

FACULTY OF ENGINEERING

Scheme of Instruction & Examination

And

Syllabi

BE VII and VIII Semester

Of

Four Year Degree Programme

In

Computer Science & Engineering

(With effect from the academic year 2021-2022)



Issued by
Dean, Faculty of Engineering
Osmania University, Hyderabad
2021

BE(CSE) SEMESTER-VII SCHEME:-

Sl.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/Wk	CIE	SEE	Duration in Hrs	
Theory Courses										
1	PC 701 CS Core-13	Information Security	3	-	-	3	30	70	3	3
2	PC 702 CS Core-14	Data Science Using R Programming	3	1	-	4	30	70	3	4
3	PC 703 CS Core-15	Distributed Systems	3	1	-	4	30	70	3	4
4	OE-II	Open Elective – II	3	-	-	3	30	70	3	3
Practical/ Laboratory Courses										
5	PC 751 CS	Data Science Lab	-	-	3	3	25	50	3	1.5
6	PC 752 CS	Distributed Systems Lab	-	-	3	3	25	50	3	1.5
7	PW 761 CS	Project Work – I	-	-	4	4	50	-	-	2
8	SI 762 CS	Summer Internship	-	-	-	-	25	50	-	2
			12	02	10	24	245	430	18	21

PC: Professional Course **PE:** Professional Elective,
HS: Humanities and social Science
MC: Mandatory Course
L: Lecture **T:** Tutorial
P: Practical **D:** Drawing
CIE: Continuous Internal Evaluation, **SEE**
Semester End Examination (Univ. Exam)

Note:

- Each contact hour is a Clock Hour
- The practical class can be of two and half hour (clock hours) duration as per the requirement of a particular laboratory.

Open Elective II	
Course Code	Course Title
OE 701 CE	Green Building Technologies
OE 701 CS**	Data Science and Data Analytics
OE701EE	Non-Conventional Energy Sources
OE702EE	Transducers and Sensors
OE701EC	Fundamentals of IoT
OE701 IT**	Cyber Security
OE701ME	Start-Up Entrepreneurship
OE701AE	Automotive Maintenance

Note:- ** Subject is not offered to the students of CSE and IT Department.

BE(CSE) SEMESTER-VIII SCHEME:-

Sl.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/Wk	CIE	SEE	Duration in Hrs	
Theory Courses										
1	PE-VI	Professional Elective – VI	3	-	-	3	30	70	3	3
2	OE-III	Open Elective – III	3	-	-	3	30	70	3	3
Practical/ Laboratory Courses										
7	PW861 CS	Project Work – II	-	-	16	16	50	100	-	8
			06	-	16	22	110	240	06	14

Profession Elective – VI		
Sl.	Course Code	Course Title
1	PE 827 CS	Mobile Computing
2	PE 828 CS	Semantic Web & Social Networking
3	PE 829 CS	Cyber Security & Forensics

Open Elective III	
Course Code	Course Title
OE 801 CE	Road Safety Engineering
OE 801CS**	Fundamentals of AL & ML
OE801EE	Smart Building Systems
OE802EE	Programmable Logic Controllers
OE801EC	Principles of Electronic Communications
OE801 IT**	Software Engineering
OE801ME	3D Printing Technologies
OE801AE	ELEMENTS OF ELECTRIC AND HYBRID VEHICLE TECHNOLOGY

Note- : ** Subject is not offered to the students of CSE and IT Department.

PC: Professional Course
MC: Mandatory Course

HS: Humanities and Sciences

L: Lectures **T:** Tutorials

P: Practical **D:** Drawing

CIE: Continuous Internal Evaluation

SEE: Semester End Examination (Univ. Exam)

Note-2: 1) Each contact hour is a Clock Hour
2) The practical class can be of two and half hour (clock hours) duration as per the requirement of a particular laboratory.

Course Code	Course Title						Core / Elective
PC 701 CS	Information Security						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	30	70	3
Course Objectives <ul style="list-style-type: none"> ➤ To learn legal and technical issues in building secure information systems ➤ To provide an understanding of network security ➤ To expose the students to security standards and practices Course Outcomes <p>After completing this course, the student will be able to</p> <ol style="list-style-type: none"> 1. Describe the steps in Security Systems development life cycle (SecSDLC) 2. Understand the common threats and attack to information systems 3. Understand the legal and ethical issues of information technology 4. Identify security needs using risk management and choose the appropriate risk control strategy based on business needs 5. Use the basic knowledge of security frameworks in preparing security blue print for the organization 6. Usage of reactive solutions, network perimeter solution tools such as firewalls, host solutions such as antivirus software and Intrusion Detection techniques and knowledge of ethical hacking tools 7. Use ethical hacking tools to study attack patterns and cryptography and secure communication protocols 8. Understand the technical and non-technical aspects of security project implementation and Accreditation 							

UNIT-I

Introduction: History, Critical Characteristics of Information, NSTISSC Security Model, Components of an Information System, Securing the Components, Balancing Security and Access, The SDLC, The Security SDLC.

Need for Security: Business Needs, Threats, Attacks, and Secure Software Development

UNIT-II

Legal, Ethical and Professional Issues: Law and ethics in Information Security, Relevant U.S. Laws, International Laws and Legal Bodies, Ethics and Information Security.

Risk Management: Overview, Risk Identification, Risk Assessment, Risk Control Strategies, selecting a Risk Control Strategy, Quantitative versus Qualitative Risk Control Practices, Risk Management Discussion Points, Recommended Risk Control Practices.

UNIT-III

Planning for Security: Security policy, Standards and Practices, Security Blue Print, Security Education, Continuity strategies.

Security Technology: Firewalls and VPNs: Physical Design, Firewalls, Protecting Remote connections.

UNIT-IV

Security Technology: Intrusion Detection, Access Control, and other Security Tools: Intrusion Detection and Prevention Systems-Scanning, and Analysis Tools- Access Control Devices.

Cryptography: Foundations of Cryptology, Cipher methods, Cryptographic Algorithms, Cryptographic Tools, Protocols for Secure Communications, Attacks on Cryptosystems

UNIT-V

Implementing Information Security: Information security project management, Technical topics of implementation, Non-Technical Aspects of implementation, Security Certification and Accreditation.

Information Security Maintenance: Security management models, Maintenance model

Short case studies in Cryptography and Security: Secure Multi party calculation, Virtual Elections, Single Sign On, Secure Inter Branch Payment transactions, Cross site scripting vulnerability (**Book 2**)

Suggested Readings:

Prescribed Books

1. Michael E Whitman and Herbert J Mattord, *Principles of Information Security*, Cengage Learning, 6 th Edition 2018
2. Atul kate, *Cryptography and Network Security*” 4 th edition , Tata Mc Graw Hill , 2019

Reference Books:

3. Nina Godbole, “Information Systems Security: Security Management, Metrics, Frameworks and Best Practices” Second Edition, WILEY 2017
4. Gupta Sarika, “Information and Cyber Security”, Khanna Publishing House, Delhi
5. V.K. Pachghare, “Cryptography and Information Security”, PHI Learning

Course Code	Course Title					Core / Elective	
PC 702 CS	Data Science Using R Programming					Core	
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	1	-	-	30	70	4
Course Objectives <ul style="list-style-type: none"> ➤ To learn basics of R Programming environment: R language, R- studio and R packages ➤ To learn various statistical concepts like linear and logistic regression, cluster analysis, time series forecasting ➤ To learn Decision tree induction, association rule mining and text mining Course Outcomes: At the end of the course, the students will be able to <ol style="list-style-type: none"> 1. Use various data structures and packages in R for data visualization and summarization 2. Use linear, non-linear regression models, and classification techniques for data analysis 3. Use clustering methods including K-means and CURE algorithm 							

UNIT – I

Data Science: Introduction to data science, Linear Algebra for data science, Linear equations, Distance, Hyper planes, Half spaces, Eigen values, Eigenvectors.

UNIT II

Statistical Modelling, Random variables, Probability mass/density functions, sample statistics, hypothesis testing.

UNIT III

Predictive Modelling: Linear Regression, Simple Linear Regression model building, Multiple Linear Regression, Logistic regression

UNIT IV

Introduction to R Programming, getting started with R: Installation of R software and using the interface, Variables and data types, R Objects, Vectors and lists, Operations: Arithmetic, Logical and Matrix operations, Data frames, functions, Control structures, Debugging and Simulation in R.

UNIT V

Classification: performance measures, Logistic regression implementation in R, K-Nearest neighbours (KNN), K-Nearest neighbours implementation in R, Clustering: K-Means Algorithm, K-Means implementation in R. Time Series Analysis using R, Social Network Analysis, Reading data from relational databases- MySQL, Reading data from NoSQL databases- MongoDB.

Suggested Readings:

1. Nina Zumel, Practical Data Science with R, Manning Publications, 2014.
2. Peter Bruce and Andrew Bruce, Practical Statistics for Data Scientists, O'Reilly, 2017.
3. Hadley Wickham and Garrett Grolemund, R for Data Science, O'Reilly, 2017.
4. Roger D Peng, R Programming for Data science, Lean Publishing, 2016.
5. Rafael A Irizarry, Introduction to Data Science, Lean Publishing, 2016.
6. Vishwa Vishwanathan and Shanthi Vishwanathan, R Data Analysis cookbook 2015

Course Code	Course Title					Core / Elective	
PC 703 CS	Distributed Systems					Core	
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	1	-	-	30	70	4

Course Objectives

- To acquire an understanding of the issues in distributed systems.
- To learn about Naming and synchronization with different algorithms.
- To study architectures and working of Distributed file systems, Distributed web-based system
- To expose the students to distributed transaction management, security issues and replication.
- To introduce Emerging trends in distributed computing

Course Outcomes

By the end of this course, the students will be able to

1. List the principles of distributed systems and describe the problems and challenges associated with these principles
2. To know about interposes communication and remote communication.
3. Understand Distributed Computing techniques, Synchronous and Processes.
4. Understand Distributed File Systems Apply Distributed web-based system. Understand the importance of security in distributed systems
5. Student will be able to know distributed service oriented architecture.
6. To know about emerging trends in distributed computing.

