**1**	**2**	**1**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**
CO4	Analyze the storage systems and security in cloud computing.	**2**	**1**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**
CO5	Develop cloud application with the use of Google and Microsoft	**2**	**2**	**1**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**-**
Course Code	**192CS2E11 - PRINCIPLES OF COMPUTER SECURITY (Professional Elective-IV)**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	Describe the key security requirements of confidentiality, integrity, andavailability, types of security threats and attacks and summarize the functional requirements for computer security.	**3**	**2**	**2**	**1**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**3**	**3**
CO2	Explain the basic operation of symmetric block encryption algorithms, use ofsecure hash functions for message authentication, digital signature mechanism.	**3**	**2**	**2**	**1**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**2**	**2**
CO3	Discuss the issues involved and the approaches for user authentication andexplain how access control fits into the broader context that includes authentication, authorization, and audit	**3**	**2**	**1**	**1**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**3**	**3**

	CO Statements	POs											PSOs	
CO4	Explain the basic concept of a denial-of-service attack, nature of flooding attacks, distributed denial-of-service attacks and describe how computersecurity vulnerabilities are a result of poor programming practices	**2**	**1**	**-**	**-**	**2**	**2**	**3**	**-**	**-**	**-**	**-**	**2**	**2**
CO5	List the steps used to secure the base operating system, specific aspects of securing Unix/Linux systems, Windows systems, and security in virtualized systems and describe the security threats and countermeasures for wirelessnetworks.	**-**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**
Course Code	**192CS2E12 - HIGH PERFORMANCE COMPUTING (Professional Elective-IV)**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	Design, formulate, solve and implement high performance versions ofstandard single threaded algorithms	**3**	**2**	**2**	**1**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**3**	**3**
CO2	Demonstrate the architectural features in the GPU and MIC hardwareaccelerators.	**3**	**2**	**1**	**2**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**3**	**-**
CO3	Analyze Symmetric and Distributed architectures	**3**	**2**	**1**	**1**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**3**	**3**
CO4	Develop and deploy large scale parallel programs on tightly coupled parallel systems using the message passing paradigm..	**3**	**2**	**-**	**-**	**2**	**2**	**3**	**-**	**-**	**-**	**-**	**2**	**2**
Course Code	192CS2L03 - MACHINE LEARNING WITH PYTHON LAB	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	Implement procedures for the machine learning algorithms.	**1**	**2**	**1**	**2**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**3**	**3**
CO2	Design Python programs for various Learning algorithms.	**1**	**2**	**1**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**1**	**3**	**3**
CO3	Apply appropriate data sets to the Machine Learning algorithms.	**2**	**1**	**3**	**3**	**2**	**-**	**-**	**-**	**1**	**2**	**1**	**3**	**3**
CO4	Identify and apply Machine Learning algorithms to solve real world problems.	**2**	**1**	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**2**	**-**	**3**	**3**
Course Code	192CS2L04 - MEAN STACK TECHNOLOGIES LAB	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	Identify the Basic Concepts of Web &Markup Languages.	**1**	**2**	**1**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**3**	**3**
CO2	Develop web Applications using Scripting Languages & Frameworks	**1**	**2**	**1**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**3**	**3**
CO3	Create Applications using JSP libraries.	**1**	**2**	**1**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**3**	**3**
CO4	Develop First Controller Working with and Displaying in Angular Jsand Nested Forms with ngform.	**1**	**2**	**1**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**3**	**3**
CO5	Create the Files in React JS and Constructing Elements with Data	**2**	**1**	**2**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**3**	**-**
Course Code	**192MC1A01 or 192MC2A01 -ENGLISH FOR RESEARCH PAPER WRITING**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	Understand how to improve the writing skills and level of readability.	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**2**	**2**	**-**	**-**	**1**	**-**
