BE (Electronics Engineering)							**SEM:** VII		
Course Name: Instrumentation System Design (ISD)							**Course Code: PCC** ELE-701		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**OR**	**TW**	**150**
3	-	2	5	4	25	75	25	25	
IA : In Semester Examination - Paper Duration – **1.5 Hours** **ESE :** End Semester Examination - Paper Duration - **3 Hours**									
Prerequisite: EMMI. PCS									

Course Objectives: To impart knowledge about the basic functions and working of various components used in Instrumentation systems, and process control and to apply them for various applications in Industrial Process control. Students also get awareness of various representations and symbols to analyze and evaluate the system.

Course Outcomes: Students will be able to:

SN	Course Outcomes	RBT Levels
1	Explain the needs of advancement in instrumentation systems	Understand (U)
2	Select and design proper components for signal conditioning circuits	Remember (R
3	Choose the proper controller for given process application	Apply(A)
4	Understand programmable logic controller design, PLC operation programming the PLC	Understand (U)
5	Design the Data acquisition system (DAS) & Supervisory control system (SCS)	Evaluate(E)
6	Design and simulating Regulators and power supplies for industrial instrumentation	Evaluate(E)

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive Levels as per RBT
1	**INTRODUCTION TO INSTRUMENTATION SYSTEM DESIGN**	5	Understand (U), Remember (R) Apply (A) Evaluate(E)
	1.1Review the various measurement techniques of temperature, pressure, flow and level, application and selection of sensors		
	1.2 Recent trends in Virtual instrumentation, Intelligent instrumentation systems. Design aspects for system level design		
2	**DESIGN OF SIGNAL CONDITIONING CIRCUITS**	8	Understand (U), Remember (R) Apply (A) Evaluate(E)
	2.1 Principles of analog & digital signal conditioning – Importance of signal conditioning ,signal level & bias change, linearization, conversion, filtering & impedance matching, concept of loading, comparators & converters		
	2.2Design of operational amplifier based circuits in instrumentation – analysis of voltage divider circuits, bridge circuits, RC filters, inverting & non-inverting amplifier, instrumentation amplifier, Use of V to I & I to V converter, integrator, differentiator & linearization (with applications)		
3	**PROCESS CONTROLLER PRINCIPLES**	8	Understand (U), Remember (R) Apply (A)
	3.1Types of controllers, Discontinuous controller – two position mode, multi-position mode & floating mode		
	3.2Continuous controllers – single mode (P, I & D) & composite mode (PD, PI & PID), split range, auto select, ratio & cascaded controllers, selection criterion of controller for a process mode		
	3.3 Tuning of PID controller – process loop tuning, open loop transient response method, Ziegler – Nichols tuning method, frequency response methods (numerical examples on PID tuning)		
4	**PROGRAMMABLE LOGIC CONTROLLERS (PLC)**	8	Understand (U), Remember (R), Analyze (AZ) Evaluate (E)
	.4.1Discrete state process controller – discrete state variables, process specifications & event sequence description		
	4.2Relay controller & ladder diagram – introduction to relay ladder diagram logic, ladder diagram elements & ladder diagram programming examples		
	4.3PLC – relay sequencers, programmable logic controller design, PLC operation programming the PLC, PLC software functions (application examples on relay ladder logic programming)		
5	**DIGITAL BASED PROCESS CONTROL**	8	Understand (U), Remember (R) Apply (A)
	5.1Data acquisition system (DAS) – objectives, signal conditioning of inputs, single channel DAS, multi-channel DAS, computer based DAS, data logger, difference between DAS & data logger		
	5.2Computer aided process control – architecture, human machine interface (HMI), supervisory control & data acquisition (SCADA), standard interfaces (RS-232C, RS-422A & RS-485)		

	5.3Supervisory control system (SCS), introduction to the Field bus & Profibus process controlled networks, overview of distributed control system (DCS), features & advantages of DC		Analyze (AZ)
6	**Industrial Instrumentation**	8	Remember (R) Understand (U), Apply (A)
	6.1PC & microcomputer based instrumentation, virtual instrumentation & Lab VIEW introduction		
	6.2**Calibration and response of industrial instrumentation** – standard testing methods and procedures – Generalized performance characteristics – static response characterization – dynamic response characterization - zero order system dynamic response characterizations – first order system dynamic response second order system dynamic response – higher order systems - Response to different forcing functions such as step, sinusoidal etc. to zero, first, second third and higher orders of systems.		
	6.3.**Regulators and power supplies for industrial instrumentation** linear series voltage regulators – linear shunt voltage regulators – integrated circuit voltage regulators –pH and conductivity sensors. Piezo-electric and ultrasonic sensors and its application in process and biomedical Instrumentation. Measurement of viscosity, humidity and thermal conductivity		
	Total No of Lectures 45		

Books and References:

SN	Title	Authors	Publisher	Edition	Year
1	Process Control Instrumentation Technology	Curtis D. Johnson	PHI	7th Edition	2014
2	Industrial Instrumentation & Control	S. K. Singh,	McGraw Hill	3rd Edition	2015
3	, Instrumentation Measurement & Analysis,	B.C. Nakra & K. K. Chaudhary,	McGraw Hill	3rd Edition	2010
4	Pneumatics & Hydraulics,	Andrew Parr,	Jaico Publishing Co.	India Special Edition	2011
5	Handbook of Process Control & Instrumentation	B. G. Liptak	CRC Press	4thedition	2010
6	Fundamentals of Industrial Instrumentation & Process Control,	William C. Dunn,	McGraw Hill	1st edition,	2009
7	Supervisory Control of discrete event systems using petrinets,	John O Moody, Paros J Antsaklis,	PHI,	PHI,	2002
8	, Process/Industrial Instruments and Controls Handbook,	Gregory K. McMillan,	Mc Graw Hill 1999	5th Edition,	1999

		Douglas M. Considine			

Suggested List of Practical/ Experiments:

Practical Number	Type of Experiment	Practical/ Experiment Topic	Hrs.	RBT Levels
1	**Basic Experiments**	To understand the operation of various Sensors	2	Understand (U),
2		To understand use of sensors in industrial applications	2	Understand (U),
3	**Design Experiments**	Design of instrumentation amplifier for variable voltage gain	2	Apply (A)
4		Design of signal conditioning circuits for LDR / thermistor / RTD / strain gauge	2	Apply (A)
5		Implementation of P-I-D controller using Simulink/MATLAB	2	Apply (A)
6		Implementation of PLC ladder diagram for given application	2	Apply (A)
7	**Basic Experiments**	Study of SCADA & HMI	2	Understand (U),
8	**Development Experiment**	Designing of data acquisition system (DAS)	2	Apply (A)
9		Simulating a simple process using Lab VIEW	2	Apply (A)
10		Design and simulating Regulators and power supplies for industrial instrumentation	2	Apply (A)
11-15	**Mini/Minor Projects/ Seminar/ Case Studies**	***Mini Project:** 1. Signal Conditioning Applications 2. PLC Application used to start and stop the motors of the conveyor belt 3. Process Controller Applications 4. PLC Motor Control 5. Designing and Verifying Fault Detection Logic 6. Data Acquisition System (DAS)Applications ***Case study:** 1. Digital Control Valves-selecting control valves & its applications	12	Create (C)

		2. Modelling and Simulating a Multistage Process 3. Procedure of PLC Programming in Industries 4. Piezo-electric and ultrasonic sensors and its application in process and biomedical Instrumentation. (*All the students Group of 03 students in one group will do the above work)		

B.E. (Electronics Engineering)							B.E SEM: VII		
Course Name: **VLSI** Design							Course Code: **PEC-ELE7011**		
Teaching Scheme (Program Specific)					**Examination scheme**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week-Theory (100)							**Practical/Oral (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR&OR**	**TW**	**150**
3	-	2@	5	5	25	75	25	25	

IA : Internal Assessment **- Paper Duration –** 1 Hour
ESE : End Semester Examination **- Paper Duration -** 3 Hours

The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance (20%)

Prerequisite: PCC-ELE302: Digital Circuit Design, PCC-ELE301/402: Analog Electronics-1 &II , PCC-ELE403: Microprocessors and Computer Organization

Course Objective: To impart the knowledge about VLSI design trends, methodologies and allied systems used in digital design.

Course Outcomes: Students will be able to:

SN	Course Outcomes	Cognitive Levels as per Blooms Taxonomy
1	Demonstrate a clear understanding of choice of technology and technology scaling, Define scaling, list various capacitances in MOSFET, Explain different models of MOSFETs.	L1,L2
2	List different parameters ,Concept of static and dynamic analysis, compare different types of Inverters .	L1,L2,L3,L4
3	Explain different design styles used in digital design like PTL, Transmission gates etc. Implement concept of sizing. Implementation of various circuits using different design styles .	L1,L2,L3
4	Explain different memory structures, explain working of memory units, its modes of operation and its peripheral circuitry.	L1,L2,L3
5	Explain different types of adder circuits, Compare it's performance. Explain multiplier circuits and allied circuitry.	L1,L2
6	Explain clocking phenomenon ,clock generation and distribution. Understand importance of Low power design , Explain Interconnect model and scaling.	L1,L2,L3

Detailed Syllabus

Module No.	Topics	Hrs	Cognitive Levels as per Blooms Taxonomy
1	**Technology Trends** **Technology Comparison:** Comparison of BJT and MOS technology **MOSFET Scaling:** Types of scaling, Level 1 and Level 2 MOSFET Models, MOSFET capacitances.	6	L1,L2
2	**MOSFET Inverters** **Types of MOS inverters:** Active and passive load and their comparison. **Circuit Analysis of MOS Inverters:** Static Analysis resistive and CMOS inverter, Design of symmetric CMOS inverter. Dynamic Analysis of CMOS inverter: Calculation of rise time, fall time and propagation delay. **Logic Circuit Design:** Analysis and design of 2-I/P NAND,NOR and complex Boolean function using equivalent CMOS inverter for simultaneous switching.	8	L1,L2,L3,L4
3	**MOS Circuit Design Styles** **Design Styles:** Static CMOS, pass transistor logic, transmission gate, Pseudo NMOS, Dynamic, Domino logic etc. **Circuit Realization:** Basic gates,SR Latch, Basic Flip-Flops, MUX using above design styles.	8	L1,L2,L3
4	**Semiconductor Memories** **SRAM:** 6T SRAM, operation, design strategy, leakage currents, read/write circuits, sense amplifier. **DRAM**: 1T_DRAM, operation modes, leakage currents, refresh operation, physical design. **ROM Array**: NAND and NOR PROM, Nonvolatile read/write memories classification and programming techniques.	8	L1,L2,L3
5	**Data Path Design** **Adder:** Ripple Carry adder,CLA adder, Manchester carry chain and high speed adders (brief introduction) **Multipliers and shifter:** Array multiplier and barrel shifter	6	L1,L2
6	**VLSI Clocking and System Design** **Clocking:** CMOS clocking styles, Clock generation, stabilization and distribution. **Low Power CMOS Circuits:** Various components of power dissipation in CMOS, Limits on low power design, low power design through voltage scaling,I/O pads and Power Distribution . **Interconnect:** Interconnect delay model, interconnect scaling and crosstalk.	9	L1,L2,L3