UNIT-I

Introduction: Characteristics & Properties of Distributed Systems – Taxonomy - Types of Distributed Systems Design goals – Transparency Issues.

Architectures: Architectural Styles, System Architectures, Architectures versus Middleware, and Self- Management in Distributed Systems.

Processes: Threads, Virtualization, Software Agents, Clients, Servers, and Code Migration.

Communication: Inter process communication Mechanisms, Remote Procedure Call, Remote Method Invocation, Message-Oriented Communication, Stream- Oriented Communication, and Multicast Communication.

UNIT-II

Naming: Names, Identifiers and Addresses, Flat Naming, Structured Naming and Attribute-Based Naming. **Synchronization:** Clock Synchronization, Logical Clocks, Mutual Exclusion, Global Positioning of Nodes, and Election Algorithms.

Consistency and Replication: Introduction, Data-Centric Consistency Models, Client-Centric Consistency Models, Replica Management, and Consistency Protocols.

UNIT-III

Fault Tolerance: Introduction to Fault Tolerance, Process Resilience, Reliable Client-Server Communication, Reliable Group Communication, Distributed Commit, and Recovery.

Distributed Object-Based Systems: CORBA, DCOM, GLOBE -Architecture, Processes, Communication, Naming, Synchronization, Consistency and Replication, Fault Tolerance, and Security.

UNIT-IV

Distributed File Systems: File system, DFS- definition, Characteristics, Goals, SUN NFS-NFS Architecture, NFS Implementation, Protocols, The CODA file system-Design Overview, An Example, Design Rational, Implementation, The GOOGLE file system-Definition, Architectures, GFS

Architecture

Distributed Web-Based Systems: Traditional Web-Based Systems, Web Services Fundamentals, The Apache Web Server, Web Server Clusters, Communication, HTTP Fundamentals, Simple Object Access Protocol SOAP, Web Proxy Caching, Replication for Web Hosting Systems-CDN'S, Service-Oriented Architectures, REST and Web Services

UNIT-V

Distributed Coordination-Based Systems -- Architecture, Naming and Security

Emerging Trends in Distributed Systems - Emerging Trends Introduction, Grid Computing, Cloud Computing and its roots in distributed systems mechanisms and self-management of distributed systems, Virtualization, Service Oriented Architecture, The Future of Emerging Trends.

Map-Reduce: Example, Scaling, Programming Model, Apache Hadoop, Amazon Elastic Map Reduce, Mapreduce.net, Pig and Hive.

Suggested Readings:

1. Andrew S. Tanenbaum and Maarten Van Steen, *Distributed Systems*, PHI 2nd Edition, 2009.
2. Distributed Computing, Sunita Mahajan and Seema Shah, Oxford University
3. R. Hill, L. Hirsch, P. Lake, S. Moshiri, *Guide to Cloud Computing*, Principles and Practice, Springer, 2013.
4. R. Buyya, J. Borberg, A. Goscinski, *Cloud Computing-Principles and Paradigms*, Wiley, 2013.
5. Distributed Operating Systems by P. K. Sinha, PHI

Reference Books:

1. Distributed Systems: Principles and Paradigms, Taunenbaum
2. Distributed Computing, Fundamentals, Simulations and Advanced topics, 2nd Edition, Hagit Attiya and Jennifer Welch, Wiley India
3. Distributed Systems: Concepts and Design, G. Coulouris, J. Dollimore, and T. Kindberg,
4. Java Network Programming & Distributed Computing by David Reilly, Michael Reill

Course Code	Course Title					Core / Elective	
OE701CE	GREEN BUILDING TECHNOLOGIES					OE-II	
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	30	70	3

Course Objectives:

- Learn the principles of green building technologies and rating systems
- Understand the principles of effective energy and resources management in buildings
- Understand the methodologies to reduce, recycle and reuse towards sustainability.

Course Outcomes:

1. After completing this course, the student will be able to
2. Classify the various features, benefits, and rating systems for a green building
3. Outline the criteria used for site selection and water efficiency methods
4. Select the energy efficiency techniques in designing a green building
5. Select materials for sustainable built environment & adopt waste management methods
6. Identify an appropriate method for maintaining indoor environmental quality in a green building

UNIT-I

Introduction to Green Buildings: Definition of green buildings and sustainable development, typical features of green buildings, benefits of green buildings towards sustainable development. Green building rating systems – GRIHA, IGBC and LEED, overview of the criteria as per these rating systems.

UNIT- II

Site selection and planning: Criteria for site selection, preservation of landscape, soil erosion control, minimizing urban heat island effect.

Water conservation and efficiency: Rainwater harvesting methods for roof & non-roof, reducing landscape water demand by proper irrigation systems, water efficient plumbing systems, water metering, waste water treatment, recycle and reuse systems.

UNIT-III

Energy Efficiency: Environmental impact of building constructions, Concepts of embodied energy, operational energy and life cycle energy.

Methods to reduce operational energy: Energy efficient building envelopes, efficient lighting technologies, energy efficient appliances for heating and air-conditioning systems in buildings, zero ozone depleting potential (ODP) materials, wind and solar energy harvesting, energy metering and monitoring, concept of net zero buildings.

UNIT-IV

Building materials: Methods to reduce embodied energy in building materials: (a) Use of local building materials (b) Use of natural and renewable materials (c) use of materials with recycled content such as blended cements materials from agro and industrial waste. (d) reuse of waste and salvaged materials

Waste Management: Handling of construction waste materials, separation of household waste, on-site and off-site organic waste management

UNIT-V

Indoor Environmental Quality for Occupant Comfort and Well being: Day lighting, air ventilation, exhaust systems, low VOC paints, materials & adhesives, building acoustics.

Codes related to green buildings: NBC, ECBC, ASHRAE, UPC etc.

Suggested Readings:

1. IGBC Green Homes Rating System, Version 2.0., Abridged reference guide, 2013, Indian Green Building Council Publishers
2. GRIHA version 2015, GRIHA rating system, Green Rating for Integrated Habitat Assessment
3. 'Alternative building materials and technologies' by K.S. Jagadish, B.V. Venkatarama Reddy and K.S. Nanjunda Rao.
4. 'Non-Conventional Energy Resources' by G. D. Rai, Khanna Publishers.
5. Sustainable Building Design Manual, Vol.1 and 2, TERI, New Delhi 2004

Course Code	Course Title					Core / Elective	
OE 701 CS	Data Science and Data Analytics					Open Elective-II	
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	30	70	3

Course Objectives

- To learn basics of Data Science: Linear Algebra, Linear Equations, Matrices, Eigen Values and Eigen Vectors.
- To learn various statistical concepts like linear and logistic regression, cluster analysis, time series forecasting
- To learn Decision tree induction, association rule mining and text mining

Course Outcomes:

1. At the end of the course, the students will be able to
2. Use various Mathematical models, and Probability and Statics
3. Use linear, non-linear regression models, and classification techniques for data analysis
4. Use clustering methods including K-means and CURE algorithm

UNIT – I

Data Science: Introduction to data science, Linear Algebra for data science, Linear equations, Distance, Hyper planes, Half spaces, Eigen values, Eigenvectors.

UNIT II

Statistical Modelling, Random variables, Probability mass/density functions, sample statistics, hypothesis testing.

UNIT III

Predictive Modelling: Linear Regression, Simple Linear Regression model building, Multiple Linear Regression, Logistic regression

UNIT IV

Decision Tree: Introduction, What Is A Decision Tree? Appropriate Problems For Decision Tree Learning, Basic Decision Tree Learning Algorithm, Measuring Features, Hypothesis Space Search In

Decision Tree Learning, Inductive Bias In Decision Tree Learning, Why Prefer Short Hypotheses, Issues In Decision Tree Learning.

Classification: K-Nearest neighbors (KNN), Performance Measures,

UNIT V

Clustering: K-Means Algorithm,

Association Rules: Introduction, Frequent Itemset, Data Structure Overview, Mining Algorithm Interfaces, Auxiliary Functions, Sampling from Transaction, Generating Synthetic Transaction Data, Additional Measures of Interestingness, Distance Based Clustering Transaction and Association.

Suggested Readings:

1. Nina Zumel, Practical Data Science with R, Manning Publications, 2014.
2. Peter Bruce and Andrew Bruce, Practical Statistics for Data Scientists, O'Reilly, 2017.
3. Hadley Wickham and Garrett Grolemund, R for Data Science, O'Reilly, 2017.
4. Roger D Peng, R Programming for Data science, Lean Publishing, 2016.
5. [Rafael A Irizarry](#), Introduction to Data Science, Lean Publishing, 2016.
6. Vishwa Vishwanathan and Shanthi Vishwanathan, R Data Analysis cookbook 2015

Course Code	Course Title					Core / Elective	
OE701EC	Fundamentals of IoT					Open Elective-II	
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	30	70	3

Course Objectives:

- Discuss fundamentals of IoT and its applications and requisite infrastructure
- Describe Internet principles and communication technologies relevant to IoT
- Discuss hardware and software aspects of designing an IoT system
- Describe concepts of cloud computing and Data Analytics
- Discuss business models and manufacturing strategies of IoT products

Course Outcomes:

1. After completing this course, the student will be able to
2. Understand the various applications of IoT and other enabling technologies.
3. Comprehend various protocols and communication technologies used in IoT
4. Design simple IoT systems with requisite hardware and C programming software
5. Understand the relevance of cloud computing and data analytics to IoT
6. Comprehend the business model of IoT from developing a prototype to launching a product.