CO2	Illustrate what to write in each section.	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**2**	**2**	**-**	**-**	**1**	**-**
CO3	Understand the skills needed when writing a Title Ensure the good quality of paper at very first-time submission.	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**2**	**2**	**-**	**-**	**1**	**-**

	CO Statements	POs											PSOs	
Course Code	**192MC1A02 or 192MC2A02 - DISASTER MANAGEMENT**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	Demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.	-	-	-	-	-	-	-	-	-	**1**	-	-	-
CO2	Evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives	-	-	-	-	-	-	-	-	-	**1**	-	-	-
CO3	Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations	-	-	-	-	-	-	-	-	-	**1**	-	-	-
CO4	Understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in.	-	-	-	-	-	-	-	-	-	**1**	-	-	-
Course Code	**192MC1A03 or 192MC2A03 - SANSKRIT FOR TECHNICAL KNOWLEDGE**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	Understanding basic Sanskrit language.	-	-	-	-	-	-	-	-	**1**	-	-	-	-
CO2	Develop the brain functioning in association with Sanskrit Language.	-	-	-	-	-	-	-	-	**1**	-	-	-	-
CO3	Use logical language will help to develop logic in students.	-	-	-	-	-	-	-	-	**1**	-	-	-	-
CO4	Understand the importance of Sanskrit Language to explore ancient literature.	-	-	-	-	-	-	-	-	**1**	-	-	-	-
Course Code	**192MC1A04 or 192MC2A04 -VALUE EDUCATION**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	Understand value of education and self- development.	-	-	-	-	-	-	-	-	-	**1**	-	-	-
CO2	Explain the need of good values in students.	-	-	-	-	-	-	-	-	-	**1**	-	-	-
CO3	Developing the overall personality.	-	-	-	-	-	-	-	-	-	**1**	-	-	-
CO4	Explain the need of character in a student.	-	-	-	-	-	-	-	-	-	**1**	-	-	-
Course Code	**192MC1A05 or 192MC2A05 - CONSTITUTION OF INDIA**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	Describe the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.	-	-	-	-	-	-	-	-	-	**1**	-	-	-
CO2	Explain the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.	-	-	-	-	-	-	-	-	-	**1**	-	-	-
CO3	Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.	-	-	-	-	-	-	-	-	-	**1**	-	-	-
CO4	Demonstrate the passage of the Hindu Code Bill of 1956.	-	-	-	-	-	-	-	-	-	**1**	-	-	-
Course Code	**192MC1A06 or 192MC2A06 - PEDAGOGY STUDIES**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	Distinguish the various pedagogical practices are being used by teachers in formal and informal classrooms in developing countries.	-	-	-	-	-	-	-	-	**1**	-	-	-	-

	CO Statements	POs											PSOs	
CO2	Explain the evidence on the effectiveness of various kinds of pedagogical practices, in different conditions.	-	-	-	-	-	-	-	-	1	-	-	-	-
CO3	Discuss the teacher's attitudes and beliefs in line with pedagogic strategies.	-	-	-	-	-	-	-	-	1	-	-	-	-
CO4	Prepare school curriculum and guidance material best support effective pedagogy.	-	-	-	-	-	-	-	-	1	-	-	-	-
CO5	List the research gaps.	-	-	-	-	-	-	-	-	1	-	-	-	-
Course Code	**192MC1A07 or 192MC2A07 - STRESS MANAGEMENT BY YOGA**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	Develop healthy mind in a healthy body to improve social health.	-	-	-	-	-	-	-	-	1	-	-	-	-
Course Code	**192MC1A08 or 192MC2A08 - PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	Develop his/her personality and achieve the highest goal in life.	-	-	-	-	-	-	-	-	1	-	-	-	-
CO2	Capable of lead the nation and mankind to peace and prosperity.	-	-	-	-	-	-	-	-	1	-	-	-	-
CO3	Develop versatile personality of students.	-	-	-	-	-	-	-	-	1	-	-	-	-
Course Code	**192MC1A09 or 192MC2A09 - SOFT SKILLS**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	Summarize the basic grammatical skills.	-	-	-	-	-	-	-	2	-	-	-	-	-
CO2	Understand interview skills & importance of business etiquette.	-	-	-	-	-	-	-	2	-	-	-	-	-
CO3	Apply typical write-up skills for business need.	-	-	-	-	-	-	-	2	-	-	-	-	-
CO4	Prepare a professional resume.	-	-	-	-	-	-	-	2	-	-	-	-	-
CO5	Use the tools of the soft skills.	-	-	-	-	-	-	-	2	-	-	-	-	-
III SEM														
Course Code	**192CS3E13 - DEEP LEARNING (Professional Elective-V)**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	Demonstrate the basic concepts fundamental learning techniques andlayers.	-	1	-	-	-	-	-	-	-	-	-	1	1
CO2	Discuss the Neural Network training, various random models.	-	1	-	2	-	-	-	-	-	-	-	1	1
