FACULTY OF ENGINEERING

Scheme of Instruction & Examination

And

Syllabi

B.E. VII and VIII Semester

Of

Four Year Degree Programme

In

Information Technology

(With effect from the academic year 2021-2022)

As approved in the faculty meeting held on _____2021

Issued by

Dean, Faculty of Engineering
Osmania University, Hyderabad
_____2021

IT Program Electives thread for V, VI , VII and VIII SEM

Thread	**5th SEM**	**6th SEM**		**7th SEM**		**8th SEM**
	Elective I	Elective II	III	IV	V	VI
AI&ML	Artificial Intelligence	Data Mining	Machine Learning	Natural Language Processing	Deep Learning	Computational Intelligence
Information &Network Security	Wireless and mobile communication	Information Security	Network Security	Cyber Security	Digital Forensics	Block Chain Technology
Software Engineering	Object oriented Analysis and Design	Compiler Construction	Software Testing	Software Reuse Techniques	Software Quality and Assurance	Agile Software Development
Multimedia and Internet of Things	Computer Graphics	Image Processing	Multimedia Technologies	Augmented and Virtual Reality	Internet of Things	Robotics
Computer Architecture and Cloud Computing	Advanced Computer Architecture	Distributed Systems	Cloud Computing	Advanced Cloud Computing	Scalable architectures for Large Applications	Architecting Applications for Cloud

SCHEME OF INSTRUCTION & EXAMINATION
B.E. - VII SEMESTER
(INFORMATION TECHNOLOGY)

S. No.	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 IT**	VLSI Design	3	1	-	4	30	70	3	3
2	**PC 702 IT**	Big Data Analytics	3	1	-	4	30	70	3	3
3	**PE-V**	Professional Elective-V	3	-	-	3	30	70	3	3
4	**OE-II**	Open Elective II	3	-	-	3	30	70	3	3
Practical/ Laboratory Courses										
5	**PC 751 IT**	VLSI Design Lab	-	-	2	2	25	50	3	1
6	**PC 752 IT**	Big Data Analytics Lab	-	-	2	2	25	50	3	1
7	**PW 761 IT**	Project Work – I	-	-	4	4	50	-	-	2
8	**SI 762 IT**	Summer Internship	`	-	-	-	25	50	-	2
			12	**02**	**8**	**22**	**245**	**430**	**18**	**18**

Profession Elective – V	
Course Code	**Course Title**
PE 711 IT	Wireless and Mobile Communication
PE 712 IT	Semantic Web
PE 713 IT	Cloud Computing
PE 714 IT	Human Computer Interaction

Open Elective II	
Course Code	**Course Title**
OE 776 IT**	Cyber Security
OE 772 CS**	Data Science and Data analytics
OE 771 CE	Green Building Technologies
OE 773 EC	Fundamentals of IoT
OE 774 EE	Non-Conventional Energy Sources
OE 775 ME	Entrepreneurship

Note-1: ** Subject is not offered to the students of CSE and IT Department.
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:

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 IT	**VLSI DESIGN**						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	1	-	-	**30**	**70**	**3**

Course Objective:

- To provide a perspective on Digital Design in the Deep Sub-micron Technology.
- To focus on CMOS and Bi CMOS Short-channel Transistor Models.
- To Study CMOS Inverter elaborately.
- To explore static and dynamic implementations of combinational and sequential circuit designs and introduce Testability of VLSI circuits.

Course Outcomes:

Students will able to

- Explain VLSI Design hierarchy and analyse logic gates using CMOS & transmission gate structures.
- Identify the layers in the physical structure of ICs and draw the layouts of CMOS logic gates
- Summarize the fabrication process of CMOS ICs and analyse the DC, switching characteristics of CMOS inverter.
- Analyse dynamic CMOS & pseudo nMOS structures of logic gates, SRAM & DRAM cells
- Develop Verilog code for logic gates, examine the effects of interconnect elements in logic cascades and Explain the floor-planning , routing techniques of VLSI circuits

UNIT-I

Moore's law ,VLSI Design Hierarchy, MOSFET as switches, pass characteristics, Basic logic gates and complex logic gates using CMOS, Bubble pushing, XOR and XNOR gates, AOI and OAI logic gates, Transmission gates-TG based 2-to-1 MUX, XOR, XNOR circuits.

Electrical Characteristics of MOSFETs, Threshold voltage, nFET Current-Voltage equations, trans-conductance and drain characteristics of nFET, RC model of a FET, MOS capacitances, gate-source and gate- drain capacitances, Junction capacitances in a MOSFET, scaling concept of MOSFETs

UNIT-II

Integrated Circuit definition and layers, Top and side view of IC layers, CMOS Layers- MOSFET layers in an n-well process. Silicon patterning for series and parallel connected FETs. Layouts of NOT gate, transmission gate, non-inverting buffer, NAND2, NOR2, Complex logic gate, 4 input AOI gate. Stick diagram representation of NOT, NAND2 and NOR2 .

Fabrication of CMOS ICs, CMOS process flow, Design rules: minimum space width, minimum spacing, surround, extension.

UNIT-III

Layouts of Basic Structure: nwells, active area definition, design of n^+, p^+ regions, masks for the nFET, pFET,active contact cross section and mask set, metal1 line with active contact, poly contact: cross section and layout,. Latchup and its prevention, Cell based Design

DC characteristics of the CMOS inverter , Expression for midpoint voltage of CMOS inverter, Symmetrical inverter, Inverter switching characteristics- RC switch model equivalent for the CMOS inverter, rise time and fall time expressions,fan-out, input capacitance and loading due to fan-out, propagation delay of CMOS inverter.