Books and References:

S. No.	Title	Authors	Publisher	Edition	Year
1	VLSI Design	Debaprasad Das	Oxford	1st Edition	2011
2	Low-Power CMOS VLSI Circuit Design	Kaushik Roy and Sharat C. Prasad	Wiley	Student edition	2009
3	CMOS VLSI Design	Neil H. E. Weste, David Harris and Ayan Banerjee	Pearson Education	3rd edition	2009
4	CMOS Digital Integrated Circuits Analysis and Design	Sung-Mo Kang and Yusuf Leblebici	Tata McGraw Hill, 3rd Edition.	3rd edition	2011

Online References:

S. No.	Website Name	URL	Modules Covered
1	www.udemy.com	https://www.udemy.com/course/svac_c1_ic_design_manufacturing_process/	M1,M2,M3
2	www.online.stanford.edu	https://online.stanford.edu/courses/ee271-introduction-vlsi-systems	M1,M2,M3,M6
3	www.classcentral.com	https://www.classcentral.com/course/swayam-cmos-digital-vlsi-design-12964	M1,M2,M3,M4,M5. M6
4	www.mooc-list.com	https://www.mooc-list.com/course/vlsi-cad-logic-layout-coursera/	M3,M4,M5,M6+advance topics

@ Practical to be conducted in Capstone Mode

Suggested list of Practical/ Experiments:

Work to be done	Hrs.
Identification and Study of Design Methodologies	8
Project Title Identification	2
Designing of different modules	2
Testing of modules using Micro wind /Open-Source platforms	6
Debugging and modification in circuit design	6
Testing of Mini Project	2
Preparation of Report	4
Total Hours	**30**

B.E. (Electronics Engineering)							B.E. SEM: VII		
Course Name: Mobile Programming							Course Code: PEC-ELE7012		
Teaching Scheme (Program Specific)					Examination scheme				
Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation				
Hours Per Week					Theory (100)		Practical/ Oral (25)	Term Work (25)	Total
Theory	Tutorial	Practical	Contact Hours	Credits	IA	ESE	OR	TW	150
03	-	02@	05	4	25	75	25	25	
IA : Internal Assessment - Paper Duration – **1.5Hour** **ESE :** - Semester End Examination Paper Duration - **3 Hours** **The weightage of marks for continuous evaluation of Term work/Report:** Formative (40%), Timely completion of practical (40%) and Attendance (20%)									
Prerequisite: Digital Communication, Computer Communication Networks									

Course Objectives: The course intends to deliver the role to study, understand and appreciate the concepts of mobile communication technology.

Course Outcomes: Students will be able to:

SN	Course Outcomes	RBT level
1	Understand the fundamentals of mobile communications	L1, L2
2	Differentiate between GSM and CDMA	L1, L2, L3
3	Understand the evolving wireless communication technologies.	L1, L2, L3, L4
4	Understand the requirement of 4 G technology	L1, L2, L3
5	Understand the fundamentals 3G and 4G, LTE, WiMAX	L1, L2, L3, L4
6	Understand the Mobile Adhoc Network, Mobile IP and Mobility Management, Wireless Sensor Networks	L1, L2, L3, L4

Detailed Syllabus:

Module No.	Topics	Hrs	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Cellular Communication System** **I**ntroduction to Cellular Communications, Frequency reuse, Multiple Access Technologies **Cellular Processes:** Channel assignment, Call Setup, Handoff strategies, interferences and system capacity **Traffic Theory:** Trunking and grade of service, improving system capacity	7	L1, L2
2	**GSM** GSM Network architecture, signaling protocol architecture, identifiers, channels, Frame structure, speech coding, authentication and security, call procedure, handoff procedure, services and features	7	L1, L2, L3
3	**CDMA digital cellular standard (1S-95).** Frequency and channel specifications of IS-95, forward and reverse CDMA channel, packet and frame formats, mobility and radio resource management	8	L1, L2, L3, L4
4	**3 G Mobile Communication System** 2.5 G TDMA Evolution Path, GPRS, EDGE , 2.5G CDMA one cellular N/W, Need of 3G Cellular N/w, IMT 2000 Global Standard, UMTS Technology, W-CDMA Air interface, TD-SCDMA Technology, CDMA 2000 Cellular Technology	8	L1, L2, L3
5	**4G Wireless Standards** Need for 4G network, difference between 3G and 4G, LTE, WiMAX	7	L1, L2, L3, L4

6	**Emerging Technologies** Mobile Adhoc Network, Mobile IP and Mobility Management, Mobile TCP, Wireless Sensor Networks, RFID Technology	8	L1, L2, L3, L4
	Total Hours	**45**	

Books and References:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	Wireless Communications	Theodore S. Rappaport,	Prentice Hall	-	-
2	Mobile & Personal Communication system & Services	K.C. Laudon and J.P. Laudon	Prentice Hall	-	-
3	Principles of Wireless Networks	KavehPahlavan,Prashant Krishnamurthy	Prentice Hall	-	-
4	Wireless communication and Networking-	Vijay Garg,	ELSEVIER Inc	-	-
5	Wireless communication-	Singhal	TMH	-	-
6	Fundamentals of Wireless Communications.	David Tse and PramodViswanath,	Publisher, Cambridge University Press	-	-
7	Wireless Communications	Andrea Goldsmith	Cambridge University Press	-	-
8	Wireless Communications & Networks 3Gand Beyond	ItiSahaMisra	TMH	3rd	2011

Online References:

Sr. No.	Website Name	URL	Modules Covered
1.	https://www.tutorialspoint.com›wireless_communication_cellular_networks	https://www.tutorialspoint.com/wireless_communication/wireless_communication_cellular_networks.htm	M1
2.	https://www.tutorialspoint.com › gsm	https://www.tutorialspoint.com/gsm/	M2
3.	https://www.tutorialspoint.com › third-generation-3g-mobile-phones	https://www.tutorialspoint.com › cdma › cdma_introduction https://www.tutorialspoint.com/third-generation-3g-mobile-phones	M3
4.	https://www.tutorialspoint.comcommunication_technologies › communi..	https://www.tutorialspoint.com/communication_technologies/communication_technologies_mobile.htm	M4
5.	https://www.tutorialspoint.com › lte	https://www.tutorialspoint.com/lte/index.htm	M5
6	https://www.tutorialspoint.com › mobile_computing›mobile_computing_	https://www.tutorialspoint.com/mobile_computing/mobile_computing_trends.htm	M6

@ Practical to be conducted in Capstone Mode

Suggested list of Practical/ Experiments as a mini project:

Work to be done	**Hrs.**
Identification and Study of different Spread Spectrum techniques	8
Project Title Identification	2
Testing of IP commands on command prompt	2
Design and Configure a network using CISCO packet tracer	6
Design and Configure a network using NS2 Simulator	6
Testing of Mini Project	2
Preparation of Report	4
Total Hours	**30**

NOTE: Students must submit one project based on the syllabus at the semester end.

B.E. (Electronics Engineering)							B.E. SEM: VII		
Course Name: Industrial Electronics							Course Code: PEC-ELE7013		
Teaching Scheme (Program Specific)					Examination scheme				
Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation				
Hours Per Week					Theory (100)		Practical/ Oral (25)	Term Work (25)	Total
Theory	Tutorial	Practical	Contact Hours	Credits	IA	ESE	OR	TW	150
03	-	02@	05	4	25	75	25	25	
IA : Internal Assessment - Paper Duration – **1.5Hour** **ESE :** - Semester End Examination Paper Duration - **3 Hours** **The weightage of marks for continuous evaluation of Term work/Report:** Formative (40%), Timely completion of practical (40%) and Attendance (20%)									
Prerequisite: Basic Electrical and Electronics Engineering, Electrical Networks									

Course Objectives: The course intends to deliver the role to study, understand and appreciate the concepts of Industrial Electronics.

Course Outcomes: Students will be able to:

SN	Course Outcome	RBT level
1	illustrate construction, working principles and applications of power electronic switches	L1, L2
2	Identify rectifiers and inverters for dc and ac motor speed control	L1, L2, L3
3	Develop circuits using OPAMP and timer IC555	L1, L2, L3, L4
4	Identify digital circuits for industrial applications	L1, L2, L3
5	Illustrate the knowledge of basic functioning of microcontroller	L1, L2, L3, L4
6	Analyze speed-torque characteristics of electrical machines for speed control	L1, L2, L3, L4

Detailed Syllabus:

Module No.	Topics	Hrs	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Semiconductor Devices: Review of Diodes: Rectifier Diode , Zener Diode, Led, Photodiode** Semiconductor Devices: Review of diodes rectifier diode , zener diode, LED, photodiode SCR V-I characteristics , R,R-C,UJT triggering circuits, turning-off of a SCR (preliminary discussion), basics of Gate Turn Off (GTO) Structure and V-I characteristics of Triac (modes of operation not needed) and Diac , Applications of Triac-Diac circuit, Characteristics and principle of Power BJT, power MOSFET, IGBT, comparison of devices	7	L1, L2
2	**Phase Controlled Rectifiers and Bridge Inverters** Full wave controlled rectifier using SCR's(semi controlled, fully controlled) with R load only. Derivation of output voltage, Concept of RL and R-L-E load, Block diagram of closed loop speed control of DC motors, Necessity of inner current control loop, current sensing Basic principle of single phase and three phase bridge inverters , block diagrams including rectifier and inverter for speed control of AC motors(frequency control only)	7	L1, L2, L3
	Operational Amplifiers and 555 Timer	8	

3	Operational amplifier circuits, Ideal OPAMP behavior , common OPAMP ICs, Basic OPAMP circuits- Inverting amplifier, Noninverting amplifier ,Voltage follower (Buffer), Instrumentation Amplifier, Summing amplifier, Schmitt triggers Active first order filter: Low pass and high pass filter Power Op Amps, Optical Isolation amplifier 555 timer-Operating modes: monostable, astable multivibrator		L1, L2, L3, L4
4	**Digital Logic and Logic Families** Digital signals, combinational and sequential logic circuits, clock signals, Boolean algebra and logic gates Integrated circuits and logic families : Logic Levels, Noise Immunity, Fan Out, Power Dissipation, Propagation Delay, TTL logic family : TTL Designations, TTL Versions, Output Configuration, TTL characteristic, The CMOS family,, comparison with TTL family Flip flops: Set Reset(SR),Trigger(T),clocked D F/Fs; Buffer and drivers Registers, decoders and encoders, Multiplexer and Demultiplexer	8	L1, L2, L3
5	**Microprocessor and Microcontrollers** Overview of generic microprocessor, architecture and functional block diagram, Comparison of microprocessor and microcontroller, MSP430 Functional block diagram and architecture, assembly language programming, C compiler programming, basics of interfacing with external input / output devices (like reading external analog voltages, digital input output)	7	L1, L2, L3, L4
6	**Motors** Review and comparison of Torque–speed characteristics of DC motors and AC induction motors. Basic principles of speed control of AC/DC motors Basics of BLDC motor, Linear Actuator motor, Servo Motor Suitability of each motor for various industrial applications, Selection and sizing of motors for different applications. Applications for pumps, conveyors, machine tools etc	8	L1, L2, L3, L4
	Total Hours	**45**	