UNIT – I

Introduction to Internet of Things: Definition and Characteristics of IoT, Physical Design of IoT: Things in IoT, IoT protocols, Logical Design of IoT: IoT functional Blocks, Communication Models, APIs, IoT enabling Technologies: Wireless Sensor Networks, Cloud Computing, Big Data Analytics (Ref 1)

IoT Applications: Smart Home, Smart Cities, Smart Environment, Smart Energy, Smart Retail and Logistics, Smart Agriculture and Industry, Smart Industry and smart Health (Ref1)

UNIT – II

Internet Principles and communication technology: Internet Communications: An Overview – IP, TCP, IP protocol Suite, UDP. IP addresses – DNS, Static and Dynamic IP addresses, MAC Addresses, TCP and UDP Ports, Application Layer Protocols – HTTP, HTTPS, Cost Vs Ease of Production, Prototypes and Production, Open Source Vs Closed Source. Prototyping Embedded Devices – Sensors, Actuators, Microcontrollers, SoC, Choosing a platform, Prototyping Hardware platforms – Arduino, Raspberry Pi. Prototyping the physical design – Laser Cutting, 3D printing, CNC Milling (Ref 2)

UNIT – III

API Development and Embedded programming: Getting started with API, writing a new API, Real time Reactions, Other Protocols, Techniques for writing embedded code: Memory management, Performance and Battery Life, Libraries, Debugging. (Ref 2)

Developing Internet of Things: IoT design Methodology, Case study on IoT System for weather monitoring (Ref 1)

UNIT – IV

IoT Systems - Logical Design using Python: Introduction to Python, Data Types and Structures, Control Flow, Functions, Modules, Packages, File Handling, Date/Time Operations., Classes, Python packages for IoT (Ref 1 and Ref 3)

IoT Physical Devices and Endpoints: Raspberry Pi, Interfaces of Pi, Programming pi with Python - Controlling LED and LDR using Pi with python programming.

UNIT – V

Cloud computing and Data analytics and IoT Product Manufacturing: Introduction to Cloud storage models and Communication APIs, Amazon web services for IoT, Skynet IoT Messaging Platform. Introduction to Data Analytics for IoT (Ref 1). Case studies illustrating IoT Design – Smart Lighting, Weather Monitoring, Smart Irrigation. (Ref 1) Business model for IoT product manufacturing, IoT Start-ups, Mass manufacturing, Ethical issues in IoT. (Ref 2)

Suggested Readings:

1. Internet of Things (A Hands-On-Approach), Vijay Madiseti, ArshdeepBahga, VPT Publisher, 1st Edition, 2014.
2. Designing the Internet of Things, Adrian McEwen (Author), Hakim Cassimally. Wiley India Publishers.
3. Fundamentals of Python, Kenneth A Lambert and B.L. Juneja, Cengage Learning
4. Internet of Things - Converging Technologies for smart environments and Integrated ecosystems, River Publishers.
5. Internet of things -A hands on Approach, Arshdeep Bahga, Universities press.

Course Code	Course Title					Core/Elective	
OE 701 IT	CYBER SECURITY					Open Elective	
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	-	-	-	30	70	3
<p>Course Objectives:</p> <p>Students should be able to understand</p> <ul style="list-style-type: none"> • The difference between threat and attacks, how threats materialize into attacks. • Security in Operating Systems & Networks. • Security Countermeasures • Privacy in Cyberspace. • Security Planning, Risk Analysis, Cyber Warfare, Cyberspace and Law <p>Course Outcomes:</p> <p>Student will be able to</p> <ol style="list-style-type: none"> 1. Acquire adequate knowledge about threat and attacks 2. Enhance their skills to implement security in design of Operating Systems 3. Use various techniques of Security Countermeasures 4. Acquire understanding in Privacy Principles and Policies in Cyberspace 5. Enhance their understanding in Security Planning, Risk Analysis, Cyber Warfare, Cyberspace and Law 							

UNIT I

Introduction To Cyber Security

Introduction -Computer Security - Threats -Harm - Vulnerabilities - Controls - Authentication - Access Control and Cryptography - Web—User Side - Browser Attacks - Web Attacks Targeting Users - Obtaining User or Website Data - Email Attacks

UNIT II

Security In Operating System & Networks

Security in Operating Systems - Security in the Design of Operating Systems -Rootkit - Network security attack- Threats to Network Communications - Wireless Network Security - Denial of Service - Distributed Denial-of-Service.

UNIT III

Defences: Security Countermeasures

Cryptography in Network Security - Firewalls - Intrusion Detection and Prevention Systems - Network Management - Databases - Security Requirements of Databases - Reliability and Integrity - Database Disclosure - Data Mining and Big Data.

UNIT IV

Privacy In Cyberspace

Privacy Concepts -Privacy Principles and Policies -Authentication and Privacy - Data Mining -Privacy on the Web - Email Security - Privacy Impacts of Emerging Technologies - Where the Field Is Headed.

UNIT V

Management And Incidents

Security Planning - Business Continuity Planning - Handling Incidents - Risk Analysis - Dealing with Disaster - Emerging Technologies - The Internet of Things - Economics - Electronic Voting - Cyber Warfare- Cyberspace and the Law - International Laws - Cyber crime - Cyber Warfare and Home Land Security.

Suggested for Readings

1. Charles P. Pfleeger Shari Lawrence Pfleeger Jonathan Margulies, Security in Computing, 5th Edition , Pearson Education , 2015
2. George K.Kostopoulos, Cyber Space and Cyber Security, CRC Press, 2013.

Course Code	Course Title				Core/Elective		
OE 701 ME	START- UP ENTREPRENEURSHIP				Open Elective		
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	-	-	-	30	70	3

Course Objectives:

Students should be able to understand

- To motivate students to take up entrepreneurship in future.
- To learn nuances of starting an enterprise & project management.
- To understand the design principles of solar energy systems, their utilization and performance evaluation.
- To understand the behavioural aspects of entrepreneurs and time management

Course Outcomes:

Student will be able to

1. Understand Indian Industrial Environment, Entrepreneurship and Economic growth, Small and Large Scale Industries, Types and forms of enterprises.
2. Identify the characteristics of entrepreneurs, Emergence of first generation entrepreneurs, Conception and evaluation of ideas and their sources.
3. Practice the principles of project formulation, Analysis of market demand, Financial and profitability analysis and Technical analysis.
4. Understand the concept of Intellectual Property Rights and Patents
5. Comprehend the aspects of Start-Ups.

Unit-I

Indian Industrial Environment-competence, Opportunities and Challenges. Entrepreneurship and Economic growth. Small Scale Industry in India, Objectives, Linkage among small, medium and heavy industries. Types of enterprises.

Unit-II:

Identification and characteristics of entrepreneurs. Emergence of First generation entrepreneurs, environmental influence and women entrepreneurs. Conception and evaluation of ideas and their sources. Choice of Technology - Collaborative interaction for Technology development.

Unit-III

Project formulation, Analysis of market demand, Financial and profitability analysis and Technical analysis, project financing in India.

Unit-IV

Intellectual Property Rights: Meaning, Nature, Classification and protection of Intellectual Property, the main forms of Intellectual Property, Concept of Patent, Patent document, Invention protection, Granting of patent, Rights of a patent, Licensing, Transfer of technology.

Unit-V

Aspects of Start-Up: What is Start-Up, Start-up Policy, start-up strategy, Progress of startups in India, Principles of future organizations, start-up sectors, action plan for start-ups by Govt. of India.

Suggested Reading:

1. Vasant Desai, *"Dynamics of Entrepreneurial Development and Management"*, Himalaya Publishing House, 1997.
2. Prasanna Chandra, *"Project-Planning, Analysis, Selection, Implementation and Review"*, Tata McGraw-Hill Publishing Company Ltd. 1995.
3. Stephen R. Covey and A. Roger Merrill, *"First Things First"*, Simon and Schuster Publication, 1994.
4. G.S. Sudha, *"Organizational Behaviour"*, 1996.
5. Robert D. Hisrich, Michael P. Peters, *"Entrepreneurship"*, Tata McGraw Hill Publishing Company Ltd., 5th Ed., 2005.
6. G.B. Reddy, *Intellectual Property Rights and the Law* 5th Ed. 2005 Gogia Law Agency
7. Ajit Parulekar and Sarita D'Souza, *Indian Patents Law – Legal & Business Implications*, Macmillan India Ltd, 2006.

Course Code	Course Title					Core/Elective	
OE 701 AE	AUTOMOTIVE MAINTENANCE					Open Elective	
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	-	-	-	30	70	3

Course Objectives:

Students should be able to understand

- To study basic types of vehicle maintenance along with its importance
- To understand the trouble diagnosis procedure for electrical and electronic systems in automobiles
- To acquaint with various Trouble shooting, fault tracing practices available in automobile industry
- To understand the maintenance procedure for air-conditioning in automobiles.