UNIT-IV

Pseudo nMOS logic gates, tri-state inverter circuit, Clocked CMOS circuit, charge leakage in C^2MOS circuit, Dynamic CMOS logic circuits : pre-charge and evaluation modes of operation, Domino logic, Dual rail logic networks- Differential Cascade Voltage Switch Logic (DCVSL) AND/NAND, OR/NOR gates, Complementary Pass Transistor Logic (CPL) structures.

SRAM – General SRAM cell, 4T &6T SRAM cell design parameters, Writing to SRAM, resistor model, SRAM arrays. Dynamic RAMs: 1T DRAM cell, charge leakage and refresh in a DRAM cell

UNIT-V

VLSI Design flow, structural gate level modeling, gate primitives, gate delays, switch level modeling, behavioral and RTL operators, timing controls, blocking and non blocking assignments, conditional statements, Data flow modeling and RTL, Comparator and priority encoder , D latch and Master-Slave D flip-flop- verilog code. Arithmetic circuits: half adder, full adder, ripple carry adder, carry look ahead adder- verilog code.

Interconnect modeling; Interconnect resistance and capacitance ,sheet resistance R_s, time delay, single and multiple rung ladder circuits, simple RC inter connect model, modeling inter connect lines with a series pass FET, Crosstalk, Floor planning and routing.

Suggested Reading

1. John P. Uyemura, "Introduction to VLSI circuits and Systems", John Wiley & Sons, 2002
2. John P. Uyemura, "Chip design for submicron VLSI: CMOS layout and simulation" IE, Cengage learning, 2006.
3. Douglas A. Pucknell, Kamran Eshraghian, "Basic VLSI Design" 3rd Edition, PHI, 2000.
4. Jan M. Rabey and others "Digital Integrated Circuits A design perspective", Pearson Education 2016

Course Code	Course Title						Core / Elective
PC 702 IT	**Big Data Analytics**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**1**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- Understand big data for business intelligence.
- Identify business case studies for big data analytics.
- Defend big data Without SQL.
- Discuss the process of data analytics using Hadoop and related tools.

Course Outcomes

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

1. Demonstrate big data and use cases from selected business domains.
2. Apply the knowledge of NoSQL big data management and experiment with Install, configure, and run Hadoop and HDFS.
3. Analyse map-reduce analytics using Hadoop.
4. Adapt Hadoop related tools such as HBase, Cassandra, Pig, and Hive for big data Analytics.

UNIT-I

Understanding Big Data: Characteristics of Data, Introduction to Big Data and its importance, Challenges posed by Big Data, Big data analytics and its classification, Big data applications: big data and healthcare – big data in banking – advertising and big data, big data technologies.

UNIT-II

Hadoop Distributed File System: Hadoop Ecosystem, Hadoop Architecture, HDFS Concepts, Blocks, Namenodes and Datanodes, Hadoop FileSystems, The Java Interface, Reading Data from a Hadoop URL, Writing Data, Querying the FileSystem, Deleting Data, Anatomy of File Read and Write

UNIT-III

NOSQL Data Management: Introduction to NOSQL – aggregate data models, aggregates key value and document data models, relationships – graph databases, schema less databases, Sharding - map reduce – partitioning and combining – composing map-reduce calculations.

UNIT-IV

Map Reduce and Yarn: Hadoop Map Reduce paradigm, Map and Reduce tasks, Job and Task trackers, Mapper, Reducer, Map Reduce workflows, classic Map-reduce – YARN – failures in classic Map-reduce and YARN – job scheduling – shuffle and sort – task execution – Map Reduce types – input formats – output formats

UNIT-V

Pig: Installing and Running Pig, an Example, Comparison with Databases, Pig Latin, User-Defined Functions, Data Processing Operators. Hive: The Hive Shell, An Example, Running Hive, Comparison with Traditional Databases, HiveQL, Tables, Querying Data, User- Defined Functions, writing a User Defined Functions.

Suggested Reading:

1.Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilly, 2012, ISBN -13: 978-1449311520, ISBN-10: 1449311520

2. Pramod Sadalage, Martin Fowler, "NoSQL Distilled - A brief guide to the emerging world of polyglot", Addison Wesley 2013

3. Eric Sammer, "Hadoop Operations", O'Reilly, 2012, ISBN -13 978-1449327057, ISBN-10: 1449327052

4. VigneshPrajapati, Big data analytics with R and Hadoop, 2013, ISBN -13: 978- 1782163282

5.. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilly, 2012, ISBN -13: 978-1449319335

Course Code	Course Title						Core/Elective
PE 711 IT	**WIRELESS AND MOBILE COMMUNICATION**						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	**30**	**70**	**3**

Course Objectives

Students shall be able to

- To introduce the transition from 2D to 3D structural problems (linear and non-linear).
- Analyse all kinds of loads and their respective effects.
- To introduce a high-end computer oriented numerical analysis tool.