CO3	Identify different types of deep learning network models.	1	3	3	-	3	-	-	-	-	-	-	-	1
CO4	Classify the Probabilistic Neural Networks.	1	-	3	-	3	-	-	-	-	-	-	2	2
CO5	Implement tools on Deep Learning techniques.	1	2	3	3	-	-	-	-	-	-	-	2	2
Course Code	**192CS3E14 - SOCIAL NETWORKS ANALYSIS (Professional Elective-V)**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	Demonstrate social network analysis and measures.	3	3	-	-	-	-	-	-	-	-	-	1	1
CO2	Analyze random graph models and navigate social networks data	3	3	2	2	2	-	-	-	-	-	-	1	1
CO3	Apply the network topology and Visualization tools	3	2	2	2	2	-	-	-	-	-	-	2	2
CO4	Analyze the experiment with small world models and clustering models	3	3	2	2	2	-	-	-	-	-	-	1	1

	CO Statements	POs											PSOs	
CO5	Compare the application driven virtual communities from social network Structure	**3**	**2**	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**1**
Course Code	**192ST3O01 - REPAIRANDREHABILITATION OF STRUCTURES (Open Elective)**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	Identify the causes of deterioration of concrete structures.	**1**	**-**	**-**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO2	Illustrate the various materials for repair and rehabilitation techniques.	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO3	Construct the various strengthening and stabilization techniques.	**-**	**-**	**1**	**-**	**-**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**
CO4	Determine various repair techniques of damaged structures.	**-**	**-**	**-**	**3**	**-**	**-**	**-**	**3**	**-**	**-**	**-**	**-**	**-**
CO5	Evaluate the usage of different types of concretes and durability aspects.	**-**	**-**	**-**	**-**	**3**	**-**	**-**	**-**	**3**	**-**	**-**	**-**	**-**
CO6	Classify the usage of high performance concretes for repairing works.	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**	**-**	**3**	**-**	**-**	**-**
Course Code	**192ST3O02 - GREEN BUILDING SYSTEMS (Open Elective)**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	Explain the principles of green building planning, its bylaws.	**-**	**1**	**-**	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO2	Explain the concepts of green building materials.	**-**	**-**	**1**	**-**	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**
CO3	Use concept of energy and resource conversion in green building construction.	**-**	**-**	**1**	**2**	**1**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**
CO4	Use of renewable energy resources in green building design.	**-**	**-**	**-**	**2**	**3**	**2**	**3**	**3**	**3**	**-**	**-**	**-**	**-**
CO5	Design climate for green buildings.	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**2**	**2**	**1**	**-**	**-**	**-**
Course Code	**192ST3O03 - BASIC CONCRETE TECHNOLOGY (Open Elective)**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	Explain the properties and tests on cement.	**-**	**1**	**-**	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO2	Classify the different types of aggregates.	**-**	**-**	**1**	**-**	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**
CO3	Outline the mixing of Fresh concrete.	**-**	**-**	**1**	**2**	**1**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**
CO4	Interpret the various tests on workability of Fresh concrete.	**-**	**-**	**-**	**2**	**3**	**2**	**3**	**3**	**3**	**-**	**-**	**-**	**-**
CO5	Demonstrate the behaviour of hardened concrete.	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**2**	**2**	**1**	**-**	**-**	**-**
CO6	Illustrate various types of Special Concrete	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**2**	**2**	**1**	**-**	**-**
Course Code	**192ST3O04 - BASIC FOUNDATION ENGINEERING (Open Elective)**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	Recognize the types of available foundations for different structures.	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO2	Classify the given soil based on index and engineering properties.	**-**	**1**	**3**	**-**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO3	Interpret the shear strength of cohesive and cohesionless soils.	**-**	**-**	**1**	**2**	**2**	**3**	**1**	**-**	**-**	**-**	**-**	**-**	**-**
CO4	Analyse a shallow foundation for a given soil condition and loading.	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**3**	**1**	**-**	**-**	**-**	**-**
CO5	Analyse a deep foundation for a given loading and soil conditions.	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**2**	**1**	**-**	**-**	**-**