Course Outcomes:

Student will be able to

1. Demonstrate the maintenance procedure for automotive Engine.
2. Illustrate the trouble diagnosis procedure for electrical systems like Battery, Starting
3. Systems
4. Identify the trouble diagnosis procedure for steering and suspension system
5. Illustrate trouble diagnosis procedure for lubrication and fuel delivery system etc.
6. Explain trouble diagnosis procedure for heating system of automobile.

UNIT – I

Maintenance, Workshop Practices, Safety and Tools: Maintenance – Need, importance, primary and secondary functions, policies - classification of maintenance work - vehicle insurance - basic problem diagnosis.

vehicles, fire safety - First aid. Basic tools –Scheduled maintenance services – service intervals - Towing and recovering.

UNIT – II

Engine and Engine Subsystem Maintenance: introduction engine IC Engine General Engine service-cooling and lubricating system, fuel system, Intake and Exhaust system, electrical system - Electronic fuel injection and engine management. Service - fault diagnosis- servicing emission controls.

UNIT – III

Transmission and Driveline Maintenance: Clutch- general checks, adjustment and service- road

testing, Rear axle service points- removing axle shaft and bearings- servicing differential assemblies- fault diagnosis.

UNIT – IV

Steering, Brake, Suspension and Wheel Maintenance: *Inspection*, Maintenance and Service of Hydraulic brake, Drum brake, Disc brake, Parking brake. Bleeding of brakes. Inspection, Maintenance and Service of Macpherson strut, coil spring, leaf spring, shock absorbers. Wheel alignment and balance, removing and fitting of tyres, tyre wear and tyre rotation. Inspection, Maintenance and Service of steering linkage.

UNIT – V

Auto Electrical and Air Conditioning Maintenance: Maintenance of batteries, starting system, charging system and body electrical -Fault diagnosis using Scan tools. Maintenance of air conditioning parts like compressor, condenser, expansion valve, evaporator - Vehicle body repairlike panel beating, tinkering, soldering, polishing, painting.

Suggested Readings:

1. Ed May, "*Automotive Mechanics Volume 1*", McGraw Hill Publications, 2003.
2. Ed May, "*Automotive Mechanics Volume Two*", McGraw Hill Publications, 2003
3. *Vehicle Service Manuals of reputed manufacturers*
4. *Bosch Automotive Handbook*, Sixth Edition, 2004

Course Code	Course Title					Core / Elective	
PC 751 CS	Data Science Lab					Core	
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	3	25	50	1.5
Course Objectives <ul style="list-style-type: none"> ➤ To understand the R Programming Language. ➤ Exposure on solving of data science problems. ➤ Understand Classification and Regression Modelling. Course Outcomes <p>After completing this course, the student will be able to</p> <ul style="list-style-type: none"> ➤ Work with data science using R Programming environment. ➤ Implement various statistical concepts like linear and logistic regression. ➤ Perform Classification and Clustering over a given data set. 							

1	R AS CALCULATOR APPLICATION <ul style="list-style-type: none"> a. Using with and without R objects on console b. Using mathematical functions on console c. Write an R script, to create R objects for calculator application and save in a specified location in disk.
2	DESCRIPTIVE STATISTICS IN R <ul style="list-style-type: none"> a. Write an R script to find basic descriptive statistics using summary, str, quartile function on mtcars& cars datasets. b. Write an R script to find subset of dataset by using subset (), aggregate () functions on iris dataset.
3	READING AND WRITING DIFFERENT TYPES OF DATASETS <ul style="list-style-type: none"> a. Reading different types of data sets (.txt, .csv) from web and disk and writing in file in specific disk location. b. Reading Excel data sheet in R.
4	VISUALIZATIONS <ul style="list-style-type: none"> a. Find the data distributions using box and scatter plot. b. Find the outliers using plot. c. Plot the histogram, bar chart and pie chart on sample data.
5	CORRELATION AND COVARIANCE <ul style="list-style-type: none"> a. Find the correlation matrix. b. Plot the correlation plot on dataset and visualize giving an overview of relationships among data on iris data. c. Analysis of covariance: variance (ANOVA), if data have categorical variables on iris data.
6	REGRESSION MODEL <p>Import a data from web storage. Name the dataset and perform Logistic Regression to find out relation between variables the model. Also check the model is fit or not [require (foreign), require (MASS)]</p>
7	CLASSIFICATION MODEL <ul style="list-style-type: none"> a. Install relevant package for classification. b. Choose classifier for classification problem. c. Evaluate the performance of classifier.
8	CLUSTERING MODEL <ul style="list-style-type: none"> a. Clustering algorithms for unsupervised classification. b. Plot the cluster data using R visualizations.

Suggested Reference Books:

1. Yanchang Zhao, "R and Data Mining: Examples and Case Studies", Elsevier, 1st Edition, 2012

Web References:

1. <http://www.r-bloggers.com/how-to-perform-a-logistic-regression-in-r/>
2. <http://www.ats.ucla.edu/stat/r/dae/rreg.htm>
3. <http://www.coastal.edu/kingw/statistics/R-tutorials/logistic.html>
4. <http://www.ats.ucla.edu/stat/r/data/binary.csv>

Tools: R-Studio

Course Code	Course Title					Core / Elective	
PC 752 CS	Distributed Systems Lab					Core	
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	3	25	50	1.5
Course Objectives <ul style="list-style-type: none"> ➤ To implement client and server programs using sockets ➤ To learn about working of NFS ➤ Understanding Remote Communication and Interprocess Communication ➤ To use Map, reduce model for distributed processing ➤ To develop mobile applications Course Outcomes <p>After completing this course, the student will be able to</p> <ul style="list-style-type: none"> ➤ Write programs that communicate data between two hosts ➤ Configure NFS ➤ To implement inter process communication and remote communication ➤ Use distributed data processing frameworks and mobile application tool kits 							

List of Experiments to be performed:

1. Implementation FTP Client
2. Implementation of Name Server
3. Implementation of Chat Server
4. Understanding of working of NFS (Includes exercises on Configuration of NFS)
5. Write a program to implement hello world service using RPC or Write a program to implement date service using RPC.
6. Implement a word count application which counts the number of occurrences of each word a large collection of documents Using Map Reduce model.
7. Develop an application using 3 -tier architectures.

Course Code	Course Title					Core / Elective	
PW 761 CS	Project Work – I					Core	
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	4	50	-	2
Course Objectives <ul style="list-style-type: none"> ➤ To enhance practical and professional skills. ➤ To familiarize tools and techniques of systematic literature survey and documentation ➤ To expose the students to industry practices and team work. ➤ To encourage students to work with innovative and entrepreneurial ideas Course Outcomes <ol style="list-style-type: none"> 1. Demonstrate the ability to synthesize and apply the knowledge and skills acquired in the academic program to the real-world problems. 2. Evaluate different solutions based on economic and technical feasibility 3. Effectively plan a project and confidently perform all aspects of project management 4. Demonstrate effective written and oral communication skills 							

The department can initiate the project allotment procedure at the end of VI semester and finalize it in the first two weeks of VII semester.

The department will appoint a project coordinator who will coordinate the following:

- Collection of project topics/ descriptions from faculty members (Problems can also be invited from the industries)
- Grouping of students (max 3 in a group)
- Allotment of project guides

The aim of project work is to develop solutions to realistic problems applying the knowledge and skills obtained in different courses, new technologies and current industry practices. This requires students to understand current problems in their domain and methodologies to solve these problems. To get awareness on current problems and solution techniques, the first 4 weeks of VII semester will be spent on special lectures by faculty members, research scholars, post graduate students of the department and invited lectures by engineers from industries and R&D institutions. After completion of these seminars each group has to formalize the project proposal based on their own ideas or as suggested by the project guide.

Seminar schedule will be prepared by the coordinator for all the students from the 5th week to the last week of the semester which should be strictly adhered to.

Each group will be required to:

1. Submit a one-page synopsis before the seminar for display on notice board.
2. Give a 30 minutes' presentation followed by 10 minutes' discussion.
3. Submit a technical write-up on the topic.

At least two teachers will be associated with the Project Seminar to evaluate students for the award of sessional marks which will be on the basis of performance in all the 3 items stated above.

The seminar presentation should include the following components of the project:

- Problem definition and specification
- Literature survey
- Broad knowledge of available techniques to solve a particular problem.
- Planning of the work, preparation of bar (activity) charts
- Presentation- oral and written.

Course Code	Course Title					Core / Elective	
SI 762 CS	Summer Internship					Core	
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	-	25	50	2
Course Objectives <ul style="list-style-type: none"> ➤ To train and provide hands-on experience in analysis, design, and programming of information systems by means of case studies and projects. ➤ To expose the students to industry practices and team work. ➤ To provide training in soft skills and also train them in presenting seminars and technical report writing. Course Outcomes After completing this course, the student will be able to <ol style="list-style-type: none"> 1. Get Practical experience of software design and development, and coding practices within Industrial/R&D Environments. 2. Gain working practices within Industrial/R&D Environments. 3. Prepare reports and other relevant documentation. 							

Summer Internship is introduced as part of the curricula of encouraging students to work on problems of interest to industries. A batch of three students will be attached to a person from the Government or Private Organisations/Computer Industry/Software Companies/R&D Organization for a period of 4-6 weeks. This will be during the summer vacation following the completion of the III-year Course. One faculty coordinator will also be attached to the group of 3 students to monitor the progress and to interact with the industry co- ordinate (person from industry).