Books and References:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	Power Electronics	M.H. Rashid	Prentice-Hall of India	-	-
2	Fundamentals of Power Electronics	P S Bhimbra	Khanna Publisher	-	-
3	Power Electronics	Ned Mohan, Undeland, Robbins	John Wiley Publication	-	-
4	Electronic Devices and Circuits	Robert Boylestad and Louis Nashelsky	Prentice-Hall	-	-
5	Industrial Electronics and Control by	S K Bhattacharya, S Chatterjee	-----	-	-
6	Modern Digitals Electronic	Jain R P	Tata McGraw Hill	-	-
7	Digital principal and Application	Malvino and Leach	Tata McGraw Hill	-	
8	Microcontrollers and Embedded System	Ramesh Gaonkar	PENRAM		

9	MSP430 Microcontroller Basics	John H. Davies	Newnes	1st edition	2008

Online References:

Sr. No.	URL	Modules Covered
1.	https://www.nptel.com/	M1,M2, M3,M4,M5,M6
2.	https://www.electronics-notes.com/articles/analogue_circuits/operational-amplifier-op-amp/inverting-amplifier.php	M3
3.	https://www.electronics-tutorials.ws/combination/comb_1.html	M4

Suggested List of Practical/ Experiments:

Practical Number	Type of Experiment	Practical/ Experiment Topic	Hrs.	Cognitive Level s as per Blooms Taxonomy
1	Basic Experiments	To plot Characteristics of DIAC	2	L1, L2
2		To plot Characteristics of SCR, TRIAC	2	L1,L2,L3
3		To implement various Firing circuits for SCR	2	L1,L2,L3
4		To vary the output voltage of Full bridge rectifier by varing firing angle.	2	L1, L2
5		Verify and compare the propagation delays of TTL / CMOS gates	2	L1,L2,L3
6		Implement logic equations using Multiplexer (IC 74151)	2	L1,L2,L3
7	Design Experiments	Design firing circuit for half wave controlled rectifier.	2	L1,L2,L3
8		Design Ring and/or twisted ring counter using flip flops	2	L1,L2,L3

9	Advanced Experiments	Speed control of DC Motor Buck converter, Boost converter and Buck-Boost converter.	2	L1,L2,L3
10		Design of sequence generator using flip flops.	2	L1,L2,L3
11	Mini/Minor Projects/ Seminar/	1. Thyristor Power Control by IR Remote 2. Lamp Life Extender by ZVS (Zero Voltage Switching) 3. Three Phase Solid State Relay with ZVS 4. RFID based Attendance System 5. Computer Simulation Code for the Quine-McCluskey Minimization Method	6	L1,L2,L3,L4,L5,L6
12				
13				
14				
15	Case study	1Dual Converter Using Thyristors 2Remote AC Power Control by Android Application with LCD Display	4	L1,L2,L3

B.E. (Electronics Engineering)							SEM: VII		
Course Name: Computer Networking & Communication							**Course Code**: PEC-ELE7014		
Teaching Scheme (Program Specific)					**Examination scheme**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**OR**	**TW**	**150**
3	-	2@	5	4	25	75	25	25	

IA: Internal Assessment - Paper Duration – **1.5 Hours**
ESE: End Semester Examination - Paper Duration - **3 Hours**

The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance (20%)

Prerequisite: PCC-ELE404: Principles of Electronic Communication Systems

Course Objective: To impart the knowledge for understanding various networking concepts and analyze various layers & protocols.

Course Outcomes: Students will be able to:

SN	Course Outcomes	Cognitive Levels as per Blooms Taxonomy
1	Understand and explain Networking Concepts and protocols	L1, L2
2	Demonstrate understanding of networking concepts and required protocols	L1, L2, L3
3	Understand and explain Data link layer services and protocols.	L1, L2, L3
4	Understand and explain Networking layer services and protocols, and evaluate different addressing schemes and routing protocols	L1, L2, L3, L4, L5
5	Understand and explain Transport layer & Application layer services and protocols.	L1, L2, L3, L4
6	Understand and explain LAN's & connecting devices.	L1, L2, L3

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive Levels as per Blooms Taxonomy
1	**Introduction to Network Architectures, Protocol Layers, and Service models.**	05	L1, L2
	Uses of computer networks: Topologies, LAN, MAN, WAN, Network topologies. **Addressing:** Physical / Logical /Port addressing, Protocols and Standards. **Protocol Architecture:** Need of layered protocol architecture, Layers details of OSI. **TCP/IP Model:** Protocol suite, Comparison of OSI and TCP/IP		
2	**Physical Layer**	08	L1, L2, L3
	Transmission Media: Guided media like Coaxial, fiber, twisted pair, and Wireless media, Transmission Impairments**. Interconnecting Devices:** Hub, Bridges, Switches, Router, Gateway. **Data communication model:** DTE, DCE, RS-232D Interface. **Multiplexing:** FDM, Synchronous TDM, ADSL, xDSL, Cable Modem		
3	**Data Link Control**	08	L1, L2, L3
	Data link services: Framing, Flow control, Error control, ARQ methods, Piggybacking. **High Level Data Link Control (HDLC):** HDLC configurations, Frame formats, Typical frame exchanges. **Medium Access Control Protocols:** ALOHA, Slotted ALOHA, CSMA, CSMA/CD		
4	**Network Layer**	14	L1, L2, L3, L4, L5
	Switching: Switched Communication networks, Circuit switching Networks, Circuit switching Concepts, Packet switching Principles: Virtual circuit switching and Datagram switching. **Routing in Packet Switching Networks**: Characteristics, Routing strategies, Link state Routing versus Distance vector Routing. **Least-Cost Routing Algorithms:** Dijkstra's Algorithm, Bellman Ford Algorithm. **Internet Protocol:** Principles of Internetworking: Requirements, Connectionless Operation, Internet Protocol Operation: IP packet, IP addressing, subnet addressing, IPv4, ICMP, ARP, RARP IPv6 (IPv6 Datagram format, comparison with IPv4, and transition from IPv4 to IPv6)		
5	**Transport Layer & Application Layer**	06	L1, L2, L3, L4
	Connection–oriented Transport Protocol Mechanisms: Transmission Control Protocol (TCP): TCP Services, TCP Header format. **User datagram Protocol (UDP) Congestion:** Effects of congestion, Congestion control methods, Traffic management, Congestion control in Packet switching Networks. **Application layer Protocols:** HTTP, FTP, DNS, SMTP, SSH.		
6	**Overview of network analysis and design process**	04	L1, L2, L3
	Network design issues, requirement analysis (user, application, device, network, other) concepts, Routing and forwarding, resource allocation, general principles of network design, network characteristics, performance metric		

Books and References:

S. No.	Title	Authors	Publisher	Edition	Year
1	Computer Networks	S. Tanenbaum	Pearson Education	4th Edition	2002
2	Computer Networks	J. F. Kurose and K. W. Ross	Addison Wesley	5th edition	2012
3	Communication Networks	Alberto Leon Garcia	McGraw Hill Education	2nd edition	2003
4	Data and Computer communications	William Stallings	Pearson Education	10th edition	2013
5	Telecommunications Network Design Algorithms	Aaron Kershenbaum	McGraw Hill education (India) Edition	ISBN: 10: 0070342288, Edition 2014	2014

Online References:

S. No.	Website Name	URL	Modules Covered
1	www.courseera.org	https://www.coursera.org/learn/networking for beginners	M1, M2, M3
2	www.udemy.com	https://www.udemy.com/networking concepts	M1, M2, M3, M4
3	https://nptel.ac.in	https://nptel.ac.in/courses/106105193/	M4, M5
4	http://www.cisco.in	http://www.ciscoh.in/courses/networking/router configuration	M5, M6

@ Practical to be conducted in Capstone Mode

Suggested list of Practical/ Experiments as a mini project:

Work to be done	Hrs.
Identification and Study of Networking Models	8
Project Title Identification	2
Testing of IP commands on command prompt	2
Design and Configure a network using CISCO packet tracer	6
Design and Configure a network using NS2 Simulator	6
Testing of Mini Project	2
Preparation of Report	4
Total Hours	**30**

NOTE: Students must submit one project based on the syllabus at the semester end.

B.E. (Electronics Engineering)							B.E. SEM: VII		
Course Name: Multimedia System Design							Course Code: PEC-ELE7015		
Teaching Scheme (Program Specific)					Examination scheme				
Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation				
Hours Per Week					Theory (100)		Practical/ Oral (25)	Term Work (25)	Total
Theory	Tutorial	Practical	Contact Hours	Credits	IA	ESE	OR	TW	150
03	-	02@	05	4	25	75	25	25	
IA: Internal Assessment - Paper Duration – **1.5Hour** **ESE:** - Semester End Examination Paper Duration - **3 Hours** **The weightage of marks for continuous evaluation of Term work/Report:** Formative (40%), Timely completion of practical (40%) and Attendance (20%)									
Prerequisite: Computer Graphics									

Course Objective: The course intends provide a knowledge about multimedia system design components and understand compression and decompression techniques and different image formats.