Course Code	**192PD3O01 - RENEWABLE ENERGY TECHNOLOGIES (Open Elective)**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	Identify alternate energy sources.	**1**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**-**
CO2	Analyze and design induction generator for power generation from wind.	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**

	CO Statements	POs											PSOs	
CO3	Analyze different wind power plants.	-	-	2	3	3	3	-	-	-	-	2	-	-
CO4	Design MPPT controller for solar power utilization.	-	-	-	3	-	-	-	2	-	-	-	-	-
CO5	Illustrate the basic operation of fuel cells.	-	-	-	-	1	2	-	-	-	-	-	-	-
Course Code	**192PD3O02 - HYBRID ELECTRIC VEHICLES (Open Elective)**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	Illustrate the performance characteristics of converter fed DC drives.	2	1	2	-	-	-	-	-	1	-	-	-	3
CO2	Analyze the two quadrants and four quadrant controls of DC motor drives.	-	2	3	3	-	-	-	-	-	1	-	3	3
CO3	Develop the mathematical models of DC drive components.	-	-	1	2	3	2	-	-	-	-	-	-	-
CO4	Analyze the four quadrant and closed loop control of DC-DC converter fed DC drive.	-	-	-	2	3	3	3	1	-	-	1	-	-
CO5	Propose various controlling techniques of DC drives for industrial applications.	2	-	-	-	3	3	3	3	3	-	-	-	-
CO6	Design various power electronic converters to control the DC motors.	3	3	3	-	-	3	3	3	3	3	-	-	-
Course Code	**192PD3O03 - ENERGY AUDIT, CONSERVATION AND MANAGEMENT (Open Elective)**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	Understand energy efficiency, scope, conservation and technologies.	2	1	-	-	2	2	3	2	3	3	2	-	-
CO2	Design energy efficient lighting systems.	-	-	-	-	-	2	2	3	-	-	3	-	-
CO3	Estimate/calculate power factor of systems and propose suitable compensation techniques.	-	-	2	-	-	-	-	-	3	-	-	-	-
CO4	Understand energy conservation in HVAC systems	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	Calculate life cycle costing analysis and return on investment on energy efficient technologies.	-	-	-	-	3	3	-	2	3	-	3	-	-
Course Code	**192PD3O04 - NEURAL NETWORKS AND FUZZY LOGIC (Open Elective)**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	Demonstrate different models of artificial neuron.	2	1	--	--	2	--	--	--	--	--	--	--	--
CO2	Identify various learning methods of ANN.	-	3	2	1	1	3	--	--	--	--	--	--	--
CO3	Analyze the various feed forward neural networks and Hopfield Network	--	-	3	3	2	2	2	--	--	--	--	--	-
CO4	Compare and Contrast Classical and Fuzzy sets.	--	--	-	2	1	--	--	2	--	--	--	-	-
CO5	Utilize different modules of Fuzzy Logic Controller for rule base and decision making Systems	--	--	--	-	3	2	1	1	3	--	--	-	-
CO6	Analyze the application of fuzzy logic control to real time systems	--	--	--	--	-	3	3	2	2	2	--	-	-
Course Code	**192PD3O05 - INDUSTRIAL SAFETY (Open Elective)**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	Understand the general industrial requirements like lighting, cleanliness prevention from hazards and accidents.	2	-	-	--	-	-	-	-	-	-	-	-	-
CO2	Analyze maintenance requirements of the industry and cost associated.	-	-	1	-	-	-	-	-	-	-	-	-	-

	CO Statements	POs											PSOs	
CO3	Analyze wear and corrosion aspects of the industry and their prevention.	-	-	-	1	-	-	-	-	-	-	-	-	-
CO4	Identify the faults prone areas and their repair and periodic maintenance.	-	-	-	2	-	-	-	-	-	-	-	-	-
Course Code	**192PD3O06 - COMPOSITE MATERIALS (Open Elective)**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	Understand characteristics and advantages of composite materials	2	-	-	--	-	-	-	-	-	-	-	-	-
CO2	Acquire knowledge of reinforcement, glass fiber, etc.	-	-	1	-	-	-	-	-	-	-	-	-	-
CO3	Identify the usage of metal matrix composites	-	-	-	1	-	-	-	-	-	-	-	-	-
CO4	Understand manufacturing of polymer matrix composites	-	-	-	2	-	-	-	-	-	-	-	-	-
CO5	Understand manufacturing of polymer matrix composites	-	-	-	-	2	-	-	-	-	-	-	-	-
Course Code	**192TE3O01 - ENERGY SYSTEMS (Open Elective)**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	Explain the working principle of various energy systems.	2	-	-	-	-	1	-	-	-	-	-	-	-
CO2	Calculate the availability analysis of the energy systems and cycles.	-	2	1	2	-	-	1	-	-	-	-	1	1
CO3	Explain the design and working principles of combustion systems.	-	-	2	1	1	-	-	1	-	-	-	-	-
CO4	Explain the thermal energy auditing technologies and procedures	-	-	-	2	1	1	-	-	1	-	-	-	-
CO5	Analyse various types of energy storage devices and perform the selection based on techno-economic view point.	-	-	-	-	2	1	1	1	-	1	-	-	-