Course Outcomes

Student will be able to:

- Understand the fundamental concepts of wireless and cellular Networks.
- Understand Spread spectrum modulation techniques and compare various Medium Access Control mechanisms
- Describe WLAN and GSM
- Analyze different variations of TCP for mobile communication systems.
- Discuss protocols for MANETs and WAP

Unit-I

Introduction to Wireless Communication Systems: Evolution of Mobile Radio Communications, Examples of Wireless Communication Systems. Modern Wireless Communication Systems : Second Generation (2G) Cellular Networks, Third Generation (3G) Wireless Networks, Wireless local Loop, Wireless **Local Area Networks.The Cellular Concept**: Introduction, Frequency Reuse, Channel Assignment Strategies, Handoff Strategies, Interference and Systems Capacity, Trunking and Grade of Service, Improving Coverage & Capacity in Cellular Systems.

Unit-II

Spread spectrum modulation techniques: Pseudo-noise sequence, direct sequence spread spectrum (DS-SS), frequency hopped spread spectrum(FHSS), performance of DS-SS, performance of FH-SS

Medium Access Control: Motivation for a specialized MAC: Hidden and Exposed terminals. Near and Far terminals; SDMA, FDMA, TDMA, and CDMA

Unit-III

Wireless LAN: IEEE 802-11 Protocol, System Architecture, Protocol Architecture, Physical Layer & MAC Layer, Newer developments, Hiper LAN

GSM: Mobile services, System architecture, Localization, Call Handling, Handover, Security, New data services.

Unit-IV

Mobile Network Layer: Mobile IP: Goals, assumptions and requirements, Entities and Terminology, IP packet delivery, Agent advertisement and discovery, Registration, Tunneling and Encapsulation, Optimizations, Reverse tunneling, Ipv6; Dynamic host configuration protocol.

Mobile Transport Layer: Traditional TCP: Congestion control, Slow start, Fast retransmit/fast recovery, Implications on mobility; Indirect TCP, Snooping TCP, Mobile TCP, Fast retransmit/fast recovery, Transmission/timeout freezing, Selective retransmission, Transaction oriented TCP

Unit-V

Mobile Ad hoc Networks (MANETs): Introduction, Applications & Challenges of a MANET, Routing, Classification of Routing Algorithms, Algorithms such as DSR, AODV, DSDV, etc. , Mobile Agents, Service Discovery.

PROTOCOLS AND TOOLS: Wireless Application Protocol-WAP. (Introduction, protocol architecture, and treatment of protocols of all layers), Bluetooth (User scenarios, physical layer, MAC layer, networking, security, link management) and J2ME.

Suggested Reading:

1) Theodore S. Rappaport, "Wireless Communications Principles and Practice", 2nd Edition, Pearson Education, 2003.

2) Jochen Schiller, "Mobile Communication", 2nd Edition, Pearson Education 2003

Course Code	Course Title						Core/Elective
PE 712 IT	**SEMANTIC WEB**						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	**30**	**70**	**3**

Course Objectives:

- To introduce the concept of Semantic Web.
- To provides a comprehensive understanding of the layered architecture of Semantic Web.
- To learn about the various Semantic Web technologies i.e. RDF,RDFS and OWL2.
- To understand the role of ontology in Semantic Web.
- To represent logic in Semantic Web and perform inference.
- To understand the concepts in ontology construction.
- To analyze the applications based on Semantic Web Technology.

Course Outcomes:

Students will be able to:

- To understand the vision of Semantic Web.
- To evaluate the role played by each layer in bringing up the Semantic Web.
- To analyze the ontology construction steps in detail with a possibility to reuse existing ontologies.
- To design queries in Semantic Web using SPARQL.
- To perform reasoning on ontologies using user defined rules.
- To gain an understanding of the use of Semantic Web technologies in various applications.

UNIT-I

The Semantic Web Vision: Introduction, Semantic Web Technologies, A Layered Approach.

UNIT –II

Describing Web Resources RDF: Introduction , RDF: Data Model, RDF Syntaxes, RDFS: Adding Semantics, RDF Schema: The Language, RDF and RDF Schema in RDF Schema, An Axiomatic Semantics for RDF and RDF Schema , A Direct Inference System for RDF and RDFS.

UNIT-III

Web Ontology Language OWL2: Introduction, Requirements for Ontology Languages, Compatibility of OWL2 with RDF/RDFS, The OWL Language, OWL2 Profiles.

Querying the Semantic Web: SPARQL Infrastructure, Basics: Matching Patterns, Filters, Constructs for Dealing with an Open World, Organizing Result Sets, Other Forms of SPARQL Queries, Querying Schemas,Adding Information with SPARQL Update.

UNIT-IV

Logic and Inference Rule: Introduction, Example of Monotonic Rules: Family Relationships, Monotonic Rules: Syntax, Monotonic Rules: Semantics, OWL2 RL: Description Logic Meets Rules, Rule Interchange Format: RIF, Semantic Web Rules Language (SWRL), Rules in SPARQL: SPIN, Nonmonotonic Rules: Motivation and Syntax, Example of Nonmonotonic Rules: Brokered Trade, Rule Markup Language (RuleML).

UNIT-V

Ontology Engineering: Introduction, Constructing Ontologies Manually, Reusing Existing Ontologies, Semiautomatic Ontology Acquisition, Ontology Mapping, Exposing Relational Databases, Semantic Web Application Architecture.

Applications: GoodRelations, BBC Artists, BBC World Cup 2010 Website, Government Data, New York Times, Sig.ma and Sindice, OpenCalais, Schema.org.