The course schedule will depend on the specific internship/training experience. The typical time per topic will vary depending on the internship

- Overview of company/project
- Safety training
- Discussions with project teams
- Background research, review of documents, white papers, and scientific papers
- Planning, designing, and reviewing the planned work
- Executing the plans
- Documenting progress, experiments, and other technical documentation
- Further team discussions to discuss results
- Final report writing and presentation

After the completion of the project, each student will be required to:

1. Submit a brief technical report on the project executed and
2. Present the work through a seminar talk (to be organized by the Department)

Award of sessionals are to be based on the performance of the students at the workplace and awarded by industry guide and internal guide (25 Marks) followed by presentation before the external examiner appointed by the university (50 Marks). One faculty member will co-ordinate the overall activity of Industry Attachment Program.

Note: Students have to undergo summer internship of 4-6 weeks at the end of semester VI and credits will be awarded after evaluation in VII semester.

BE(CSE) SEMESTER-VIII SCHEME:-

Sl.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/Wk	CIE	SEE	Duration in Hrs	
Theory Courses										
1	PE-VI	Professional Elective – VI	3	-	-	3	30	70	3	3
2	OE-III	Open Elective – III	3	-	-	3	30	70	3	3
Practical/ Laboratory Courses										
7	PW861 CS	Project Work – II	-	-	16	16	50	100	-	8
			06	-	16	22	110	240	06	14

Profession Elective – VI		
Sl.	Course Code	Course Title
1	PE 827 CS	Mobile Computing
2	PE 828 CS	Semantic Web & Social Networking
3	PE 829 CS	Cyber Security & Forensics

Open Elective III	
Course Code	Course Title
OE 801 CE	Road Safety Engineering
OE 801CS**	Fundamentals of AL & ML
OE801EE	Smart Building Systems
OE802EE	Programmable Logic Controllers
OE801EC	Principles of Electronic Communications
OE801 IT**	Software Engineering
OE801ME	3D Printing Technologies
OE801AE	ELEMENTS OF ELECTRIC AND HYBRID VEHICLE TECHNOLOGY

Note- : ** Subject is not offered to the students of CSE and IT Department.

PC: Professional Course

MC: Mandatory Course

HS: Humanities and Sciences

L: Lectures **T:** Tutorials

P: Practical **D:** Drawing

CIE: Continuous Internal Evaluation

SEE: Semester End Examination (Univ. Exam)

Note-2: 1) Each contact hour is a Clock Hour

2) The practical class can be of two and half hour (clock hours) duration as per the requirement of a particular laboratory.

Course Code	Course Title						Core / Elective
PE 827 CS	Mobile Computing						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	30	70	3
Course Objectives <ul style="list-style-type: none"> ➤ To introduce basics of wireless voice and data communication technologies ➤ To build working knowledge on various telephone and satellite networks ➤ To study the working principles of wireless LANs and standards ➤ To study principles of adhoc networks and routing ➤ To gain knowledge on integration of mobile networks into Internet ➤ To build skills in working with wireless application protocols to develop mobile applications. Course Outcomes After completing this course, the student will be able to <ol style="list-style-type: none"> 1. Understand the applicability of the components of radio transmission and 4G devices. 2. Understand and apply various techniques involved in transmission for realistic scenarios 3. Discuss and use the architecture, standards and services of wireless 4. Illustrate the route discovery process of Adhoc Network Routing protocols. 5. Identify the File System support for mobility, and understand the constraints and security aspects of Mobile operating system. 							

UNIT-I

Introduction – Wireless transmission – Frequencies for radio transmission – Signals – Antennas – Multiplexing – Modulations – Spread spectrum, Cellular Wireless Networks,
 4G -Introduction, features and challenges, Applications of 4G, 4G Network architecture

UNIT-II

Telecommunication systems – GSM – GPRS – DECT – UMTS – IMT-2000 – Satellite Networks - Basics – Parameters and Configurations – Capacity Allocation – FAMA and DAMA – Broadcast Systems – DAB – DVB

UNIT-III

Wireless LAN – IEEE 802.11 - Architecture – services – MAC – Physical layer – IEEE 802.11a - 802.11b standards – HIPERLAN – Blue Tooth.

UNIT-IV

Mobile IP, Dynamic Host Configuration Protocol, Routing in MANETs: DSDV, DSR, AODV and ZRP. MANETS vs VANETs

UNIT-V

WAP, and WAP 2.0, Mobile Transaction models, File Systems and Mobility Management, Mobile Device Operating Systems – Special Constraints & Requirements, Mobile Payment System – Security Issues

Suggested Readings:

1. Jochen H. Schiller, “Mobile Communications”, Addison Wesley, Second Edition, 2003.
2. William Stallings, “Wireless Communications and Networks”, PHI/Pearson Education, 2002.
3. Kaveh Pahlavan, Prasanth Krishnamurthy, “Principles of Wireless Networks”, Prentice Hall, 2003.
4. Uwe Hansmann, LotharMerk, Martin S. Nicklons and Thomas Stober, “Principles of Mobile Computing”, Springer, 2003.
5. Krzysztof Wesolowski, Mobile Communication Systems, John Wiley and Sons Ltd, 2002.

Course Code	Course Title					Core / Elective	
PE 828 CS	Semantic Web & Social Networking					Elective	
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	30	70	3

Course Objectives

- To learn Knowledge Representation for the Semantic Web & Web Application
- To learn Social Network Analysis and semantic web
- To understand the role of ontology and inference engines in semantic web
- To explain the analysis of the social Web and the design of a new class of
- To describe how the Semantic Web provides the key in aggregating and to incorporating user generated metadata and other clues left behind by users.

Course Outcomes

After completing this course, the student will be able to

- Create ontology
- Build blogs and social networks
- Understand the basics of Semantic Web and Social Networks, Electronic sources for network analysis
- Modeling and aggregating social network data, Develop social-semantic applications.
- Evaluate Web- based social network and Ontology

UNIT –I: Web Intelligence Thinking and Intelligent Web Applications, The Information Age ,The World Wide Web, Limitations of Today’s Web, The Next Generation Web, Machine Intelligence, Artificial Intelligence, Ontology, Inference engines, Software Agents, Berners-Lee www, Semantic Road Map, Logic on the semantic Web.

UNIT -II: Knowledge Representation for the Semantic Web Ontologies and their role in the semantic web, Ontologies Languages for the Semantic Web – Resource Description Framework(RDF) / RDF Schema, Ontology Web Language(OWL), UML, XML/XML Schema

UNIT-III: Ontology Engineering Ontology Engineering, Constructing Ontology, Ontology Development Tools, Ontology Methods, Ontology Sharing and Merging, Ontology Libraries and Ontology Mapping, Logic, Rule and Inference Engines.

UNIT-IV: Semantic Web Applications, Services and Technology Semantic Web applications and services, Semantic Search, e-learning, Semantic Bioinformatics, Knowledge Base ,XML Based Web Services, Creating an OWL-S Ontology for Web Services, Semantic Search Technology, Web Search Agents and Semantic Methods

UNIT-V: .Social Network Analysis and semantic web What is social Networks analysis, Development of the social networks analysis, Electronic Sources for Network Analysis – Electronic Discussion networks, Blogs and Online Communities, Web Based Networks. Building Semantic Web Applications with social network features.

TEXT BOOKS:

1. Thinking on the Web - Berners Lee, Godel and Turing, Wiley inter science, 2008.
2. Social Networks and the Semantic Web, Peter Mika, Springer, 2007.

REFERENCE BOOKS:

1. Semantic Web Technologies, Trends and Research in Ontology Based Systems, J.Davies, R.Studer, P.Warren, John Wiley & Sons.,2006
2. Semantic Web and Semantic Web Services -Liyang Lu Chapman and Hall/CRC Publishers,(Taylor & Francis Group)
3. Information Sharing on the semantic Web – Heiner Stuckenschmidt; Frank Van Harmelen, Springer Publications. ,2005
4. Programming the Semantic Web, T.Segaran, C.Evans, J.Taylor, O’Reilly, SPD.2009
4. Towards the Semantic Web: Ontology Driven Knowledge Management, John Davis, Dieter Fensal, Frank Van Harmelen, J. Wiley.

Course Code	Course Title					Core / Elective	
PE 829 CS	Cyber Security & Forensics					Elective	
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	30	70	3

Course Objectives

- To learn the basic elements of Cyber Security and its role in real world
- To familiarize the various types of cyber-attacks and cyber-crimes
- Understand the broad concepts of technical, social & legal aspect of Cyber Security
- Insights to application of Cyber Security to resolve vulnerability and security problems.
- Develop professionals skilled in information/network security and forensic analysis of compromised systems.

Course Outcomes

After completing this course, the student will be able to

- Describe the basic elements of Cyber Security and its role in real world with operational and organizational security Aspects
- Understand various cyber-attacks, types of cybercrimes and cyber laws
- To protect oneself from cyber-attacks and ultimately and understanding of securing entire Internet community from such attacks
- Comprehend the purpose of Cyber Crime and its implication on mobile and wireless devices.
- Understand the basics of computer forensics.

Unit - I:

Introduction to Cyber Security

Overview of Cyber Security, Types of Vulnerability, Computer Criminals, CIA Triad, Cyber Threats:- Cyber Warfare-Cyber Crime-Cyber terrorism-Cyber Espionage.