CO6	Explain various measurement techniques useful for the evaluation of Energy Conservation Schemes.	-	1	1	-	-	2	-	1	-	-	1	-	-
Course Code	**192TE3O02 - FUELS AND COMBUSTION (Open Elective)**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	Explain detailed classification of solid fuels and their conversion process	1	1	1	-	-	-	-	-	-	-	-	-	-
CO2	Differentiate various rate of reactions.	-	1	1	1	-	-	-	-	-	-	-	-	-
CO3	Evaluate thermodynamics related to combustion process.	-	-	3	2	2	2	-	-	-	-	1	-	-
CO4	Explain the parameters involved in Flame propagation.	-	1	-	1	1	1	1	-	-	-	-	-	-
CO5	Identify the various sources of air pollution.	-	-	-	-	1	1	1	1	-	-	-	-	-
Course Code	**192TE3O03 - GREEN ENGINEERING TECHNOLOGY (Open Elective)**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	Distinguish the various solar energy collection methods and measuring instruments.	3	1	-	3	-	-	-	-	3	2	-	2	-
CO2	Explain the different methods of solar energy storage and their applications.	-	3	3	1	3	-	-	1	-	3	3	2	2
CO3	Illustrate the various types of wind mills and performance characteristics.	-	-	3	3	2	1	-	-	1	-	2	-	-
CO4	Explain the principle of Biomass production, Geothermal energy sources and Ocean thermal energy conversion.	2	-	-	3	3	2	1	-	-	1	-	-	-
CO5	Illustrate the various types of electrical systems and mechanical systems.	2	2	-	-	1	2	1	1	-	-	1	-	-

	CO Statements	POs											PSOs	
CO6	Compare the various energy efficient process.	**-**	**1**	**1**	**-**	**-**	**2**	**1**	**1**	**1**	**-**	**-**	**-**	**-**
Course Code	**192TE3O04 - IC ENGINES (Open Elective)**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	Predict the engine combustion characteristics.	**3**	**3**	**2**	**3**	**1**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO2	Evaluate engine performance.	**-**	**3**	**3**	**2**	**3**	**1**	**3**	**-**	**-**	**-**	**-**	**-**	**-**
CO3	Interpret the formation of engine emission and their control strategies.	**-**	**-**	**3**	**3**	**2**	**3**	**1**	**3**	**-**	**-**	**-**	**-**	**-**
CO4	Distinguish the usage of different alternative fuels and their compatibility with fossil fuels	**-**	**-**	**-**	**3**	**3**	**3**	**3**	**1**	**3**	**-**	**-**	**-**	**-**
CO5	Explain the constructional and working principles of electrical vehicle and their accessories	**-**	**-**	**-**	**-**	**1**	**2**	**1**	**1**	**1**	**3**	**-**	**-**	**-**
Course Code	**192TE3O05 - AUTOMOTIVE TECHNOLOGY (Open Elective)**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	Summarize the vehicle chassis layout and constructional features of vehicle body.	**3**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**1**	**1**	**-**	**-**	**-**
CO2	Explain the constructional and working principles of sprung masses.	**-**	**2**	**1**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**-**
CO3	Explain the constructional and working principles of unsprung masses.	**-**	**-**	**3**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO4	Summarize the functionalities of various electrical systems of a typical automobile.	**1**	**-**	**-**	**2**	**1**	**1**	**-**	**-**	**1**	**-**	**-**	**-**	**-**
Course Code	**192ES3O01 - EMBEDDED SYSTEM DESIGN (Open Elective)**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	Apply processor based embedded system design concepts to develop an embedded system.	**1**	**2**	**1**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO2	Analyze the hardware components, processor performance of an embedded system design.	**-**	**2**	**3**	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO3	Make use of operating systems and embedded programming languages to develop a real-time system.	**-**	**-**	**1**	**2**	**1**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO4	Utilize modern development tools, CAD tools for integrating software and hardware components in embedded system designs.	**-**	**-**	**-**	**1**	**2**	**1**	**3**	**3**	**-**	**-**	**-**	**-**	**-**
CO5	Develop an embedded system by understanding the various processor architecture case studies along with its applications.	**-**	**-**	**-**	**-**	**1**	**2**	**1**	**3**	**-**	**-**	**-**	**-**	**-**
Course Code	**192ES3O02 - DIGITAL SYSTEM DESIGN (Open Elective)**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	Examine CAMP Algorithms for minimizing the complexity of digital system design	**2**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO2	Simplify digital circuits using PLA minimization algorithm (IISc algorithm) and PLA folding algorithm	**-**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO3	Construct digital circuits using CPLDs, FPGAs and ASICs.	**-**	**-**	**1**	**2**	**1**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**