Suggested Reading:

1. Groth, Paul, Frank van Harmelen, Rinke Hoekstra, and Grigoris Antoniou. A Semantic Web Primer, MIT Press, Third edition 2012.
2. Pascal Hitzler, Markus Krotzsch, Sebastian Rudolph, Foundations of Semantic Web Technologies, CRC Press, 2009.
3. Dean Allemang, James Hendler, Semantic Web for the Working Ontologist: Effective Modeling in RDFS and OWL, Morgan Kauffmann, ISBN-10: 0-12-373556-4 2008.
4. Thinking on the Web - Berners Lee, Godel and Turing, Wiley inter science, 2008.

Course Code	Course Title						Core/Elective
PE 713 IT	**CLOUD COMPUTING**						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	**30**	**70**	**3**

Course Objectives:

- To introduce basic concepts cloud computing and enabling technologies
- To learn about Auto-Scaling, capacity planning and load balancing in cloud
- To introduce security, privacy and compliance issues in clouds
- To introduce cloud management standards and programming models

.**Course Outcomes:**

Student will be able to :

- Understand the architecture and concept of different cloud models: IaaS, PaaS, SaaS
- Create virtual machine images and deploy them on cloud
- Identify security and compliance issues in clouds.

UNIT- I

Introduction, Benefits and challenges, Cloud computing services, Resource Virtualization, Resource pooling sharing and provisioning

UNIT -II

Scaling in the Cloud, Capacity Planning , Load Balancing, File System and Storage

UNIT-III

Multi-tenant Software, Data in Cloud , Database Technology, Content Delivery Network, Security Reference Model , Security Issues, Privacy and Compliance Issues

UNIT-IV

Portability and Interoperability Issues, Cloud Management and a Programming Model Case Study, Popular Cloud Services

UNIT- V

Enterprise architecture and SOA, Enterprise Software , Enterprise Custom Applications, Workflow and Business Processes, Enterprise Analytics and Search, Enterprise Cloud Computing Ecosystem.

Suggested Readings:

1. Cloud Computing - Sandeep Bhowmik, Cambridge University Press, 2017.

2. Enterprise Cloud Computing - Technology, Architecture, Applications by Gautam Shroff, Cambridge University Press, 2016.

3. Kai Hwang, Geoffrey C.Fox, Jack J.Dongarra, ―*Distributed and Cloud Computing From ParallelProcessing to the Internet of Things*‖,Elsevier, 2012.

Course Code	Course Title						Core/Elective
PE 714 IT	**HUMAN COMPUTER INTERACTION**						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	**30**	**70**	**3**

Course Objectives:

- To introduce interaction frameworks and styles
- To learn about interaction design process, design standards and principles
- To introduce the concept of usability and usability testing
- To familiarize interface components and technical issues of concern

.**Course Outcomes:**

Student will be able to :

- Ability to specify, design and implement a prototype that involves significant human computer interaction.
- Describe typical human–computer interaction (HCI) models and styles, as well asvarious historic HCI paradigms.
- Understand that the interfaces' design emerges iteratively, through repeated design–evaluation–redesign cycles involving users.
- Outline how to characterize the user experience in terms of usability, user experience goals, and design principles.
- Analyze and identify user models, user support, socio-organizational issues, andstakeholder requirements of HCI systems.

UNIT- I

Interaction Paradigms: Computing Environments, Analyzing Interaction Paradigms, Interaction Paradigms
Interaction Frameworks and Styles: Frameworks for Understanding Interaction, Coping with Complexity, Interaction Styles.

UNIT- II

Interaction Design **Process:** Iterative Design, User-Centered Design, Interaction Design Models, Overview of Interaction Design Models
Discovery: Discovery Phase Framework, Collection, Interpretation, Documentation
Design: Conceptual Design, Physical Design, Evaluation, Interface Design Standards, Designing the Facets of the Interface

UNIT- III

Design Principles: Principles of Interaction Design, Comprehensibility, Learn ability, Effectiveness/Usefulness, Efficiency/Usability, Grouping, Stimulus Intensity, Proportion, Screen Complexity, Resolution/Closure, and Usability Goals
Interaction Design Models: Model Human Processor , Keyboard Level Model, GOMS, Modeling Structure, Modeling Dynamics, Physical Models
Usability Testing: Usability, Usability Test, Design the Test, Prepare for the Test, Perform the Test, Process the Data

UNIT- IV

Interface Components: The WIMP Interface, Other Components
Icons: Human Issues Concerning Icons, Using Icons in Interaction Design, Technical Issues Concerning Icons
Color: The Human Perceptual System, Using Color in Interaction Design, Color Concerns for Interaction Design, Technical Issues Concerning Color

UNIT- V

Text: Human Issues Concerning Text, Using Text in Interaction Design, Technical Issues Concerning Text **Speech and Hearing :** The Human Perceptual System, Using Sound in Interaction Design, Technical Issues Concerning Sound
Touch and Movement: The Human Perceptual System, Using Hap-tics in Interaction Design, Technical Issues Concerning Hap-tics

Suggested reading:

1) Steven Heim, *The Resonant Interface: HCI Foundations for Interaction Design*, Addison-Wesley, 2007
2) J. Preece, Y. Rogers, and H. Sharp, *Interaction Design: Beyond Human-Computer Interaction*, Wiley & Sons, 2nd Ed., 2007
3) Ben Shneiderman, Catherine Plaisant, Designing the User Interface: Strategies for Effective Human-Computer Interaction, 5th edition,, Addison-Wesley, 2009

Course Code	Course Title						Core/Elective
OE 776 IT	**CYBER SECURITY**						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

- 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

Course Outcomes:

Student will be able to

- Acquire adequate knowledge about threat and attacks
- Enhance their skills to implement security in design of Operating Systems
- Use various techniques of Security Countermeasures
- Acquire understanding in Privacy Principles and Policies in Cyberspace
- 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.Kostopoulous, Cyber Space and Cyber Security, CRC Press, 2013.