Course Outcomes: Students will be able to:

SN	Course Outcomes	RBT level
1	Understand multimedia architecture and its latest applications	L1, L2
2	Understand various multimedia input and output devices	L1, L2
3	Understand various audio and video file formats	L1, L2
4	Apply various compression and decompression techniques for different formats for image, audio and video	L1, L2, L3
5	Understand various retrieval techniques for audio and video	L1, L2
6	Apply planning and development cycle for multimedia projects	L1, L2, L3

Detailed Syllabus:

Module No.	Topics	Hrs	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Fundamentals of Multimedia Systems Design** An Introduction Multimedia Systems, Design Fundamentals, Elements of multimedia, Multimedia system architecture - High resolution graphics display, IMA Architectural Framework, Network architecture for multimedia systems, Defining objects for Multimedia systems: Text, Images, Audio and video	6	L1, L2
2	**Multimedia Input and Output Technologies** Key Technology Issues, Touch screen, Pen Input, Video and Image Display Systems, Print Output Technologies, Image Scanners, Digital Voice and Audio, Video Images and Animation, Full Motion Video	09	L1, L2, L3
3	**Multimedia File format and standards** RTF, TIFF, RIFF, MIDI, JPEG DIB, AVI, MIDI audio, JPEG & MPEG standards, MIDI Vs Digital Audio, Analog display standards, Digital display standards, Digital video	09	L1, L2, L3, L4
4	**Compression and Decompression Techniques** Introduction to coding and compression techniques- Lossy and Lossless, Entropy encoding, Run length encoding, Huffman coding, JPEG compression process, Discrete Cosine Transform, Video compression-MPEG-1, MPEG2, MPEG-4, Audio Compression-MPEG, Adaptive differential pulse code modulation	10	L1, L2, L3
	Storage and retrieval technologies		L1, L2, L3

5	Magnetic Media Technology, RAID-Level-0 To 5, Optical Media, WORM optical drives	5	
6	**Planning and costing** Idea Analysis, Pretesting, Task Planning, Prototype Development, Alpha Development, Beta Development, Delivery, Scheduling, Estimating	5	L1, L2, L3, L4
	Total Hours	**45**	

Books and References:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	Multimedia Systems Design Paperback	Prabhat K. Andleigh, Kiran Thakrar	Pearson Education India	First	2015
2	Multimedia: Making it Work	TayVaguhan	McGraw Hill Professional	Seventh Edition	2008
3	Fundamentals of Multimedia	Li and Ze – Nian Mark's Drew	PHI	First	2005

Online References:

Sr. No.	Website Name	URL	Modules Covered
01	NPTEL	https://nptel.ac.in/courses/117/105/117105083/	M1 to M6

@ Practical to be conducted in Capstone Mode

Suggested list of Practical/ Experiments as a mini project:

Work to be done	Hrs.
Identification and Study of multimedia system architecture	8
Project Title Identification	2
Identification of Multimedia input and output technologies	2
Design of the project	6
Design of the project	6
Testing of Mini Project	2
Preparation of Report	4
Total Hours	**30**

NOTE: Students must submit one project based on the syllabus at the semester end.

B.E. (Electronics Engineering)							B.E. SEM: VII		
Course Name: Analog and Mixed VLSI Design							Course Code: PCC-ELE7021		
Teaching Scheme (Program Specific)					Examination scheme				
Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation				
Hours Per Week					Theory (100)		Practical/ Oral (25)	Term Work (25)	Total
Theory	Tutorial	Practical	Contact Hours	Credits	IA	ESE	OR	TW	150
03	-	02@	05	4	25	75	25	25	
IA : Internal Assessment - Paper Duration – **1.5Hour** **ESE :** - Semester End Examination Paper Duration - **3 Hours** **The weightage of marks for continuous evaluation of Term work/Report:** Formative (40%), Timely completion of practical (40%) and Attendance (20%)									
Prerequisite: Analog Electronics I, Analog Electronics II, Digital Circuit Design, IC and Applications									

Course Objectives: The course will introduce students to various mixed circuit's building block and its design techniques. It will also summarize upon issues related to CMOS analog VLSI circuit design and mixed layout design.

Course Outcomes: Students will be able to:

SN	Course Outcomes	RBT level
1	Demonstrate an understanding of analyze building blocks of CMOS analog VLSI circuits.	L1,L2,L3,L4,L5
2	Design basic building blocks of CMOS analog VLSI circuits.	L1,L2,L3,L4
3	Understand and discuss tradeoffs involved in analog VLSI Circuits.	L1,L2,L3
4	Understand the use of tools to carry out verifications of issues involved in analog and mixed signal circuits	L1,L2,L3

Detailed Syllabus:

Module No.	Topics	Hrs	RBT Levels
1	**Analog building blocks** Need for CMOS analog and mixed signal designs, MOS Transistor as sampling switch, active resistances, current source and sinks, current mirror. Voltage References: Band Gap References, General Considerations, Supply-independent biasing, Temperature independent references,	7	L1,L2,L3
2	**Amplifier Fundamentals** Single Stage Amplifiers: Basic concepts, Gain Bandwidth (GBW), Common-source stage (with resistive load, diode connected load, current source load, triode load, source degeneration), source follower, common gate stage. Differential Amplifiers: Single ended and differential operation, Basic differential pair, Common-mode response, Differential pair with MOS loads..	8	L1,L2,L3,L4, L5
3	**MOS Operational Amplifiers** Stability and Frequency Compensation: General Considerations, Multipole systems, Phase margin, Frequency compensation, compensation of two stage op- amps Op-amp Design: General Considerations, performance parameters, One-stage op- amps, Two-stage op-amps, Gain Boosting, Common-mode feedback, Input range limitations(ICMR), in op-amps. Design of single ended and double ended two stage Op-amps	10	L1,L2,L3,L4, L5

4	**Mixed Signal Circuits** Basic Concepts: AMS design flow, ASIC, Full custom design, Semicustom design, System on Chip, System in package, Hardware software co-design, and mixed signal layout issues. Oscillators: General considerations, Ring oscillators, LC oscillators ,VCO Phase-Locked Loop: Simple PLL, Charge pump PLL, Non-ideal effects in PLL, Delay locked loops and applications of PLL in integrated circuits	7	L1,L2,L3
5	**Data Converter Fundamentals** Switch Capacitor Circuits: MOSFETs as switches, Speed considerations, Precision Considerations, Charge injection cancellation, Unity gain buffer, Non- inverting amplifier and integrator. Basic CMOS comparator Design Fundamentals: Analog versus discrete time signals, converting analog signals to data signals, sample and hold characteristics. DAC specifications, ADC specifications, DAC architectures and ADC architectures	7	L1,L2
6	**Layout Techniques** ASIC design flow ,Basic of analog layout techniques, different concept like floor planning, shielding	6	L1,L2

Books and References:

SR. No.	Title	Authors	Publisher	Edition	Year
1	Design of Analog CMOS Integrated Circuits	B Razavi	Tata McGraw Hill	First	2000
2	CMOS Circuit Design, Layout, and Simulation	R. Jacaob Baker, Harry W. Li, David E. Boyce	Wiley	Student	1997
3	CMOS Analog Circuit Design	P. E. Allen and D. R. Holberg,	Oxford University Press	Third	2010
4	Analysis and design of Analog Integrated Circuits	Gray, Meyer, Lewis, Hurst	Wiley	Fifth	2008

Online References:

SR. No.	Website Name	URL	Modules Covered
1	https://accessengineeringlibrary.com/	https://www.accessengineeringlibrary.com/content/book/9780071826631	M1,M2,M3,M4 ,M5,M6
2	https://accessengineeringlibrary.com/	https://www.accessengineeringlibrary.com/content/book/9781260441451	M1,M2,M3,M4 ,M5,M6
3	https://nanohub.org/	https://nanohub.org/resources/	M1,M2,M3,M4
4	https://nptel.ac.in	https://nptel.ac.in/courses/117107094/	M1,M2,M3,M5
5	https://nptel.ac.in	http://www.nptelvideos.in/2012/11/analog-ics.html	M1,M2,M3,M4 ,M5,M6

@ Practical to be conducted in Capstone Mode

Suggested list of Practical/ Experiments as a mini project:

Work to be done	Hrs.
To design Common Gate amplifier and analyze its frequency response	2hr/week
To design Common Source amplifier and analyze its frequency response.	2hr/week
To design Source Follower and analyze its frequency response	2hr/week
To design two stage operational amplifier for given specifications	2hr/week

To design Common Gate amplifier and analyze its frequency response	2hr/week
To analyze Differential amplifier with passive load and its frequency response	2hr/week
To analyze Differential amplifier with active load and its frequency response	2hr/week
R-2R ladder networks	2hr/week
Current steering	2hr/week
Cyclic DAC	2hr/week
Flash	2hr/week
Integrating ADCs	2hr/week
Successive approximation ADCs	2hr/week
Total Hours	**30**

NOTE: Students must submit one project based on the syllabus at the semester end.

B.E. (Electronics Engineering)							B.E. SEM:VII		
Course Name: Internet Programming							Course Code: PEC-ELE7022		
Teaching Scheme (Program Specific)					Examination scheme				
Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation				
Hours Per Week					Theory (100)		Practical/Oral (25)	Term Work (25)	Total
Theory	Tutorial	Practical	Contact Hours	Credits	IA	ESE	OR	TW	150
03	-	02@	05	4	25	75	25	25	

IA : Internal Assessment - Paper Duration – **1.5Hour**
ESE : - Semester End Examination Paper Duration - **3 Hours**
The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance (20%)

Prerequisite: Operating System

Course Objectives: To introduce students with mobile operating system and mobile development IDE‟s. The course will explain the core concepts related to mobile application development.

Course Outcomes: Students will be able to:

SN	Course Outcomes	RBT level
1	Apply Java basics for creating websites and web pages	L1,L2,L3,L4
2	Build web page and web sites using basic HTML tags	L1,L2,L3,L4
3	build dynamic and responsive web sites using JavaScript	L1,L2,L3,L4
4	Develop server side programs using Servlets and JSP.	L1,L2,L3,L4
5	Construct web pages in PHP with database connectivity and to represent data in XML format.	L1,L2,L3,L4
6	Build responsive, mobile-first websites using Bootstrap.	L1,L2,L3,L4

Detailed Syllabus:

Module No.	Topics	Hrs	RBT levels
1	**JAVA PROGRAMMING.**	6	L1, L2, L3, L4,
	An overview of JAVA – Syntax, Data Types, Variables and Arrays, Operators, Control Statements etc ,JAVA Methods – method overloading, scope, recursion JAVA classes – modifiers, encapsulation, Interface, inheritance etc JAVA File handling – read, write , delete file Java Examples		
2	**WEBSITES BASICS - HTML**	6	L1, L2, L3, L4
	Basics-RIA Rich Internet Applications - Collaborations tools - Understanding websites and web servers: Understanding Internet – Difference between websites and web server- Internet technologies Overview –Understanding the difference between internet and intranet; HTML and CSS: HTML 5.0 , XHTML, CSS 3.		
3	**CLIENT SIDE PROGRAMMING**	8	L1, L2, L3, L4
	Java Script: An introduction to JavaScript-JavaScript DOM Model-Date and Objects,-Regular Expressions- Exception Handling-Validation-Built-in objects-Event Handling, DHTML with JavaScript- JSON introduction – Syntax – Function Files – Http Request -SQL.		
4	**SERVER SIDE PROGRAMMING**	8	L1, L2, L3, L4
	Servlets: Java Servlet Architecture- Servlet Life Cycle- Form GET and POST actions-Session Handling- Understanding Cookies- Installing and Configuring Apache Tomcat Web Server DATABASE CONNECTIVITY: JDBC perspectives, JDBC program		

	example – JSP: Understanding Java Server Pages-JSP Standard Tag Library (JSTL)-Creating HTML forms by embedding JSP code.		
5	**PHP and XML** An introduction to PHP: PHP- Using PHP- Variables- Program control- Built-in functions-Connecting to Database – Using Cookies-Regular Expressions; XML: Basic XML- Document Type Definition- XML Schema DOM and Presenting XML, XML Parsers and Validation, XSL and XSLT Transformation, News Feed (RSS and ATOM).	9	L1,L2,L3,L4
6	**INTRODUCTION BOOTSTRAP 3** Bootstrap 3 basics – tables, images, alerts, buttons, progress bar, panels, collapse, forms etc Bootstrap grids – vertical, horizontal, small, medium, large	8	L1,L2,L3,L4
	TOTAL	45	