CO4	Analyze the functionality of combinational circuits using different fault diagnosis & test methods.	**-**	**-**	**-**	**2**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

	CO Statements	POs											PSOs	
CO5	Analyze the testing aspects and fault diagnosis methods of sequential circuits	-	-	-	-	2	3	2	-	-	-	-	-	-
Course Code	**192ES3O03 - PROGRAMMING LANGUAGES FOR EMBEDDED SYSTEMS (Open Elective)**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	Develop the moderate complex programs in embedded C.	1	-	1	-	-	-	-	-	-	-	-	-	-
CO2	Compare the different programming techniques in object-oriented programming.	-	2	3	-	-	-	-	-	-	-	-	-	-
CO3	Analyze the algorithm in C++.	-	-	1	-	1	-	-	-	-	-	-	-	-
CO4	Distinguish the different types of overloading & Inheritance	-	-	-	2	-	-	-	-	-	-	-	-	-
CO5	Understand the templates and scripting languages.	-	-	-	-	-	1	-	-	-	-	-	-	-
Course Code	**192ES3O04 - SENSORS AND ACTUATORS (Open Elective)**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	Classify various sensors/transducers based on their applications	-	-	-	2	2	1	-	-	-	-	-	-	-
CO2	Dissect various types of Resistive, Inductive and Capacitive Sensors	-	2	3	-	3	3	3	-	-	3	-	3	-
CO3	Analyze various approaches, procedures and results related to Thermal and Magnetic sensors	3	-	2	3	2	3	3	1	-	-	3	3	-
CO4	Examine the radiation sensors based on their characteristics	-	3	-	2	3	2	3	3	-	2	-	-	-
CO5	Apply Smart Sensors in the field of Communication, Automation and Manufacturing.	3	-	3	-	1	3	1	3	3	2	-	-	-
CO6	Perceive various control values and types of actuators	-	3	-	2	-	3	3	-	3	3	3	-	-
Course Code	**192VD3O01 - PHYSICAL DESIGN AUTOMATION (Open Elective)**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	Understand the relationship between design automation algorithms and various constraints posed by VLSI fabrication and design technology.	-	1	-	2	-	-	-	-	-	-	-	-	-
CO2	Adapt the design algorithms to meet the critical design parameters.	-	-	3	-	3	-	-	-	-	-	-	-	-
CO3	Identify layout optimization techniques and map them to the algorithms	-	-	1	-	-	3	-	-	-	-	-	-	-
CO4	Develop proto-type EDA tool and test its efficacy	-	-	-	-	-	-	-	3	-	-	-	-	-
CO5	Analyze the different partitioning algorithms and its evolution.	-	-	-	-	2	3	-	-	-	-	-	-	-
Course Code	192VD3O02 - VLSI TECHNOLOGY (Open Elective)	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	Summarize characteristics of MOS transistors.	3	2	-	-	-	-	-	-	-	-	-	-	-
CO2	Outline the MOS fabrication process and short channel effects.	-	3	2	2	-	-	-	-	-	-	-	-	-
CO3	Identify the basic rules in layout designing.	-	-	3	3	2	-	3	-	-	-	-	-	-
CO4	Analyze various combinational logic networks and sequential systems.	-	-	-	3	3	2	2	3	-	-	-	-	-
Course Code	**192VD3O03 - NANO-ELECTRONICS (Open Elective)**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	Demonstrate challenges due to scaling on CMOS devices.	-	3	-	2	2	3	-	1	1	1	3	1	-
CO2	Analyse and explain working of novel MOS based silicon devices and various multi gate devices.	-	2	3	2	2	2	3	-	1	1	1	-	-

	CO Statements	POs											PSOs	
CO3	Analyse working of spin electronic devices	**3**	**-**	**2**	**3**	**2**	**2**	**2**	**3**	**-**	**1**	**1**	**2**	**-**
CO4	Summarize nano electronics systems and building blocks such as: low dimensional semiconductors, hetero structures, carbon nano tubes, quantum dots, nanowires etc	**1**	**3**	**-**	**1**	**2**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**
CO5	Develop nano electronics systems and building blocks such as: carbon nanotubes, quantum dots, nanowires etc.	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**3**	**3**	**2**	**-**	**-**	**-**
CO6	Explain various design methodologies for chip design.	**2**	**2**	**2**	**2**	**-**	**3**	**2**	**3**	**1**	**1**	**2**	**-**	**-**
Course Code	**192CS3O01 - PYTHON PROGRAMMING (Open Elective)**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	Apply fundamental concepts of Python programming language.	**3**	**3**	**-**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO2	Develop programs using control statements.	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO3	Use data structures in Python to solve various problems.	**-**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**