Course Code	Course Title						Core/Elective
PC 751 IT	**VLSI DESIGN LAB**						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	2	**25**	**50**	**1**

Course Objectives

- To introduce the students to understand basics in Hardware design using CAD tools
- Understand and Experience Verilog Design Flow
- Learn Transistor-Level CMOS Logic Design using both Verilog and VHDL
- Understand VLSI Fabrication and experience CMOS Physical Design using backend tools

Course Outcomes

After completing this course, the student will be able to

- Demonstrate Xilinx ISE suite to write Verilog code for logic gates, combinational circuits and sequential circuits.
- Write Verilog code for basic logic gates, complex logic gates, combinational circuits, and sequential circuits using switch level, gate level, data flow and behavioural modelling.
- Develop test bench code using Verilog and verify the simulation results.
- Demonstrate the FPGA implementation of digital circuits and generate the synthesis report.
- Draw the layouts of basic logic gates using Microwind

List of Experiments to be performed

1. Switch level modelling using Verilog a) Logic gates b) AOl and OAI gates c) Transmission gate d) Complex logic gates using CMOS
2. Gate-level Modelling—Digital circuits using gate primitives—using Verilog.

a) Half adder and full adders b) AOl gate with and without delay c) OAl gate with and without delay d) 2:1 MUX using tri-state buffers e) S-R latch

3. RTL Modelling of general VLSI system components.

a) 4:1 MUX b) 2 to 4 Decoder c) 8:3 Priority encoder d) Flip-flops

4. Mixed gate-level and Switch-level modelling using Verilog a) Constructing a 4-input AND gate using CMOS 2-input NAND and NOR gates. b) Constructing a 2 to 4 decoder using CMOS 2-input AND gates and NOT gates etc.
5. Synthesis of Digital Circuits a) Ripple carry adder and carry look-ahead adder
6. Verilog code for finite state machine
7. Simple layouts of Inverter, NAND2 and NOR2 gates
8. Stick diagram representations of Inverter, NAND2 and NOR2 gates

Course Code	Course Title						Core / Elective
PC 752 IT	**Big Data Analytics Lab**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**-**	**-**	**-**	**2**	**25**	**50**	**1**

Course Objectives

- To provide the knowledge to setup a Hadoop Cluster
- To impart knowledge to develop programs using MapReduce Technique
- To learn file handling in HDFS
- To introduce Pig, PigLatin and HiveQL to process big data
- To learn machine learning operations using Mahout Hadoop
- To introduce NoSQL databases

Course Outcomes

After completing this course, the student will be able to

1. Understand Hadoop working environment
2. Work with big data applications in multi node clusters
3. Write scripts using Pig to solve real world problems
4. Write queries using Hive to analyse the datasets
5. Apply big data and echo system techniques for real world

List of Experiments to be performed

1. Understanding and using basic HDFS commands
2. Word count application using Mapper Reducer on single node cluster
3. Working with files in Hadoop file system: Reading, Writing and Copying
4. Writing User Defined Functions/Eval functions for filtering unwanted data in Pig
5. Retrieving user login credentials from /etc/passwd using Pig Latin
6. Working with HiveQL.
7. Writing User Defined Functions in Hive

Suggested reading:

1. Tom White, "Hadoop: The Definitive Guide", 4th Edition, O'Reilly Media Inc, April 2015.
2. Alan Gates, "Programming Pig", O'Reilly Media Inc, 2011.

Course Code	Course Title						Core/Elective
PW 761 IT	**PROJECT WORK – I**						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	4	**50**	**-**	**2**

Course Objectives

- 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

After completing this course, the student will be able to

- Demonstrate the ability to synthesize and apply the knowledge and skills acquired in the academic program to the real-world problems.
- Evaluate different solutions based on economic and technical feasibility
- Effectively plan a project and confidently perform all aspects of project management
- 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 talk.

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 IT	**SUMMER INTERNSHIP**						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	-	**25**	**50**	**2**

Course Objectives

- 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

- Get Practical experience of software design and development, and coding practices within Industrial/R&D Environments.
- Gain working practices within Industrial/R&D Environments.
- 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 coordinate (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 committee constituted by the department (25 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.

SCHEME OF INSTRUCTION & EXAMINATION
B.E. - VIII SEMESTER
(INFORMATION TECHNOLOGY)

S. No.	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										
3	PW861 IT	Project Work – II	-	-	16	16	50	100	-	8
			06	**-**	**16**	**22**	**110**	**240**	**06**	**14**

Profession Elective – VI	
Course Code	**Course Title**
PE 811 IT	Quantum Computing
PE 812 IT	Deep Learning
PE 813 IT	Fundamentals of IoT
PE 814 IT	Cryptography and Network Security
PE 815 IT	Scalable Architecture

Open Elective – III		
S. No.	Course Code	Course Title
1	**OE 882 IT****	Software Engineering

Note-1: ** 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 811 IT	**QUANTUM COMPUTING**						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	**30**	**70**	**3**

Course Objectives:

The objective of this course is to impart necessary knowledge to the learner so that he/she can develop and implement algorithm and write programs using these algorithms.