Books and References:

SR. No.	Title	Authors	Publisher	Edition	Year
1	Internet and World Wide Web - How to Program	Deitel and Deitel and Nieto	Prentice Hall	5th Edition.	2011
2	Web Technologies A Computer Science Perspective	Jeffrey C and Jackson,	Pearson Education	-	2011
3	Java-The Complete Reference	Herbert Schildt	Mc Graw Hill Professional	English Edition	2011
4	Core Java A Comprehensive Study	Mahesh P. Matha,	Prentice Hall of India	-	2011
5	Web Programming – Building Intranet Applications.	Chris Bates	WileyPublications,	3rd Edition,	2009
6	Web Technology	Gopalan N.P. and Akilandeswari J.,	Prentice Hall of India,	-	2011 .

Online References:

SR. No.	Website Name	URL	Modules Covered
1	https://www.sensors.co.uk/	https://www.webtechnology.uk /	M1 to M6
2	www.udemy.com	https://www.udemy.com/course fwebtechnology	M1,M2,M3,M4

@ Practical to be conducted in Capstone Mode

Suggested list of Practical/ Experiments as a mini project:

Work to be done	Hrs.
Experiment on JAVA using Data Types – Variables and Arrays – Operators – Control Statements – Classes – Objects – Methods – Inheritance - Packages	4
Experiment on HTML - Collaborations tools - Understanding websites and web servers: Understanding Internet	4
Experiment on Java Servlet Architecture- Servlet Life Cycle- Form GET and POST actions- Session Handling-	4
Experiment on Using PHP- Variables- Program control- Built-in functions-Connecting to Database –	4
Experiment on Bootstrap – tables, images, alerts, buttons, progress bar, panels, collapse, forms, grids etc	4
Mini Project	6
Testing of project and Preparation of Report	4
Total Hours	**30**

NOTE: Students must submit one project based on the syllabus at the semester end.

B.E. (Electronics Engineering)							B.E. SEM:VII		
Course Name: Power Electronics and Drives							Course Code:PEC-ELE7023		
Teaching Scheme (Program Specific)					Examination scheme				
Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation				
Hours Per Week					Theory (100)		Practical/ Oral (25)	Term Work (25)	Total
Theory	Tutorial	Practical	Contact Hours	Credits	IA	ESE	OR	TW	150
03	-	02@	05	4	25	75	25	25	
IA : Internal Assessment - Paper Duration – **1.5Hour** **ESE :** - Semester End Examination Paper Duration - **3 Hours** **The weightage of marks for continuous evaluation of Term work/Report:** Formative (40%), Timely completion of practical (40%) and Attendance (20%)									
Prerequisite: Basic Electrical and Electronics Engineering, Electrical Networks									

Course Objectives: To enhance the ideas of students for more complex power electronic system and to teach the analytical methods in power electronic systems exposing the students to various applications of power electronics in electronics equipment, drives and non-conventional energy systems.

Course Outcomes: Students will be able to:

SN	Course Outcomes	RBT level
1	Understand working of power devices	
2	Thoroughly understand the modern methods of analysis and control of power electronic systems.	L1
3	Carry out the theoretical analysis of the power electronic systems	L1, L2,L3
4	Understand power electronic converters.	L1, L2, L3
4	Simulate and analyze power electronic systems.	L1, L2, L3,L4
5	Understand Applications in power electronics AC and DC drives	L1, L2, L3,L4
6	Understand applications of power electronics systems.	L1, L2, L3,L4

Detailed Syllabus:

Module No.	Topics	Hrs	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Single-phase Rectifiers** 1.1 Introduction to Power Devices 1.2 Introduction to controlled rectifiers, Half wave controlled rectifiers with R, RL load, effect of free-wheeling diode, Full wave fully controlled rectifiers (centre-tapped, bridge configurations), full-wave half controlled (semi-converters) with R, RL load, effect of freewheeling diode. 1.3 Calculation of performance parameters	7	L1, L2
2	**Single -phase inverters and control** 2.1 Introduction to basic and improved series/parallel inverters. 2.2 Introduction, principle of operation, performance parameters of Single-phase half / full bridge voltage source inverters with R and R-L load. 2.3 Voltage control of single-phase inverters using PWM techniques, harmonic neutralization of inverters.	7	L1, L2, L3
	DC-DC Converters	8	

3	3.1 Basics of chopper circuits, basic buck, boost and buck-boost converters. 3.2 Feedback control of converters (PI and PID).		L1, L2, L3, L4
4	**Power Electronic Applications in DC Drives** 4.1 Introduction to DC motors, speed control of DC motor, drives with semi converters, full converters and dual converters. 4.2 Chopper-based drive. 4.3 BLDC control mechanism	8	L1, L2, L3
5	**Power Electronic Applications in AC Drives** 5.1 Introduction to three-phase induction motor, speed control methods for three-phase induction motor i) Stator voltage ii) Variable frequency iii) Rotor resistance iv) V/f control v) Slip power recovery schemes	7	L1, L2, L3, L4
6	**Power Electronic Applications** 6.1 Application areas in electric vehicle and utilities for charging electric vehicles. 6.2 Induction heating, Energy conversion in renewable energy system.	8	L1, L2, L3, L4
	Total Hours	**45**	

Books and References:

SN	Title	Authors	Publisher	Edition	Year
1	Power Electronics	M. H. Rashid	Pearson	Third	2008
2	Power Electronics	Ned Mohan, Undeland, Robbins	John Wiley Publication	Second	2011
3	Power Electronics	P. S. Bhimbra	Khanna Publishers	Second	2012
4	Power Electronics	M.D. Singh and K. B. Khanchandani	Tata McGraw Hill	Second	2011
5	Fundamentals of Power Electronics	R. W. Erickson, D. Maksimovic	Springer	2nd Edition	--

Online References:

S. No.	Website Name	URL	Modules Covered
1	www.udemy.com	https://www.udemy.com/topic/electronics/	M4,M5, M6
2	https://nptel.ac.in	https://nptel.ac.in/courses	M1,M2,M3,M4,M5, M6
3	http://www.electrical4u.com	http://www.electrical4u.com/electric-machines/	M1,M2,M3

Suggested List of Practical/ Experiments:

Practical Number	Type of Experiment	Practical/ Experiment Topic	Hrs.	Cognitive Level s as per Blooms Taxonomy
1		To study characteristics of power electronics devices.	2	L1, L2

2	**Basic Experiments**	To implement firing circuits of SCR.	2	L1,L2,L3
3		To vary the output voltage of Full bridge rectifier by varing firing angle.	2	
4		Simulation of single phase Half wave and Full wave rectifier circuit using Matlab for various firing angles.	2	L1, L2, L3
5		To simulate single phase PWM inverter with various load conditions	2	L1, L2
6		To implement step down chopper for various control strategies of duty cycle.	2	L1,L2,L3
7	**Design Experiments**	To simulate Induction motor with V/f control.	2	L1,L2,L3
8		To construct three phase fed closed loop chopper drive circuit and to control the speed of the separately-excited dc motor	2	L1,L2,L3
9	**Advanced Experiments**	Study of electric vehicles infrastructure battery charging phenomenon	2	L1,L2,L3,L4
10		To develop model for electric vehicle battery charging station	2	L1,L2,L3
11 12 13 14	**Mini/Minor Projects/ Seminar/**	1. Thyristor Power Control by IR Remote 2. Lamp Life Extender by ZVS (Zero Voltage Switching) 3. Three Phase Solid State Relay with ZVS 4. Industrial Battery Charger by Thyristor Firing Angle Control 5. Precise Illumination Control of Lamp 6. Sine Pulse Width Modulation (SPWM)	6	L1,L2,L3,L4,L5,L6
15	**Case study**	1. Power Electronics Converters for Wind Turbine Systems 2. Remote AC Power Control by Android Application with LCD Display	4	L1,L2,L3

B.E. (Electronics Engineering)							B.E. SEM:VII		
Course Name: Power Electronics and Drives							Course Code:PEC-ELE7023		
Teaching Scheme (Program Specific)					Examination scheme				
Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation				
Hours Per Week					Theory (100)		Practical/ Oral (25)	Term Work (25)	Total
Theory	Tutorial	Practical	Contact Hours	Credits	IA	ESE	OR	TW	150
03	-	02@	05	4	25	75	25	25	
IA : Internal Assessment - Paper Duration – **1.5Hour** **ESE :** - Semester End Examination Paper Duration - **3 Hours** **The weightage of marks for continuous evaluation of Term work/Report:** Formative (40%), Timely completion of practical (40%) and Attendance (20%)									
Prerequisite: Basic Electrical and Electronics Engineering, Electrical Networks									

Course Objectives: To enhance the ideas of students for more complex power electronic system and to teach the analytical methods in power electronic systems exposing the students to various applications of power electronics in electronics equipment, drives and non-conventional energy systems.