CO4	Develop programs using functions, strings and files	**3**	**-**	**-**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO5	Make Use of Standard libraries like math, turtle, tkinter, re etc. in building real time applications.	**-**	**-**	**-**	**1**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**
CO6	Discuss on Object Oriented Programming concepts and Exceptions.	**-**	**1**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**
CO7	Design various applications using database connectivity.	**3**	**2**	**1**	**1**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**
Course Code	**192CS3O02 - PRINCIPLES OF CYBER SECURITY (Open Elective)**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	Illustrate cybercrime fundamentals.	**2**	**1**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO2	Analyze cyber offence planning.	**-**	**3**	**3**	**2**	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO3	Interpret cybercrime on mobile and wireless devices.	**-**	**-**	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**
CO4	Distinguish type of tools and methods used in cyber crimes.	**-**	**-**	**-**	**3**	**3**	**2**	**2**	**3**	**-**	**-**	**-**	**-**	**-**
CO5	Explain the importance of cyber security.	**-**	**-**	**-**	**-**	**2**	**1**	**-**	**-**	**2**	**-**	**-**	**-**	**-**
Course Code	**192CS3O03 - INTERNET OF THINGS (Open Elective)**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	Summarize on the term 'internet of things' in different contexts.	**3**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO2	Analyze various protocols for IoT.	**-**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO3	Design a PoC of an IoT system using Rasperry Pi/Arduino.	**-**	**-**	**3**	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO4	Apply data analytics and use cloud offerings related to IoT.	**-**	**-**	**-**	**3**	**3**	**1**	**2**	**-**	**-**	**-**	**-**	**-**	**-**
CO5	Analyze applications of IoT in real time scenario.	**-**	**-**	**-**	**-**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**
Course Code	**192CS3O04 - MACHINE LEARNING (Open Elective)**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	Domain Knowledge for Productive use of Machine Learning andDiversity of Data.	**3**	**2**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO2	Demonstrate on Supervised and Computational Learning problems.	**-**	**3**	**2**	**1**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO3	Analyze on Statistics in learning techniques and Logistic Regression.	**-**	**-**	**3**	**2**	**1**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**
CO4	Illustrate on Support Vector Machines and Perceptron Algorithm.	**-**	**-**	**-**	**3**	**2**	**1**	**-**	**3**	**-**	**-**	**-**	**-**	**-**
CO5	Design a Multilayer Perceptron Networks and classification of decisiontree	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**-**	**3**	**-**	**-**	**-**	**-**

	CO Statements	POs											PSOs	
Course Code	**192CS3O05 - ARTIFICIAL INTELLIGENCE (Open Elective)**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	Describe the fundamentals of Artificial Intelligence and its applications	**2**	**1**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO2	Illustrate the time and space complexities of searching techniques	**-**	**2**	**1**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO3	Apply various logical systems to inference the different logical problems.	**-**	**-**	**3**	**2**	**1**	**1**	**3**	**-**	**-**	**-**	**-**	**-**	**-**
CO4	Create knowledge structure using traditional and complex structures and Advanced knowledge representation techniques.	**-**	**-**	**-**	**3**	**2**	**1**	**1**	**3**	**-**	**-**	**-**	**-**	**-**
CO5	Apply Fuzzy Logic and Reasoning to handle Uncertainty for solving scientific Problems.	**-**	**-**	**-**	**-**	**3**	**2**	**1**	**1**	**3**	**-**	**-**	**-**	**-**
Course Code	**192CS3O06 - DEEP LEARNING (Open Elective)**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	Demonstrate the basic concepts fundamental learning techniques and layers.	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO2	Discuss the Neural Network training, various random models.	**-**	**-**	**1**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO3	Identify different types of deep learning network models.	**-**	**-**	**1**	**3**	**3**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**