Course Outcomes:

After completing this course, students will be able to:

- Explain the working of a Quantum Computing program, its architecture and program model
- Develop quantum logic gate circuits
- Develop quantum algorithm
- Program quantum algorithm on major toolkits

UNIT-I

Introduction to Quantum Computing: Motivation for studying Quantum Computing, Major players in the industry (IBM, Microsoft, Rigetti, D-Wave etc.) Origin of Quantum Computing, Overview of major concepts in Quantum Computing Qubits and multi-qubits states, Bra-ket notation: Bloch Sphere representation, Quantum Superposition, Quantum Entanglement

UNIT-II

Math Foundation for Quantum Computing: Matrix Algebra: basis vectors and orthogonality, inner product and Hilbert spaces, matrices and tensors, unitary operators and projectors, Dirac notation, Eigen values and Eigen vectors.

UNIT-III

Building Blocks for Quantum Program: Architecture of a Quantum Computing platform, Details of q-bit system of information representation: Block Sphere, Multi-qubits States, Quantum superposition of qubits (valid and invalid superposition), Quantum Entanglement, Useful states from quantum algorithmic perceptive e.g. Bell State, Operation on qubits: Measuring and transforming using gates. Quantum Logic gates and Circuit: Pauli, Hadamard, phase shift, controlled gates.

UNIT-IV

Programming model for a Quantum Computing Program: Steps performed on classical computer, Steps performed on Quantum Computer, Moving data between bits and qubits.

UNIT-V

Quantum Algorithms: Amplitude amplification, Quantum Fourier Transform, Phase Kick-back, Quantum Phase estimation, Quantum Walks

Suggested Readings:

1. Michael A. Nielsen, “Quantum Computation and Quantum Information”, Cambridge University Press. October 2000.
2. David McMahon, “Quantum Computing Explained”, Wiley 2007
3. IBM Experience: https://quantumexperience,ng,bluemix.net
4. Microsoft Quantum Development Kit
   https://www.microsoft.com/en-us/quantum/development-kit
   Forest SDK PyQuil: https://pyquil.readthedocs.io/en/stable/

Course Code	Course Title						Core/Elective
PE 812 IT	**DEEP LEARNING**						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	**30**	**70**	**3**

Course Objectives:

- Understand the concept of neural networks, convolutional neural networks, and recurrent neural networks.
- Implement deep learning algorithms, and learn how to train deep networks.
- Gain in-depth knowledge of TensorFlow along with its functions, operations, and the execution pipeline.
- Understanding the major Architectures of Neural Networks and getting into the Convolutional neural Networks.
- Understand the applications of implementing deep learning such as image processing, natural language processing, speech recognition, deep face - facial recognition system, etc.

Course Outcomes:

After completing this course, students will be able to:

- To understand the fundamentals of deep learning.
- To be able to understand deep learning algorithms and design neural network.
- To be able to train and implement a neural network.
- To be able to have knowledge about convolutional neural networks.
- To be able to apply neural networks in various fields.

UNIT – I

What is deep learning? Artificial intelligence, Machine learning,and Deep learning -Artificial intelligence - Machine learning - Learningrepresentations from data - The "deep" in deep learning -Understanding how deep learning works, in three figures -What deep learning has achieved so far- The promise of AI

UNIT – II

Getting started with neural networks - Anatomy of a neural network - Layers: the building blocks of deep learning - Models:networks of layers - Loss functions and optimizers: keysto configuring the learning process

The Neural Network-Building Intelligent Machines, The Limits of Traditional Computer Programs, The Mechanics of Machine Learning, The Neuron, Expressing Linear Perceptrons as Neurons, Feed-Forward Neural Networks, Linear Neurons and Their Limitations, Sigmoid, Tanh

UNIT – III

Training Feed-Forward Neural Networks - The Fast-Food Problem - Gradient Descent - The Delta Rule and Learning Rates - Gradient Descent with Sigmoidal Neurons - The Backpropagation Algorithm - Stochastic and Minibatch Gradient Descent - Test Sets, Validation Sets, and Overfitting - Preventing Overfitting in Deep Neural Networks

Implementing Neural Networks in TensorFlow - What is TensorFlow? - How Does TensorFlow Compare to Alternatives?- Installing TensorFlow - Creating and Manipulating TensorFlow Variables - TensorFlow Operations - Placeholder Tensors - Sessions in TensorFlow - Navigating Variable Scopes and Sharing Variables - Managing Models over the CPU and GPU - Specifying the Logistic Regression Model in TensorFlow - Logging and Training the Logistic Regression Model - Leveraging TensorBoard to Visualize Computation Graphs and Learning -Building a Multilayer Model for MNIST in TensorFlow

UNIT – IV

Introduction to Major Architectures of Deep Networks–Unsupervised Pretrained Networks (UPNs), Convolutional Neural Networks (CNNs), Recurrent Neural Networks, Recursive Neural Networks

Convolutional Neural Networks -Neurons in Human Vision - The Shortcomings of Feature Selection - Vanilla Deep Neural Networks Don't Scale - Filters and Feature Maps - Full Description of the Convolutional Layer - Max Pooling - Full Architectural Description of Convolution Networks - Closing the Loop on MNIST with Convolutional Networks - Accelerating Training with Batch Normalization.