Course Outcomes: Students will be able to:

SN	Course Outcomes	RBT level
1	Understand working of power devices	
2	Thoroughly understand the modern methods of analysis and control of power electronic systems.	L1
3	Carry out the theoretical analysis of the power electronic systems	L1, L2,L3
4	Understand power electronic converters.	L1, L2, L3
4	Simulate and analyze power electronic systems.	L1, L2, L3,L4
5	Understand Applications in power electronics AC and DC drives	L1, L2, L3,L4
6	Understand applications of power electronics systems.	L1, L2, L3,L4

Detailed Syllabus:

Module No.	Topics	Hrs	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Single-phase Rectifiers** 1.1 Introduction to Power Devices 1.2 Introduction to controlled rectifiers, Half wave controlled rectifiers with R, RL load, effect of free-wheeling diode, Full wave fully controlled rectifiers (centre-tapped, bridge configurations), full-wave half controlled (semi-converters) with R, RL load, effect of freewheeling diode. 1.3 Calculation of performance parameters	7	L1, L2
2	**Single -phase inverters and control** 2.1 Introduction to basic and improved series/parallel inverters. 2.2 Introduction, principle of operation, performance parameters of Single-phase half / full bridge voltage source inverters with R and R-L load. 2.3 Voltage control of single-phase inverters using PWM techniques, harmonic neutralization of inverters.	7	L1, L2, L3
	DC-DC Converters	8	

3	3.1 Basics of chopper circuits, basic buck, boost and buck-boost converters. 3.2 Feedback control of converters (PI and PID).		L1, L2, L3, L4
4	**Power Electronic Applications in DC Drives** 4.1 Introduction to DC motors, speed control of DC motor, drives with semi converters, full converters and dual converters. 4.2 Chopper-based drive. 4.3 BLDC control mechanism	8	L1, L2, L3
5	**Power Electronic Applications in AC Drives** 5.1 Introduction to three-phase induction motor, speed control methods for three-phase induction motor i) Stator voltage ii) Variable frequency iii) Rotor resistance iv) V/f control v) Slip power recovery schemes	7	L1, L2, L3, L4
6	**Power Electronic Applications** 6.1 Application areas in electric vehicle and utilities for charging electric vehicles. 6.2 Induction heating, Energy conversion in renewable energy system.	8	L1, L2, L3, L4
	Total Hours	**45**	

Books and References:

SN	Title	Authors	Publisher	Edition	Year
1	Power Electronics	M. H. Rashid	Pearson	Third	2008
2	Power Electronics	Ned Mohan, Undeland, Robbins	John Wiley Publication	Second	2011
3	Power Electronics	P. S. Bhimbra	Khanna Publishers	Second	2012
4	Power Electronics	M.D. Singh and K. B. Khanchandani	Tata McGraw Hill	Second	2011
5	Fundamentals of Power Electronics	R. W. Erickson, D. Maksimovic	Springer	2nd Edition	--

Online References:

S. No.	Website Name	URL	Modules Covered
1	www.udemy.com	https://www.udemy.com/topic/electronics/	M4,M5, M6
2	https://nptel.ac.in	https://nptel.ac.in/courses	M1,M2,M3,M4,M5, M6
3	http://www.electrical4u.com	http://www.electrical4u.com/electric-machines/	M1,M2,M3

Suggested List of Practical/ Experiments:

Practical Number	Type of Experiment	Practical/ Experiment Topic	Hrs.	Cognitive Level s as per Blooms Taxonomy
1		To study characteristics of power electronics devices.	2	L1, L2

2	**Basic Experiments**	To implement firing circuits of SCR.	2	L1,L2,L3
3		To vary the output voltage of Full bridge rectifier by varing firing angle.	2	
4		Simulation of single phase Half wave and Full wave rectifier circuit using Matlab for various firing angles.	2	L1, L2, L3
5		To simulate single phase PWM inverter with various load conditions	2	L1, L2
6		To implement step down chopper for various control strategies of duty cycle.	2	L1,L2,L3
7	**Design Experiments**	To simulate Induction motor with V/f control.	2	L1,L2,L3
8		To construct three phase fed closed loop chopper drive circuit and to control the speed of the separately-excited dc motor	2	L1,L2,L3
9	**Advanced Experiments**	Study of electric vehicles infrastructure battery charging phenomenon	2	L1,L2,L3,L4
10		To develop model for electric vehicle battery charging station	2	L1,L2,L3
11 12 13 14	**Mini/Minor Projects/ Seminar/**	1. Thyristor Power Control by IR Remote 2. Lamp Life Extender by ZVS (Zero Voltage Switching) 3. Three Phase Solid State Relay with ZVS 4. Industrial Battery Charger by Thyristor Firing Angle Control 5. Precise Illumination Control of Lamp 6. Sine Pulse Width Modulation (SPWM)	6	L1,L2,L3,L4,L5,L6
15	**Case study**	1. Power Electronics Converters for Wind Turbine Systems 2. Remote AC Power Control by Android Application with LCD Display	4	L1,L2,L3

B.E. Semester –VII									
B.E. (Electronics Engineering)							B.E. SEM: VII		
Course Name: Digital Signal Processing							Course Code: PEC-ELE7024		
Teaching Scheme (Program Specific)					Examination scheme				
Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation				
Hours Per Week					Theory (100)		Practical/ Oral (25)	Term Work (25)	Total
Theory	Tutorial	Practical	Contact Hours	Credits	IA	ESE	OR	TW	150
3	-	2@	5	4	25	75	25	25	
IA: Internal Assessment - Paper Duration – **1.5 Hour** **ESE:** - End Semester Examination Paper Duration - **3 Hours** **The weightage of marks for continuous evaluation of Term work/Report:** Formative (40%), Timely completion of practical (40%) and Attendance (20%)									
Prerequisite: Signals and Systems, IC and Applications									

Course Objective: To Impart the design and performance analysis techniques of digital filters. The course will also introduce the students to advanced signal processing techniques, digital signal and their applications.

Course Outcomes: Students will be able to:

SN	Course Outcomes	Cognitive Levels as per Bloom's Taxonomy
1	Demonstrate an understanding of the discrete-time Fourier transform and the concept of digital frequency.	L1, L2, L3
2	Design FIR and IIR digital filters to meet arbitrary specifications and Develop algorithms for implementation	L1, L2, L3, L4
3	Understand the effect of hardware limitations on performance of digital filters	L1, L2
4	Understand the fundamentals of digital image representation and simple pixel relations and apply various image transforms techniques to different digital images.	L1, L2, L3, L4
5	Understand the use of advanced signal processing techniques, digital signal processors and digital image processing in various applications	L1, L2

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive Levels as per Bloom's Taxonomy
1	**Discrete Fourier Transform and Fast Fourier Transform** Definition and Properties of DFT, IDFT, circular convolution of sequences using DFT and IDFT, Relation between Z-transform and DFT Filtering of long data sequences, Method Computation of DFT, Fast Fourier transforms (FFT), Radix-2decimationintime and decimation in frequency FFT algorithms, inverse FFT,	09	L1, L2, L3
2	**IIR Digital Filters** Types of IIR Filters (Low Pass, High Pass, Band Pass, Band stop and All Pass) Analog filter approximations: Butterworth, Chebyshev I and II, Mapping of S-plane to Z-plane, impulse invariance method, bilinear transformation method, Design of IIR digital filters from analog filters with examples,	08	L1, L2, L3

3	**FIR Digital Filters** Characteristics of FIR digital filters, Minimum Phase, Maximum Phase, Mixed Phase and Linear Phase Filters Frequency response, location of the zeros of linear phase FIR filters, Design of FIR filters using window techniques (Rectangular, Hamming, Hanning, Blackmann, Barlet) Comparison of IIR and FIR filters	06	L1, L2, L3, L4
4	**Finite Word Length Effects in Digital Filters and Multirate DSP** Quantization, truncation and rounding, Effects due to truncation and rounding, Input quantization error, Product quantization error, Co-efficient quantization error, Zero input limit cycle oscillations, Overflow limit cycle oscillations, Scaling, Quantization in Floating Point realization of IIR digital filters Finite word length effects in FIR digital filters Introduction and concept of Multirate Processing, Block Diagram of Decimator and Interpolator, Decimation and Interpolation by Integer numbers Multistage Approach to Sampling rate converters, Sample rate conversion using Polyphase filter structure	06	L1, L2, L3
5	**Basics of Image Processing & Image Transforms** **Digital Image Fundamentals:** Elements of Visual Perception, A Simple Image Model, Two-dimensional Sampling and Quantization, Tonal and Spatial Resolutions, Some Basic Relationships between Pixels, Image File Formats: BMP, TIFF and JPEG. Color Models (RGB, HSI, YUV) **Image Transforms:** Introduction to 2-Dimensional Fourier Transform, Discrete Fourier Transform, Properties of the Two-Dimensional Fourier Transform, Fast Fourier Transform (FFT), Computation of 2 DFFT 5.2 Discrete Hadamard Transform (DHT), Fast Hadamard Transform (FHT), Discrete Cosine Transform (DCT), Introduction to Discrete Wavelet Transform (DWT) **Enhancement in the frequency domain:** Frequency Domain Filtering Lowpass Filtering, High-pass Filtering, Homomorphic Filtering, Generation of Spatial Masks from Frequency Domain Specifications	08	L1, L2, L3, L4
6	**DSP & DIP Applications** Applications of DSP: Radar Signal Processing and Speech Processing, Applications of DIP: Case Study on Digital Watermarking, Biometric Authentication (Face, Fingerprint, Signature Recognition), Vehicle Number Plate Detection and Recognition, Object Detection using Correlation Principle, Person Tracking using DWT, Handwritten and Printed Character Recognition, Contend Based Image Retrieval, Text Compression	08	L1, L2

Books and References:

SR. No	Title	Authors	Publisher	Edition	Year
1	Digital Signal Processing, A Practical Approach	Emmanuel C. Ifeachor, Barrie W. Jervis	Pearson Education	2nd Edition	2011
2	Digital Signal Processing	Tarun Kumar Rawat	Oxford University Press	2nd Edition	2015
3	Digital Signal Processing	Proakis J., Manolakis D	Pearson Education	4th Edition	2010
4	Digital Signal Processing – A Computer Based Approach	Sanjit K. Mitra	McGraw Hill Education	4th Edition	2012

			(India) Private Limited		
5	Discrete Time Signal Processing	Oppenheim A., Schafer R., Buck J.	Pearson Education	2nd Edition	2010
6	Digital Signal Processors, Architecture, Programming and Applications	B. Venkata Ramaniand, M. Bhaskar	Tata McGraw Hill	3rd Edition	2004
7	Theory and Applications of Digital Signal Processing	L. R. Rabinerand B. Gold	Prentice-Hall of India	4th Edition	2006
8	Digital Signals Processing	A. Nagoor Kani	Tata McGraw-Hill Education	2nd Edition	2017
9	Digital Image Processing	Rafel C. Gonzalez and Richard E. Woods	Pearson Education, Asia	3rd edition	2009
10	Fundamentals and Digital Image Processing	Anil K. Jain	Prentice Hall of India Private Ltd	3rd edition	2009
11	Digital Image Processing	S. Jayaraman, E. Esakkirajan and T. Veerkumar	TataMcGraw Hill Education Private Ltd.	1st edition	2009
12	Digital Image Processing	William K. Pratt	John Wiley & Sons, Inc.	3rd edition	2001

Online References:

SR. No.	Website Name	URL	Modules Covered
1	https://nptel.ac.in	https://nptel.ac.in/courses/117102060/	M1, M2, M3
2	https://swayam.gov.in	https://swayam.gov.in/nd1_noc19_ee50/preview	M1, M2, M3, M4
3	http://www.ti.com	http://www.ti.com/processors/digital-signal-processors/overview.html	M5, M6
4	https://www.analog.com	https://www.analog.com/en/design-center/landing-pages/001/beginners-guide-to-dsp.html	M4, M5, M6
5	https://www.nxp.com	https://www.nxp.com/products/processors-and-microcontrollers/additional-processors-and-mcus/digital-signal-processors:Digital-Signal-Processors	M6
6	https://www.classcentral.com/	https://www.classcentral.com/course/coursera-digital-signal-processing-423	M1, M2, M3, M4, M5
7	www. university of tartu.org	https://sisu.ut.ee/imageprocessing/book/1	M1, M2, M3
8	www.courseera.org	https://www.coursera.org/learn/computervision-imageprocessing	M1, M2, M3, M4
9	www.udemy.com	https://www.udemy.com/course/image-processing-and-computer-vision-with-python-opencv/	M2, M3, M4
10	https://nptel.ac.in	https://nptel.ac.in/courses/117105079/	M1, M2, M3, M4, M5, M6

@ Practical to be conducted in Capstone Mode

Suggested list of Practical/ Experiments as a mini project:

Work to be done	**Hrs.**
Design & implementation of Low Pass Butterworth filter.	2hr/week
Design & implementation of IIR Butterworth LPF using IIMT method.	2hr/week
Design & implementation of IIR Butterworth LPF using BLT method	2hr/week
Design FIR using windowing method	2hr/week
Design decimation & interpolation for defined factor.	2hr/week
To Compare performance of various windowing method for FIR filter	2hr/week
To Compute FFT and compare performance of DFT and FFT	2hr/week
Surveillance Checking with Android Phone	2hr/week
Forgery Detection of Medical Image.	2hr/week
Identification of Human Act by Image Processing	2hr/week
Currency Identification System	2hr/week
Intelligent Traffic Light Control using Image Processing	2hr/week
Image Slider using MATLAB	2hr/week
Total Hours	**30**

NOTE: Students must submit one project based on the syllabus at the semester end.

B.E. (Electronics Engineering)							B.E. SEM:VII		
Course Name: Special Electronics & Applications							Course Code:PCC-ELE7025		
Teaching Scheme (Program Specific)					Examination scheme				
Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation				
Hours Per Week- Theory (100)							Practical/Oral (25)	Term Work (25)	Total
Theory	Tutorial	Practical	Contact Hours	Credits	IA	ESE	OR	TW	150
03	-	02@	05	4	25	75	25	25	
IA : Internal Assessment - Paper Duration – **1.5Hour** **ESE :** - Semester End Examination Paper Duration - **3 Hours** **The weightage of marks for continuous evaluation of Term work/Report:** Formative (40%), Timely completion of practical (40%) and Attendance (20%)									
Prerequisite: Analog Electronics I, Analog Electronics II, Digital Circuit Design, IC and Applications									

Course Objectives: The course aims at providing knowledge of the short channel effects and the different transistors that can be used for high-speed VLSI circuit design

Course Outcomes: Students will be able to:

SN	Course Outcomes	RBT level
1	Understand the basic CMOS process flow and the different short channel effects	L1,L2,L3
2	Explain the different SOI, FinFET and CNTFET	L1,L2,L3,L4,L5
3	Understand the MOS capacitor and the different integration issues of high k dielectric	L1,L2,L3,L4
4	Understand the need and of germanium nano mosfet	L1,L2,L3
5	Explain Metal gate transistor and its different integration issues	L1,L2,L3
6	Explain the different Emerging nano materials and structures	L1,L2

Detailed Syllabus:

Module No.	Topics	Hrs	RBT Levels
1	**Introduction** Nano devices, Nano materials, Nano characterization. Definition of Technology node, Basic CMOS Process flow. MOS Scaling theory, Issues in scaling MOS transistors : Short channel effects, Description of a typical 65 nm CMOS technology.	06	L1,L2,L3
2	**SOI and Vertical Transistors** Requirements for Non classical MOS transistor SOI - PDSOI and FDSOI, SOI based SRAM design Ultrathin body SOI - double gate transistors, integration issues. Vertical transistors - FinFET and Surround gate FET, Carbon nanotube electronics, bandstructure & transport, devices, applications. Circuit design with FinFET and CNTFET. SRAM design.	10	L1,L2,L3,L4, L5
3	**MOS Capacitor** MOS capacitor, Role of interface quality and related process techniques, Gate oxide thickness scaling trend, SiO2 vs High-k gate dielectrics. Integration issues of high-k . Interface states, bulk charge, band offset, stability, reliability - Qbd high field, possible candidates, CV and IV techniques.	08	L1,L2,L3,L4
4	**Germanium Nano MOSFETs**	08	L1,L2,L3

	Strain, quantization, Advantages of Germanium over Silicon, PMOS versus NMOS. Compound semiconductors - material properties, MESFETs Compound semicocnductors MOSFETs in the context of channel quantization and strain, Hetero structure MOSFETs exploiting novel materials, strain, quantization		
5	**Metal Gate Transistor**	08	L1,L2,L3
	Metal gate transistor: Motivation, requirements, Integration Issues.Transport in Nano MOSFET, velocity saturation, ballistic transport, injection velocity, velocity overshoot.		
6	**Emerging nano materials**	05	L1,L2
	Nanotubes, nanorods and other nano structures, LB technique, Soft lithography etc. Microwave assisted synthesis, Self assembly etc.		

Books and References:

SR. No.	Title	Authors	Publisher	Edition	Year
1	Fundamentals of Modern VLSI Devices	Y. Taur and T. Ning	Cambridge University Press	First	1998
2	Silicon VLSI Technology	Plummer, Deal , Griffin	Pearson Education India.	First	2009
3	Nanoelectronic Circuit Design	Niraj K. Jha, Deming Chen	Springer	First	2010
4	FinFETs and Other Multigate Transistors	Jean-Pierre Colinge	Springer	First	2008
5	SOI Circuit Design Concepts	Kerry Bernstein and N. J. Rohrer	Kluwer Academic Publishers	First	2000
6	The Physics of Low-Dimensional Semiconductors	John H. Davies	Cambridge University Press.	First	1998

Online References:

SR. No.	Website Name	URL	Modules Covered
1	NPTEL	http://ece.iisc.ernet.in/~navakant/nano/2007/course.html.	M1,M3,M4,M6

@ Practical to be conducted in Capstone Mode

Suggested list of Practical/ Experiments as a mini project:

Work to be done	Hrs.
Identification and Study of the different sort channel effects	8
Project Title Identification	2
Testing of the basic circuits on circuit simulator	2
Design the layout of the circuit	6
Analyze the circuit with respect to the speed, power operations	6
Testing of Mini Project	2
Preparation of Report	4
Total Hours	**30**

NOTE: Students must submit one project based on the syllabus at the semester end.

B.E. (Electronics Engineering)							B.E. SEM: VII		
Course Name: Economics for Engineers							Course Code: HSMC- ELE701		
Teaching Scheme (Program Specific)					Examination scheme				
Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation				
Hours Per Week					Theory (100)		Practical/ Oral (25)	Term Work (25)	Total
Theory	Tutorial	Practical	Contact Hours	Credits	IA	ESE	OR	TW	100
03	-	-	03	3	25	75	-	-	
IA : Internal Assessment - Paper Duration – **1.5Hour** **ESE :** - Semester End Examination Paper Duration - **3 Hours** **The weightage of marks for continuous evaluation of Term work/Report:** Formative (40%), Timely completion of practical (40%) and Attendance (20%)									
Prerequisite: Basic Mathematics									

Course Objectives: Engineering economics is a field that addresses the dynamic environment of economic calculations and principles through the prism of engineering

Course Outcomes: Students will be able to:

SN	Course Outcomes	RBT level
1	To understand the principles of economics that govern the operation of any organization under diverse market conditions	L1, L2
2	Comprehend macroeconomic principles and decision making in diverse business set up .	L1, L2, L3, L4
3	To study the Inflation & Price Change as well as Present Worth Analysis	L1, L2, L3, L4
4	Apply the principles of economics through various case studies	L1, L2, L3, L4
5	Analyze the estimating models for economics decision	L1, L2, L3, L4
6	Apply the principles of economics through various case studies	L1, L2, L3

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive Levels as per Bloom's Taxonomy
1	**Economic Decisions** Economic Decisions Making – Overview, Problems, Role, Decision making process, Inflation and Price Change, Present Worth Analysis	6	L1,L2,L3
2	**Cash flow** Cash Flow, Interest and Equivalence: Cash Flow – Diagrams, Categories & Computation, Time Value of Money, Debt repayment, Nominal & Effective Interest. Cash Flow & Rate of Return Analysis Calculations, Treatment of Salvage Value,	7	L1, L2,L3
3	**Cost and Estimation** Engineering Costs & Estimation – Fixed, Variable, Marginal & Average Costs, Sunk Costs, Opportunity Costs, Recurring and Nonrecurring Costs, Incremental Costs, Cash Costs vs Book Costs, Life-Cycle Costs; Types of Estimates,	8	L1,L2,L3,L4
4	**Modelling** Estimating Models - Per-Unit Model, Segmenting Model, Cost Indexes, Power-Sizing Model, Improvement & Learning Curve, Benefits. Case Study - Price and Income Elasticity of Demand in the real world	8	L1,L2,L3,L4
5	**Cash flow aspects analysis**	8	

	Annual Cash Flow Analysis, Analysis Periods; In-Semester Rate Of Return, Calculating Rate of Return, Incremental Analysis; Best Alternative Choosing An Analysis Method, Future Worth Analysis, Benefit-Cost Ratio Analysis, Sensitivity And Breakeven Analysis. Economic Analysis In The Public Sector - Quantifying And Valuing Benefits & drawbacks.		L1,L2,L3,L4
6	**Economic Decisions & Case studies** Definition, Effects, Causes, Price Change with Indexes, Types of Index, Composite vs Commodity Indexes, Use of Price Indexes In Engineering Economic Analysis, Cash Flows that inflate at different Rates.Case Study – Competition in the Advertise Segment in India	8	L1, L2,L3

Books and References:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	Engineering Economics	James L.Riggs,David D. Bedworth, Sabah U. Randhawa	Tata McGraw-Hill	4th Edition	2004
2	Engineering Economics Analysis	Donald Newnan, Ted Eschembach, Jerome Lavelle	Oxford press	3rd Edition	2004
3	Principle of Engineering Economic Analysis	John A. White, Kenneth E.Case,DavidB.Pratt	John Wiley	9th Edition	2012
4	Engineering Economics Analysis	Author : Michael R Lindeburg	Professional Pubns Inc	1st Edition	1997

Online References:

Sr. No.	Website Name	URL	Modules Covered
1	https://ocw.mit.edu/courses/economics/	https://ocw.mit.edu/courses/economics/	M1,M2,M3,M4,M5
2	https://onlinecourses.nptel.ac.in/noc20_hs03/preview	https://onlinecourses.nptel.ac.in/noc20_hs03/preview	M1,M2,M3,M4,M5

Suggested Case study: case study relevant to industry, national or international level

B.E. Semester –VII									
B.E. (Electronics Engineering)							**B.E. SEM:** VII		
Course Name: Major Project -I							**Course Code:** PROJ- ELE701		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR**	**TW**	**50**
-	-	6	6	3			25	25	
Prerequisite: This project work in final year may be extension of the Mini Project work done in pre-final year.									