Global Internet Governance – Challenges and Constraints, Need for a Comprehensive Cyber Security Policy, Need for a Nodal Authority, Need for an International convention on Cyberspace.

Unit - II:

Cyber Security Vulnerabilities and Cyber Security Assessments

Cyber Security Vulnerabilities-Overview, vulnerabilities in software and Hardware, Security system administration, Threats for Open Access to Organizational Data, Weak Authentication, Poor Cyber Security Awareness and Training.

Cyber Security Assessments- Overview, Access control, Audit, Authentication, Biometrics, Cryptography, Deception, Denial of Service Filters, Ethical Hacking, Firewalls, Intrusion Detection Systems, Response, Scanning, Security policy, Threat Management.

UNIT – III:

Introduction to Cyber Crime and its implication on mobile and wireless devices

Cybercrime: Introduction to cyber-crime, intellectual property in the cyberspace, dimension of cybercrimes, mindset and skills of hackers and other cyber criminals.

Introduction to Cybercrime in Mobile and Wireless Devices, Proliferation of Mobile and Wireless Devices, Credit card Frauds in Mobile and Wireless Computing, Security Challenges in Mobile Devices and wireless devices, Types of Attacks on Mobile and wireless devices, Organizational Security Policies and Measures for securing Mobile and wireless devices.

UNIT- IV:

Cyber Forensics

Introduction to Cyber Forensics, Handling Preliminary Investigations, Controlling an Investigation, Conducting disk-based analysis, Investigating Information-hiding, Scrutinizing E-mail, Validating E-mail header information, Tracing Internet access, Tracing memory in real-time.

Unit –V:

Forensic Tools and Processing of Electronic Evidence

Introduction to Forensic Tools, Usage of Slack space, tools for Disk Imaging, Data Recovery, Vulnerability Assessment Tools, Encase and FTK tools, Anti Forensics and probable counters, retrieving information, process of computer forensics and digital investigations, processing of digital evidence, digital images, damaged SIM and data recovery, multimedia evidence, retrieving deleted data: desktops, laptops and mobiles, retrieving data from slack space, renamed file, ghosting, compressed files.

SUGGESTED READING

1. W.A.Coklin, G.White, Principles of Computer Security: Fourth Edition, McGrawHill,2016
2. Anand Shinde, Introduction to Cyber Security: Guide to the World of Cyber Security, 2021.
3. John Vacca,Computer Forensics: Computer Crime Scene Investigation,2015
4. Cyber Forensics by Dejei & S. Murugan , OXFORD UNIVERSITY PRES, 2018

REFERENCE BOOKS

1. Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press, First Edition, 2016.
2. Introduction to Cyber Security, Chwan-Hwa(john) Wu,J. David Irwin, CRC Press T&F Group, 2013
3. Fundamentals Of Forensic Science, Manjugouda R Patil, Dr.C.F.Mulimani, First Edition. 2020

Course Code	Course Title					Core / Elective	
OE801CE	ROAD SAFETY ENGINEERING					Open Elective-III	
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	30	70	3
Course Objectives: <ul style="list-style-type: none"> • Introduction to various factors considered for road safety and management • Explain the road safety appurtenances and design elements • Discuss the various traffic management techniques Course Outcomes: After completing this course, the student will be able to <ol style="list-style-type: none"> 1. Understand the fundamentals of traffic safety analysis 2. Analyze Accident data 3. Remember the concepts of road safety in urban transport 4. Apply crash reduction techniques 5. Design of urban Infrastructure considering safety aspects. 							

UNIT – I

Introduction: Road Safety scenario in India and World, Road Accident Characteristics.

Traffic Safety Analysis: Fundamentals of Traffic Engineering - Basic Characteristics of Motor-Vehicle Traffic, Highway Capacity, Applications of Traffic Control Devices, Design of Parking Facilities, Traffic Engineering Studies; Statistical Methods in Traffic Safety Analysis – Regression Methods, Poisson Distribution, Chi- Squared Distribution, Statistical Comparisons.

UNIT – II

Accident Analysis: Accident Investigations and Risk Management, Collection and Analysis of Accident Data, Condition and Collision Diagram, Causes and Remedies, Traffic Management Measures and Their Influence on Accident Prevention, Assessment of Road Safety, Methods to Identify and Prioritize Hazardous Locations and Elements, Determine Possible Causes of Crashes, Crash Reduction Capabilities and Countermeasures, Effectiveness of Safety Design Features, Accident Reconstruction. Application of computer analysis of accident data.

UNIT – III

Road Safety in planning and Geometric Design: Vehicle And Human Characteristics, Road Design and Road Equipment's, Redesigning Junctions, Cross Section Improvements, Reconstruction and Rehabilitation of Roads, Road Maintenance, Traffic Control, Vehicle Design and Protective Devices, Post Accident Care.

UNIT – IV

Traffic Signals & Road signs: Traffic Signals, Factors affecting signal design, street lighting, Provisions for NMT Vehicles in India, Safety Provisions for Pedestrians & Cyclists, Road Signs and Pavement Markings.

Safety at Construction Site: Safety provisions for workers at construction site, Construction Zone markings, signs.

UNIT – V

Traffic Management safety audit: Traffic Management Systems for Safety, Road Safety Audits and Tools for Safety Management Systems, Road Safety Audit Process, Approach to Safety, Road Safety Improvement Strategies, ITS and Safety.

Suggested Readings:

1. Kadiyali L.R., *Traffic Engineering and Transport planning*, 9th Edition, Khanna Tech Publishers, 2013.
2. C.E.G. Justo, A. Veeraragavan and S. K. Khanna, *Highway Engineering*, 10th Edition, Nem Chand Publishers, 2017.
3. Donald Drew, *Traffic Flow Theory Chapter 14 in Differential Equation Models*, Springer, 1983
4. C. Jotinkhisty and B. Kent Lall, *Transportation Engineering – An Introduction*, 3rd Edition, Pearson publications, 2017
5. Rune Elvik, Alena Hoyer, Truls Vaa, Michael Sorenson, *Handbook of Road Safety measures*, second Edition, Emerald Publishing, 2009.
6. Highway Research Programme (NCHRP) Synthesis 336. *A synthesis of Highway Research Board*, Washington D.C, 2016.

Course Code	Course Title					Core / Elective	
OE801CS	FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING					Open Elective-III	
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	30	70	3
Course Objectives: <ul style="list-style-type: none"> • Cover various paradigms that come under the broad umbrella of AI. • To understand various key paradigms for machine learning approaches • To familiarize with the mathematical and statistical techniques used in machine learning. • To understand and differentiate among various machine learning techniques Course Outcomes: After completing this course, the student will be able to <ol style="list-style-type: none"> 1. Develop an understanding of modern concepts in AI and where they can be used 2. Design, implement and apply novel AI techniques based on emerging real-world requirements 3. To formulate a machine learning problem 4. Select an appropriate pattern analysis tool for analyzing data in a given feature space. 5. Apply pattern recognition and machine learning techniques such as classification and feature selection to practical applications and detect patterns in the data. 6. Design and program efficient algorithms related to recent machine learning techniques, train models, conduct experiments, and develop real-world ML-based applications and products 							

UNIT-I:

INTRODUCTION: Definitions of Artificial Intelligence, Artificial Intelligence Problems, Topics of Artificial Intelligence, Timelines of Artificial Intelligence, Production Systems, State Space Representation, Branches of Artificial Intelligence, Applications of Artificial Intelligence,

UNIT-II:

HEURISTIC SEARCH TECHNIQUES: Generate-and-Test , Hill Climbing, Search Techniques, Problem Reduction, Constraints Satisfaction, Means-ends Analysis

KNOWLEDGE REPRESENTATION: Knowledge Management, Types of Knowledge, Knowledge Representation, Approaches to Knowledge Representation, Issues in Knowledge Representation, Knowledge Base

UNIT-III:

LEARNING: Types of Learning, Machine Learning, Intelligent Agents

CLUSTERING: k-Means Clustering, Fuzzy Clustering, Hierarchical Clustering, Cluster Similarity, Case Studies,

UNIT-IV:

STATISTICAL LEARNING: Hidden Markov Models, Linear Classifiers, Quadratic Classifiers, Decision Trees, Bayesian Networks, Case Studies,

ARTIFICIAL NEURAL NETS: ANN Basics, ANN—Learning Process, Types of Networks, Perceptron, RBF Networks, ANN Summary, Case Studies

UNIT-V:

SUPERVISED LEARNING: Support Vector Machines, Inductive Logic Programming, Case-based Reasoning, Ensemble Classifiers, Nearest Neighbourhood, Fuzzy Network, Case Studies,

UNSUPERVISED LEARNING: Expectation Maximization, Self organizing maps, Adaptive resonance theory, Case studies

Suggested Readings:

1. Vinod Chandra S.S and AnandHareendran S , “Artificila Intelligence and Machine Learning ”, PHI , 2014
2. PrashantKikani, “Demystifying Artificial intelligence: Simplified AI and Machine Learning concepts for Everyone”, January 2021, BPB publication
3. Dr. Nilakshi Jain , “Artificial Intelligence, As per AICTE: Making a System Intelligent” January 2019, WILEY India
4. LavikaGoel , “Artificial Intelligence: Concepts and Applications” January 2021, WILEY India

Course Code	Course Title					Core / Elective	
OE701EE	Smart Building Systems					Open Elective-II	
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	30	70	3

Course Objectives

- To understand the basic blocks of Building Management System.
- To design various sub systems (or modular system) of building automation
- To integrate all the sub systems

Course Outcomes

At the end of the course students will be able to

1. Describe the basic blocks and systems for building automation
2. Use different subsystems for building automation and integrate them.
3. Understand basic blocks and systems for building automation
4. Design different systems for building automation and integrate those systems

UNIT-I

Introduction: Concept and application of Building Management System (BMS) and Automation, requirements and design considerations and its effect on functional efficiency of building automation system, architecture and components of BMS.