CO4	Classify the Probabilistic Neural Networks.	**-**	**-**	**-**	**1**	**-**	**3**	**-**	**3**	**-**	**-**	**-**	**-**	**-**
CO5	Implement tools on Deep Learning techniques	**-**	**-**	**-**	**-**	**1**	**2**	**3**	**3**	**-**	**-**	**-**	**-**	**-**
Course Code	**192PE3O01 - INTRODUCTION TO PETROLEUM ENGINEERING (Open Elective)**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	Understand the role of petroleum engineers in various facets of petroleum exploration, production, transportation, refining and processing	**3**	**2**	**1**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO2	Students get motivated to work for the energy security after knowing the present scenario of petroleum and natural gas.	**-**	**2**	**2**	**1**	**2**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**
CO3	Analyze various case studies available in petrochemical, fine chemical, bioprocesses and carbon capture	**-**	**-**	**3**	**2**	**1**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO4	Explain the principal involved in gathering oil and gas storage	**-**	**-**	**-**	**3**	**2**	**-**	**1**	**1**	**-**	**-**	**-**	**-**	**-**
CO5	Understand the basic concepts of Downstream processing	**-**	**-**	**-**	**-**	**2**	**2**	**-**	**2**	**1**	**-**	**1**	**-**	**-**
Course Code	**192PE3O02 - PROCESS INTENSIFICATION (Open Elective)**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	Apply the basic principles and mechanisms that are responsible for process intensification	**3**	**2**	**1**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO2	Analyze various modifications to process equipment and designs with which process intensification becomes a reality in unit operations and unit processes.	**-**	**2**	**2**	**1**	**2**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**
CO3	Analyze various case studies available in petrochemical, fine chemical, bioprocesses and carbon capture.	**-**	**-**	**3**	**2**	**1**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO4	Correlate textbook reported methodologies with Computational Fluid Dynamics	**-**	**-**	**-**	**3**	**2**	**-**	**1**	**1**	**-**	**-**	**-**	**-**	**-**

	CO Statements	POs											PSOs	
CO5	Correlate textbook reported methodologies with experimental process intensification.	-	-	-	-	2	2	-	2	1	-	1	-	-
Course Code	**192PE3O03 - FUNDAMENTALS OF LIQUEFIED NATURAL GAS (Open Elective)**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	Explain the LNG value chain.	1	1	-	-	-	-	-	-	-	-	-	-	-
CO2	Classify the different liquefaction technologies of LNG.	-	3	2	-	-	1	-	-	-	-	-	-	-
CO3	Explain the components of LNG receiving terminals.	-	-	3	-	-	-	-	-	-	-	-	-	-
CO4	Summarize LNG storage and transportation facilities	-	-	-	3	1	-	-	-	-	-	-	-	-
CO5	Identify major equipment and safety aspects of LNG industry.	-	-	-	-	3	2	-	-	3	-	-	-	-
Course Code	**192PE3O04 - SUBSEA ENGINEERING (Open Elective)**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	Explain Overall View of subsea engineering	-	3	-	-	-	-	-	-	-	-	-	-	-
CO2	Explain the Subsea Distribution System.	-	-	3	-	-	-	-	2	1	-	-	-	-
CO3	Identification and monitoring of Subsea Control.	-	-	2	3	-	1	-	-	-	-	-	-	-
CO4	Studies on Subsea Power Supply, Subsea systems engineering.	-	-	-	1	-	-	-	-	3	-	-	-	-
CO5	Understanding the Hydrates, Wax and Asphaltenes.	-	-	-	-	-	-	2	-	2	-	-	-	-
Course Code	**192PE3O05 - GEOLOGY (Open Elective)**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	Explain the general facts of the earth.	2	-	-	-	-	2	2	1	-	-	-	-	-
CO2	Analyze the different processes for the formation of land forms.	-	2	2	-	-	-	-	-	-	-	-	-	-
CO3	Analyze the different structures like folds, faults etc.	-	-	2	2	1	-	-	-	-	-	-	-	-
CO4	Compare and classify various kinds of rocks.	-	-	-	-	2	-	-	-	-	-	-	-	-
CO5	Explain the process of transportation, generation of sedimentary structures	-	-	-	-	2	2	-	2	1	-	2	-	-
Course Code	**192PE3O06 - HSE IN PETROLEUM INDUSTRY (Open Elective)**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	Explain the environmental issues in drilling and production operations	-	-	-	-	-	2	-	3	1	-	-	-	-
CO2	Summarize impacts of petroleum industry wastes and waste treatment methods.	-	3	3	-	-	-	-	-	-	-	-	-	-
CO3	Demonstrate the oil mines regulations in various petroleum industry operations	-	-	-	3	2	2	-	-	-	-	2	-	-
CO4	Make use of the hazop study concepts for safe practices in Petroleum industry.	-	-	-	2	-	-	-	3	-	-	-	-	-
CO5	Illustrate the fire triangle, different methods of suppression of hydrocarbon fires.	-	-	-	-	-	2	-	-	3	-	-	-	-