UNIT –V

Deep Learning Applications - Large Scale Deep Learning - Computer Vision - Speech Recognition - Natural Language Processing - Other Applications

Suggested Reading:

1. Nikhil Buduma and Nicholas Locascio - Fundamentals of Deep Learning : Designing Next-Generation Machine Intelligence Algorithms – First Edition - O'Reilly , 2017
2. Francois Chollet-Deep Learning with Python-Second Edition,Manning Publications, 2017.
3. Josh Patterson and Adam Gibson- Deep Learning: A Practitioner's Approach - First Edition - O'Reilly , 2017
4. Ian Goodfellow, Yoshua Bengio, Aaron Courville - Deep Learning – Second Edition- MIT Press , 2016

Course Code	Course Title						Core/Elective
PE 813 IT	**FUNDATMENTALS OF IoT**						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Computer Networks, Programming knowledge	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:

Student will be able to

- Understand the various applications of IoT and other enabling technologies.
- Comprehend various protocols and communication technologies used in IoT
- Design simple IoT systems with requisite hardware and C programming software
- Understand the relevance of cloud computing and data analytics to IoT
- Comprehend the business model of IoT from developing a prototype to launching a product.

UNIT- I

Introduction to Internet of Things

IOT vision, Strategic research and innnovation directions, Iot Applications, Related future technologies, Infrastructure, Networks and communications, Processes, Data Management, Security, Device level energy issues.

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 Addressess, TCP and UDP Ports, Application Layer Protocols –
HTTP,HTTPS, Cost Vs Ease of Production, Prototypes and Production, Open Source Vs Closed source

UNIT- III

Prototyping and programming for IoT

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.

Techniques for writing embedded C code: Integer data types in C, Manipulating bits - AND,OR,XOR,NOT, Reading and writing from I/ O ports. Simple Embedded C programs for LED Blinking, Control of motor using switch and temperature sensor for arduino board.

UNIT- IV

Cloud computing and Data analytics

Introduction to Cloud storage models -SAAS, PAAS, IAAS. Communication APIs, Amazon webservices for IoT, Skynet IoT Messaging Platform.

Introduction to Data Analytics for IoT - Apache hadoop- Map reduce job execution workflow.

UNIT- V

IoT Product Manufacturing - From prototype to reality

Business model for IoT product manufacturing, Business models canvas, Funding an IoT Startup,

Mass manufacturing - designing kits, designing PCB,3D printing, certification, Scaling up software, Ethical issues in IoT- Privacy, Control, Environment, solutions to ethical issues.

Suggested Readings:

1. Internet of Things - Converging Technologies for smart environments and Integrated ecosystems, River Publishers. Jan 2013

2. Designing the Internet of Things , Adrian McEwen, Hakim Cassimally. Wiley India Publishers December 2013

3. Fundamentals of embedded software: where C meets assembly by Daneil W lewies, Pearson. 1st edition November 2013

4. Internet of things -A hands on Approach, ArshdeepBahga, Universities press. December 2013 ISBN : #1494435144

Course Code	Course Title						Core/Elective
PE 814 IT	**CRYPTOGRAPHY AND NETWORK SECURITY**						Elective
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:

Student will be able to

- Understand the various applications of IoT and other enabling technologies.
- Comprehend various protocols and communication technologies used in IoT
- Design simple IoT systems with requisite hardware and C programming software
- Understand the relevance of cloud computing and data analytics to IoT
- Comprehend the business model of IoT from developing a prototype to launching a product.

UNIT – I

Security Concepts: Introduction, The need for security, Security approaches, Principles of security, Types of Security attacks, Security services, Security Mechanisms, A model for Network Security Cryptography Concepts and Techniques: Introduction, plain text and cipher text, substitution techniques, transposition techniques, encryption and decryption, symmetric and asymmetric key cryptography, steganography, key range and key size, possible types of attacks.

UNIT – II

Symmetric key Ciphers:Block Cipher principles, DES, AES, Blowfish, RC5, IDEA, Block cipher operation, Stream ciphers, RC4. Asymmetric key Ciphers: Principles of public key cryptosystems, RSA algorithm, Diffie-Hellman Key Exchange.

UNIT – III

Cryptographic Hash Functions: Message Authentication, Secure Hash Algorithm (SHA-512), Message authentication codes: Authentication requirements, HMAC, CMAC, Digital signatures. Key Management and Distribution: Symmetric Key Distribution Using Symmetric & Asymmetric Encryption, Distribution of Public Keys, Kerberos, X.509 Authentication Service.

UNIT – IV

Transport-level Security:Web security considerations, Secure Socket Layer and Transport Layer Security, HTTPS, Secure Shell (SSH) Wireless Network Security: Wireless Security, Mobile Device Security, IEEE 802.11 Wireless LAN, IEEE 802.11i Wireless LAN Security

UNIT – V

E-Mail Security: Pretty Good Privacy, S/MIME IP Security: IP Security overview, IP Security architecture, Authentication Header, Encapsulating security payload, Combining security associations.