UNIT-II

Fire Alarm (FA) System: concept of fire, Fire modes, History, Components, and Principles of Operation. Different fire sensors, smoke detectors and their types, Fire control panels, design considerations for the FA system. Field Components, Panel Components, Applications. Types of FAS Architectures, Examples. Classification of FAS loops, Examples. FAS Design procedure in brief, NFPA 72A, BS 5839, IS, Concept of IP enabled fire & alarm system, design aspects and components of PA system.

UNIT-III

Access Control System: Access Components, Access control system Design.

CCTV: Camera Operation & types, Camera Selection Criteria, Camera Applications, DVR Based system, DVM, Network design, Storage design. Components of CCTV system like cameras, types of lenses, typical types of cables, controlling system. CCTV Applications.

UNIT-IV

Security Systems Fundamentals: Introduction to Security Systems, Concepts.

Perimeter Intrusion: Concept, Components, Technology, Advanced Applications. Security system design for verticals. concept of automation in access control system for safety, Physical security system with

components, RFID enabled access control with components, Computer system access control –DAC, MAC, RBAC.

EPBX System & BMS subsystem integration: Design consideration of EPBX system and its components, integration of all the above systems to design BMS.

UNIT-V

Energy Management: Energy Savings concept & methods, Lighting control, Building Efficiency improvement, Green Building (LEED) Concept & Examples.

Building Management System: IBMS (HVAC, Fire & Security) project cycle, Project steps BMS, Advantages& Applications of BMS, IBMS Architecture, Normal & Emergency operation, Advantages of BMS.

Suggested Reading:

1. Jim Sinopoli, *Smart Buildings*, Butterworth-Heinemann imprint of Elsevier, 2nd ed., 2010.
2. Reinhold A. Carlson, Robert A. Di Giandomenico, *Understanding Building Automation Systems (Direct Digital Control, Energy Management, Life Safety, Security, Access Control, Lighting, Building Management Programs)*, R.S. Means Company Publishing, 1991.
3. Albert Ting-Pat So, WaiLok Chan, Kluwer , *Intelligent Building Systems*, Academic publisher, 3rd ed., 2012.
4. Robert Gagnon, *Design of Special Hazards and Fire Alarm Systems*, Thomson Delmar Learning; 2nd edition, 2007.
5. Levenhagen, John I. Spethmann, Donald H, *HVAC Controls and Systems*, McGraw-Hill Pub.
6. Hordeski, Michael F, *HVAC Control in the New Millennium*, Fairmont press, 2001.
7. Bela G. Liptak, *Process Control-Instrument Engineers Handbook*, Chilton book co.

Course Code	Course Title						Core / Elective
OE 801 EE	PROGRAMMABLE LOGIC CONTROLLERS						
Prerequisite	Contact Hours per Week				CIE	SEE	Open Elective-III
	L	T	D	P			Credits
-	3	-	-	-	30	70	3
Course Objectives <ul style="list-style-type: none"> To be able to understand basics of Programmable logic controllers, basic programming of PLC. To make the students to understand the Functions and applications of PLC Course Outcomes At the end of the course students will be able to <ol style="list-style-type: none"> Develop PLC programs for industrial applications. Acquire the knowledge of PLC counter functions and PLC Arithmetic functions and data handling functions. 							

UNIT-I

PLC Basics: Definition and History of PLC - PLC advantages and disadvantages - Over all PLC Systems - CPUs and Programmer Monitors - PLC input and output models - Printing PLC Information- Programming Procedures - Programming Equipment - Programming Formats- Proper Construction of PLC Diagrams - Devices to which PLC input and output modules are connected - Input on/off switching devices - Input analog devices - Output analog on/off devices and output analog devices.

UNIT-II

Basic PLC Programming: Programming on/off inputs to produce on/off outputs - PLC input instructions - Outputs - Operational procedures - Contact and coil input/output programming examples - Relation of digital gate logic contact / coil logic - PLC programming and conversion examples - Creating ladder diagrams from process control descriptions - Sequence listings - Large process ladder diagram constructions.

UNIT-III

Basic PLC Functions: General Characteristics of Registers - Module addressing - Holding registers - Input registers - output registers - PLC timer functions - examples of timer functions. Industrial applications - PLC counter functions.

UNIT-IV

Intermediate Functions: PLC Arithmetic functions - PLC additions and subtractions - The PLC repetitive clock - PLC Multiplications, Division and Square Root - PLC trigonometric and log functions - Other PLC arithmetic functions - PLC number comparison functions. PLC basic comparison functions and applications - Numbering systems and number conversion functions - PLC conversion between decimal and BCD-Hexadecimals numbering systems.

UNIT-V

Data Handling Functions: The PLC skip and master control relay functions - Jump functions - Jump with non return - Jump with return. PLC data move Systems - The PLC functions and applications. PLC functions working with bits - PLC digital bit functions and applications - PLC sequence functions - PLC matrix functions.

Suggested Reading:

1. John W. Weff, Ronald A. Reis, Programmable Logic Controllers, Prentice Hall of India Private Limited, Fifth edition, 2003.
2. Frank D. Petruzella, *Programmable Logic Controllers*, 5th Edition, Mc-Graw Hill, 2019.

Course Code	Course Title					Core / Elective	
OE 801 EC	PRINCIPLES OF ELECTRONIC COMMUNICATIONS					Open Elective-III	
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	30	70	3

Course Objectives

- Provide an introduction to fundamental concepts in the understanding of communications systems.
- Provide an introduction to network model and some of the network layers including physical layer, data link layer, network layer and transport layer.
- Provide an introduction to the evolution of wireless systems and current wireless technologies.

Course Outcomes

1. Understand the working of analog and digital communication systems
2. Understand the OSI network model and the working of data transmission
3. Understand the evolution of communication technologies from traditional telephony systems to modern wireless communication systems.

UNIT – I

Introduction to communication systems: Electromagnetic Frequency Spectrum, Signal and its representation, Elements of Electronic Communications System, Types of Communication Channels.

Signal Transmission Concepts: Baseband transmission and Broadband transmission,

Communication Parameters: Transmitted power, Channel bandwidth and Noise, Need for modulation **Signal Radiation and Propagation:** Principle of electromagnetic radiation, Types of Antennas, Antenna Parameters and Mechanisms of Propagation.

UNIT – II

Analog and Digital Communications: Amplitude modulation and demodulation, FM modulation and demodulation, Digital converters, Digital modulation schemes – ASK, FSK, PSK, QPSK, Digital demodulation.

UNIT – III

Data Communication and Networking: Network Models, OSI Model, Data Link Layer – Media Access control, Ethernet, Network Layer – Internet Protocol (IPv4/IPv6), Transport Layer – TCP, UDP.

UNIT – IV

Telecommunication Systems: Telephones, Telephone system, Paging systems, Internet Telephony.

Optical Communications: Optical Principles, Optical Communication Systems, Fiber –Optic Cables, Optical Transmitters & Receivers, Wavelength Division Multiplexing.

UNIT – V

Wireless Communications: Evolution of Wireless Systems: AMPS, GSM, CDMA, WCDMA, OFDM. Current Wireless Technologies: Wireless LAN, Bluetooth, PAN and ZigBee, Infrared wireless, RFID communication, UWB, Wireless mesh networks, Vehicular adhoc networks.

Suggested Readings:

1. *Principles of Electronic Communication Systems*, Louis E. Frenzel, 3e, McGraw Hill, 2008.
2. *Data Communications and Networking*, Behrouz A. Forouzan, 5e TMH, 2012.
3. Kennady, Davis, *Electronic Communications systems*, 4e, McGraw Hill, 1999.

Course Code	Course Title					Core / Elective	
OE 801 IT	SOFTWARE ENGINEERING					Open Elective-III	
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	30	70	3
<p>Course Objectives:</p> <ul style="list-style-type: none"> To introduce the basic concepts of software development processes from defining a product to shipping and maintaining. To impart knowledge on various phases, methodologies and practices of software development. To understand the importance of testing in software development, study various testing strategies along with its relationship with software quality and metrics. <p>Course Outcomes:</p> <p>After completing this course, the student will be able to</p> <ol style="list-style-type: none"> Acquired working knowledge of alternative approaches and techniques for each phase of software development Judge an appropriate process model(s) assessing software project attributes and analyze necessary requirements for project development eventually composing SRS. Creation of visual models to describe (non-) algorithmic solutions for projects using various design principles. Acquire skills necessary as an independent or as part of a team for architecting a complete software project by identifying solutions for recurring problems exerting knowledge on patterns. 							

UNIT – I

Introduction to Software Engineering:

A generic view of Process: Software Engineering, Process Framework, CMM Process Patterns, Process Assessment.

Process Models: Prescriptive Models, Waterfall Model, Incremental Process Models, Evolutionary Process Models, Specialized Process Models, The Unified Models, Personal and Team Process Models, Process Technology, Product and Process.

An Agile view of Process: Introduction to Agility and Agile Process, Agile Process Models

UNIT – II

Software Engineering Principles: SE Principles, Communication Principles, Planning Principles, Modeling Principles, Construction Principles, Deployment.