Suggested reading:

- Cryptography and Network Security – Principles and Practice: William Stallings, Pearson Education, 6th Edition
- Cryptography and Network Security: AtulKahate, Mc Graw Hill, 3rd Edition

Course Code	Course Title						Core/Elective
PE 815 IT	**SCALABLE ARCHITECTURE**						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	30	70	3

Course Objectives:

- Students will be able to learn application and building Scalable Machine Learning, Hadoop, SMACK Stack and also Message Services.
- Students will be able to select the appropriate architecture for enterprise architectures based on the size, scale and applications used in the enterprise

Course Outcomes:

Student will be able to

- Understand the basic concepts of Scalable Machine Learning
- To become a data scientist work in some development environment tailored for statistics and Machine Learning.
- Obtain expertise to turn actionable insights and Fast Data Applications into innovative methods to solve real-world problems.
- To impart knowledge on Kubernetes and batch processing.

UNIT –I

Introduction to Scalable Machine Learning, Some Machine Learning Background
Algorithms for Large scale Learning, Overview of Hadoop and Current Big Data Systems

UNIT II

How Programming for Data Flow Differs, Basic Spark, Working with Vectors and Matrices in Spark, Brief tour of Spark ML, beyond parallelization, Practical Big Data

UNIT III

Anatomy of Fast Data Applications, SMACK Stack – Functional Decomposition,
Message Backbone- Understanding messaging requirements, Data ingestion, Fast data& low latency, Message Delivery Semantics, Distributing Messages

UNIT IV

Compute Engines- Micro Batch Processing, One-at-a time Processing, Choice of processing engine,
Storage as the Fast Data Borders, The message backbone as Transition Point

UNIT V

Sharing stateful streaming state, Data Driven Micro-services, State and Micro-services.
Deployment environments for Fast Data Applications, Application containerization, resource scheduling, Apache Mesos, Kubernetes, Cloud Deployments.

Suggested Reading:

1. Designing Fast Data Application Architectures by Gerard Maas, Stavros Kontopoulos, Sean Glover , Publisher: O'Reilly Media, Inc., June 2018
2. Spark- The definitive Guide by Bill Chambers & Matei Zaharia, O'Reilly Media, Inc., June 2019

Course Code	Course Title						Core/Elective
OE 882 IT	**SOFTWARE ENGINEERING**						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	-	-	-	**30**	**70**	**3**

Course Objectives

- To introduce the basic concepts of software development- processes from defining a product to shipping and maintaining that product
- To impart knowledge on various phases, methodologies and practices of software development
- To understand the importance of testing in software development and study various testing strategies and software quality metrics.

Course Outcomes

At the end of the course students will be able to:

- Acquire knowledge about different software development processes and their usability in different problem domains.
- Understand the process of requirements collection, analyzing, and modeling requirements for effective understanding and communication with stakeholders.
- Design and develop the architecture of real world problems towards developing a blueprint for implementation.
- Understand the concepts of software quality, testing and maintenance.
- Understand Concepts related to Software Process Improvement

UNIT-I

The Software Problem: Cost, Schedule and Quality, Scale and change, Software Processes: - Process and project, Component Software Processes, Software Development Process Models, Project management Process.

UNIT-II

Software Requirements Analysis and Specification: Value of a good SRS, Requirements Process, Requirements Specification, Functional Specification with Use Cases, Other approaches for analysis.
Software Architecture: Role of Software Architecture Views, Component and connector view, Architectural styles for C & C view, Documenting Architecture Design, Evaluating Architectures.

UNIT-III

Planning a Software Project: Effort Estimation, Project Schedule and staffing, Quality Planning, Risk Management Planning, Project Monitoring Plan, Detailed Scheduling.
Design: Design concepts, Function oriented Design, Object Oriented Design, Detailed Design, Verification, Metrics.

UNIT-IV

Coding and Unit Testing: Programming Principles and Guidelines, Incrementally developing code, managing evolving code, unit testing, code inspection, Metrics.
Testing: Testing Concepts, Testing Process, Black Box testing, White box testing, Metrics.

UNIT-V

Maintenance and Re-engineering: Software Maintenance, supportability, Reengineering, Business process Reengineering, Software reengineering, Reverse engineering; Restructuring, Forward engineering, Economics of Reengineering.
Software Process Improvement: Introduction, SPI process, CMMI, PCMM, Other SPI Frameworks, SPI return on investment, SPI Trends.

Suggested Readings:

1. Pankaj Jalote, "Software Engineering- A Precise Approach", Wiley India, 2010.

2. Roger. S. Pressman, "Software Engineering - A Practitioner's Approach", 7th Edition, McGraw Hill Higher Education, 2010.
3. Deepak Jain, "Software Engineering", Oxford University Press, 2008.
4. Rajib Mall, "Fundamentals of Software Engineering", 4th Edition, PHI Learning, 2014.
5. Ian Sommerville, "Software Engineering", 10th Edition, Addison Wesley, 2015.

Course Code	Course Title						Core/Elective
PW 961 IT	**PROJECT WORK – II**						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	-	-	-	**16**	**50**	**100**	**8**

Course Objectives

- 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

At the end of the course students will be able to:

- Demonstrate the ability to synthesize and apply the knowledge and skills acquired in the academic program to the real-world problems.
- Evaluate different solutions based on economic and technical feasibility
- Effectively plan a project and confidently perform all aspects of project management
- 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 for25 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.