System Engineering: Computer-based Systems, The System Engineering Hierarchy, Business Process Engineering, Product Engineering, System Modeling.

Requirements Engineering: A Bridge to Design and Construction, Requirements Engineering Tasks, Initiating Requirements Engineering Process, Eliciting Requirements, Developing Use-

Cases, Building the Analysis Model, Negotiating Requirements, Validating Requirements.

UNIT – III

Building the Analysis Model: Requirements Analysis Modeling Approaches, Data Modeling Concepts, Object-Oriented Analysis, Scenario-based Modeling, Flow-oriented Modeling, Class-based Modeling, Creating a Behavioral Model.

Design Engineering: Design within the context of SE, Design Process and Design Quality, Design Concepts, The Design Model, Pattern-based Software Design.

UNIT – IV

Creating an Architectural Design: Software Architecture, Data Design, Architectural Styles and Patterns, Architectural Design. **Modeling Component-Level Design:** Definition of Component, Designing Class-based Components, Conducting Component-level Design, Object Constraint Language, Designing Conventional Components. **Performing User Interface Design:** The Golden Rules, User Interface Analysis and Design, Interface Analysis, Interface Design Steps, Design Evaluation.

UNIT – V

Testing: Strategies: A Strategic Approach to Conventional Software Testing, Test Strategies for O-O Software.

Tactics: Software Testing Fundamentals, Black-box and White-box Testing, Basis Path Testing, Control Structure Testing, O-O Testing Methods.

Debugging: Debugging Techniques, The Art of Debugging.

Product Metrics: A Framework for Product Metrics, Metrics for each phase of software development.

Software Quality: Definition, **Quality Assurance:** Basic Elements, Formal Approaches, Statistical Software Quality Assurance, Software Reliability, ISO9000 Quality Standards, SQA Plan.

Suggested Readings:

1. Roger S. Pressman, *Software Engineering: A Practitioner's Approach*, 7th Edition, McGraw Hill, 2009
2. Ali Behforooz and Frederick J. Hudson, *Software Engineering Fundamentals*, Oxford University Press, 1996
3. Pankaj Jalote, *An Integrated Approach to Software Engineering*, 3rd Edition, Narosa Publishing House, 2008

Course Code	Course Title					Core / Elective	
OE 801 ME	3D PRINTING TECHNOLOGIES					Open Elective-III	
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	30	70	3

Course Objectives:

- To understand the fundamental concepts of 3D Printing, its advantages and limitations.
- To know the working principle, advantages, disadvantages and applications of liquid, solid and Powder based 3D Printing Technologies.
- To know diversified applications of 3D Printing Technologies.

Course Outcomes:

After completing this course, the student will be able to

1. Interpret the features of 3D Printing and compare it with conventional methods.
2. Illustrate the working principle of liquid, solid and powder-based 3D Printing Technologies.
3. Apply the knowledge of various 3D Printing technologies for developing Innovative applications.

Unit-I

Introduction: Prototyping fundamentals, Historical development, Fundamentals of 3D Printing, Advantages and Limitations of 3D Printing, commonly used Terms, 3D Printing Process Chain, 3D Modeling, Data conversion and Transmission, Checking and Preparing, Building, Post-processing, RP Data formats, Classification of 3D printing processes, Fundamental Automated Processes, Distinction between 3D Printing and Conventional Machining Processes.

Unit-II

Liquid-based Systems: Stereo Lithography Apparatus (SLA): Models and specifications, Process, working principle, photopolymers, photo polymerization, Layering technology, laser and laser scanning, Applications, Advantages and Disadvantages, Case studies. Polyjet: Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Solid ground curing (SGC): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies.

Unit-III

Solid-based System: Laminated Object Manufacturing (LOM): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Fused Deposition Modeling (FDM): Models and specifications, Process, working principle, Applications, Advantages

and Disadvantages, Case studies. Multi-Jet Modelling (MJM): Models and specifications, Process, Working principle, Applications, Advantages and Disadvantages, Case studies.

Unit-IV

Powder Based Systems: Selective laser sintering (SLS): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Three- dimensional Printing (3DP): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Laser Engineered Net Shaping (LENS): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies.

Unit-V

Applications of 3D Printing : Application in Design, Application in Engineering, Analysis and Planning, Aerospace Industry, Automotive Industry, Electronic Industry, Jewelry Industry, Coin Industry, GIS application, Arts and Architecture, Pattern for investment and vacuum casting, Medical Models and Bioengineering Applications: Planning and simulation of complex surgery, Customized Implants & Prosthesis, Design and Production of Medical Devices, Forensic Science and Anthropology, and Web Based Rapid Prototyping Systems.

Suggested Reading:

1. Chee Kai Chua and Kah Fai Leong, "3D Printing and Additive Manufacturing Principles and Applications" Fifth Edition, World scientific
2. Ian Gibson, David W Rosen, Brent Stucker, "Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing" Springer, Second Edition, 2010.
3. Frank W. Liou, "Rapid Prototyping & Engineering Applications"- CRC Press, Taylor & Francis Group, 2011.
4. Rafiq Noorani, "Rapid Prototyping: Principles and Applications in Manufacturing", John Wiley & Sons, 2006.

Course Code	Course Title				Core / Elective		
OE 801 AE	ELEMENTS OF ELECTRIC AND HYBRID VEHICLE TECHNOLOGY				Open Elective-III		
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	30	70	3

Course Objectives:

- To understand the hybrid vehicle technology
- To know the energy storage requirements and analyze the hybridization of different storage devices.
- To understand the configuration of various electric propulsion units.
- To know the different hybrid drives and the concept of electric drive trains.

Course Outcomes:

After completing this course, the student will be able to

1. Explain the basics of electric and hybrid electric vehicles, their architecture, technologies and fundamentals.
2. Discuss different energy storage technologies used for hybrid electric vehicles and their control.
3. Analyze various electric drives suitable for hybrid electric vehicles.
4. Explain plug – in hybrid electric vehicle architecture, design and component sizing and the power electronics devices used in hybrid electric vehicles.
5. Demonstrate different configurations of electric vehicles and its components, hybrid vehicle configuration by different techniques, sizing of components and design optimization and energy management.

Unit - I

Introduction: Introduction to Hybrid Electric Vehicles: History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies Electric vehicles; configuration of EVs, performance, traction motor characteristics, tractive effort and transmission requirements.

Unit- II

Energy Storage: Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Hybridization of different energy storage devices.

Unit - III

Electric Propulsion unit: Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives

Unit - IV

Hybrid Drives: Introduction, features, functional classification, start/stop system, mild hybrid, full hybrid, plug-in-hybrid, batteries for hybrid vehicles, and optimization of hybrid configurations. Changing modes for conductive charging.

Unit - V

Hybrid Electric Vehicles (HEVs) And Drive Structures: Concept of electric drive train, architecture of hybrid electric drive train, series hybrid drive, parallel hybrid electrical drive train.

Electric and Hybrid Vehicles - Case Studies: Honda Insight, Chevrolet Volt, GM EV1, Toyota RAV 4 EV and Ford; Think City

Suggested Reading

1. Iqbal Husain, "Electric and Hybrid vehicles Design Fundamentals" , CRC Press, second edition 2013
2. James Larminie, John Lowry, "Electric vehicle technology Explained" 2nd Ed., Wiley 2012
3. Vehicular Electrical Power Systems – Emadi, Ehasni, Mercel (Marcel Dekker)
4. Electric and Hybrid vehicles – Pistoia (Elsevier)
5. Fuel cells principles and applications - B.Vishwanath, M. AuliceScibion (University Press)
6. Electrical vehicle machine and drives – K.T.Chau (Wiley).

Course Code	Course Title					Core / Elective	
PW 861 CS	Project Work - II					Core	
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	16	50	100	8
Course Objectives <ul style="list-style-type: none"> ➤ To enhance practical and professional skills. ➤ To familiarize tools and techniques of systematic literature survey and documentation ➤ To expose the students to industry practices and team work. ➤ To encourage students to work with innovative and entrepreneurial ideas Course Outcomes <ol style="list-style-type: none"> 1. Demonstrate the ability to synthesize and apply the knowledge and skills acquired in the academic program to the real-world problems. 2. Evaluate different solutions based on economic and technical feasibility 3. Effectively plan a project and confidently perform all aspects of project management 4. Demonstrate effective written and oral communication skills 							

The aim of Project work –II is to implement and evaluate the proposal made as part of Project Work - I. Students can also be encouraged to do full time internship as part of project work-II based on the common guidelines for all the departments. The students placed in internships need to write the new proposal in consultation with industry coordinator and project guide within two weeks from the commencement of instruction.

The department will appoint a project coordinator who will coordinate the following:

1. Re-grouping of students - deletion of internship candidates from groups made as part of project Work-I
2. Re-Allotment of internship students to project guides
3. Project monitoring at regular intervals

All re-grouping/re-allotment has to be completed by the 1st week of VIII semester so that students get sufficient time for completion of the project.

All projects (internship and departmental) will be monitored at least twice in a semester through student presentation for the award of sessional marks. Sessional marks are awarded by a monitoring committee comprising of faculty members as well as by the supervisor. The first review of projects for 25 marks can be conducted after completion of five weeks. The second review for another 25 marks can be conducted after 12 weeks of instruction.

Common norms will be established for the final documentation of the project report by the respective departments. The students are required to submit draft copies of their project report within one week after completion of instruction.

Note: Three periods of contact load will be assigned to each project guide.