Course Objective: The project work may be internally assigned or may be externally assigned by the research institutes, industry etc. Each group will be assigned one faculty as a supervisor. This project work in final year

Course Outcomes: Students will be able to:

SN	Course Outcomes	Cognitive Level s as per Blooms Taxonomy
1	Learning additional skills	L1, L2, L3, L4,L5
2	Development of ability to define, design, analysis and implementation of the problem and lead to its accomplishment with proper planning	L1, L2, L3, L4,L5
3	Learn the behavioral science by working in a group	L1 L2 L3
4	The project area may be selected in which the student intend to do further education and/or may be either intend to have employment or self employment	L1, L2, L3, L4,L5
5	Learn the behavioral science by working in a group	L1, L2, L3, L4,L5
6	The topic of project should be different and / or may be advancement in the same topic of Mini Project	L1, L2, L3, L4,L5

Detailed Syllabus:

Module No	Topics	Hrs.	Cognitive Level s as per Blooms Taxonomy
1	The main intention of Project work is to enable students to apply the knowledge and skills learned out of courses studied to solve/implement predefined practical problem. The Project work may be beyond the scope of curriculum of courses taken or may be based on the courses but thrust should be I. Learning additional skills II. Development of ability to define, design, analysis and implementation of the problem and lead to its accomplishment	**06/**	L1, L2, L3, L4,L5

	with proper planning III. Learn the behavioral science by working in a group IV. The project area may be selected in which the student intend to do further education and/or may be either intend to have employment or self-employment V. The topic of project should be different and / or may be advancement in the same topic of Mini Project VI. The students may use this opportunity to learn different computational techniques as well as some model development. This they can achieve by making proper selection of Project work. The Institute should keep proper assessment record of the progress of project and at the end of the semester it should be assessed for awarding TW marks. The TW should be examined by approved internal faculty appointed by the head of the institute on the basis of following: I. Scope and objective of the project work. II. Extensive Literature survey. III. Progress of the work (Continuous assessment) IV. Report in prescribed University format. An approved external examiner from Industry and internal examiner appointed by the head of the institute together will assess during oral examination. The oral examination is a presentation by the group members on the project along with demonstration of the work done. In the examination each individual student should be assessed for his/her contribution, understanding and knowledge gained.	**week**	

B.E. Semester –VII
Choice Based Credit Grading Scheme with Holistic Student Development (CBCGS-H 2019)
TCET Autonomy Scheme (w.e.f. A.Y. 2020-21)

<table>
<tr><td colspan="5">B.E.(Electronics Engineering)</td><td colspan="3">B.E.(SEM : VII)</td></tr>
<tr><td colspan="5">Course Name : Professional Skills- VII</td><td colspan="3">Course Code: HSD-ELEPS701</td></tr>
<tr><td colspan="5">Teaching Scheme (Program Specific)</td><td colspan="3">Examination Scheme (Formative/ Summative)</td></tr>
<tr><td colspan="5">Modes of Teaching / Learning / Weightage</td><td colspan="3">Modes of Continuous Assessment / Evaluation</td></tr>
<tr><td colspan="5">Hours Per Week</td><td>Presentation</td><td>Report</td><td>Term Work</td></tr>
<tr><td>Theory</td><td>Tutorial</td><td>Practical</td><td>Contact Hours</td><td>Credits</td><td>AC</td><td>AC</td><td>TW</td></tr>
<tr><td>15</td><td>-</td><td>30</td><td>45</td><td>2</td><td>50</td><td>25</td><td>75</td></tr>
<tr><td colspan="8">Audit course evaluated by Teacher Guardian</td></tr>
<tr><td colspan="8">Mid Semester Assessment for Term work will be on continuous basis</td></tr>
<tr><td colspan="8">Prerequisite: Subject knowledge, Domain knowledge</td></tr>
</table>

Objective:. The course intends to develop professional skills necessary for becoming technically skilled personnel. The course intends to make students aware about how to design digital skills / application to be an successful Industry person /entrepreneur

Course Outcomes: Upon completion of the course students will be able to:

Sr. No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Illustrate important of digital skills .	L1, L2
2	Familiarization of latest and emerging digital skills/suite tools.	L1,L2, L3
3	Learning Installation/usage of tools.	L1,L2, L3
4	Write test cases using digital tools.	L1,L2, L3
5	Identify the various commands and their usage.	L1, L2, L3
6	Apply skills to design simulation based applications such as /robot design	L1, L2, L3

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Basics of digital Skills**	3	L1, L2
	Introduction to digital skills, types of digital skills, Need of collaboration digital skills, Exercise to manually and report errors.		
2	**Introduction to digital skill tools**	2	L1,L2, L3
	Presentation desk and its types, QR code generation and reading, Augmented reality experience and usage		
3	**Basics of Application development**	2	L1,L2, L3
	Step for creating presentation desk with QR code , Step for creating AR Experience with available tools , Basics of Robot design tool, Installation process and operation basics		
4	**Application Commands**	3	L1,L2, L3
	Learning various Commands – level 1,2,3(Actions button, rotation, if else) , Create a script and test it		
5	**Design of Application**	3	L1, L2, L3
	Design of ideation, selection of commands and its implementation., Writing script using a learned tool, Use of level 3 commands in Robot development		
6	**Case Study**	2	L1,L2, L3
	Write a complete executable code for assigned task		
	Total Hours	**15**	

Books and References:

SN	Title	Authors	Publisher	Edition	Year
1	Robot Building for Beginners (Technology in Action)	David Cook	Apress	2nd	2010
2	Winning in the Digital Age: Seven Building Blocks of a Successful Digital Transformation Hardcover – 24 February 2021	Nitin Seth	Penguin Enterprise	1st	2021

Online References:

S. No.	Website Name	URL	Modules Covered
1	https://www.coursera.org/	https://www.coursera.org/in	M1, M2,
2	https://www.udemy.com	https://www.udemy.com/course/make-money-from-your-digital-skills/	M3,M4

4	https://www.coursera.org/	https://www.coursera.org/collections/product-manager-skills	M4,M5,M6

List of Practical/ Experiments:

Practical Number	Type of Experiment	Practical/ Experiment Topic	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	Basic Experiments	To generate QR code	2	L1
2		To generate Augmented reality experience	2	L1, L2
3	Design Experiments	Design presentation desk	2	L1, L2, L3
4		Write program using Line movement using level 1 command	2	L1, L2, L3
5		Write program using Line movement using level 2 command	2	L1, L2, L3
6		Write program using Level 3 commands	2	
7	Advanced Experiments	Write program using level 3 commands to draw diamond	4	L1, L2, L3
8		Write program using sensors	4	L1, L2, L3
9	Mini/Minor Projects/ Seminar/	1. To design a square 2. To design command-based light on /OFF 3. To design touch-based movement	6	L1, L2, L3
10	Case Studies/ Group Presentation	1. Study other tools used for digital skills testing 2. To create presentation desk for assigned project 3. To create QR code for presentation desk 4. To create 3D experience for assigned task	4	L1, L2, L3
		Total Hours	**30**	

B.E. Semester –VII							
B.E. (Electronics Engineering)					**B.E. SEM: VII**		
Course Name: Research Based Learning -III					**Course Code:** HSD-ELERBL701		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**		
Modes of Teaching / Learning / Weightage					**Assessment/Evaluation Scheme**		
Hours Per Week					**Presentation**	**Report**	**Term Work**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**AC**	**AC**	**TW**
-	-	30	30	1	25	25	50
Audit course evaluated by Teacher Guardian							
Mid Semester Assessment for Term work will be on continuous basis							
Prerequisite: Subject knowledge, Domain knowledge							

Course Objectives: This course is focused to engage the learner in research using critical thinking, problem solving, coding and technical writing related to upcoming latest technologies.

Course Outcomes: Upon completion of the course students will be able to:

S.N.	Course Outcome	Cognitive level attainment as per revised Bloom Taxonomy
1	Upgrade the knowledge of latest technologies and developments in their domain.	L1, L2
2	Develop prototype based on idea which providing solutions to industry, research organization, academic organization, community or society as a whole.	L1, L2, L3,L4,l5,L6
3	Design and develop the code /model for given problem definition in a competitive environment and contribute for grants.	L1, L2, L3,L4,l5,L6
4	Write a research paper and understand technical writing.	L1, L2, L3,L4,l5

Detailed Syllabus:

Module No.	Topics	Hours	Cognitive level attainment as per revised Bloom Taxonomy
1	**Participation in online community / Forums/writing Blogs** I. **Registration** on online community/forum/follow blogs /Twitter etc. Creating own Blogs and Linkedin profile. II. **Evaluation** is based on report submission on activities learned through registration on various platforms. Student need to submit Linkedin profile address, Blog URL is recommended **Presentation and Evaluation**	8	L1, L2
2	**Proto type development/ Mathematical model development based on Idea** I. **Proto type development**: Introduction to Research Methodology techniques. Introduction and importance of prototype development. Transforming Idea into prototype with implementation/working model. II. **Presentations** by students, Experience sharing by entrepreneurs or Hackathon Winners. **Presentation and Evaluation**	8	L1, L2, L3,L4,l5,L6

3	**Building Competitive Attitude** I. **Participation in Project competitions/Coding competitions/Working for research grant/Consultancy: a)** Participating at institute/National level/University level/ Conference /participate in competitions. **b)** Participation in funded project/consultancy projects **c)** Experience sharing by good coders/winners II. **Evaluation** based on Presentation/Certificates/ Grant received/Consultancy received **Presentation and Evaluation**	8	L1, L2, L3,L4,l5,L6
4	**Research Paper Publication** I. **Introduction to Research paper writing:** Write a paper/case study on review of literature based on idea and developed prototype. II. **Publishing:** Identification of appropriate journal or conference at University level / State level/National level for submission and Preparation of a review paper. **Evaluation of Research paper based on quality and acceptance of research paper.**	6	L1, L2, L3,L4,L5,L6

References:

Sr. No.	Title	Authors	Publisher	Edition	Year
1.	Guide to Competitive Programming: Learning and Improving Algorithms Through Contests	Antti Laaksonen	Springer	Kindle	2018
2.	Writing Research Papers: A Complete Guide	James D. Lester	Longman	10th	2001
3.	Creativity in Product Innovation	Jacob Goldenberg	Cambridge University Press	Kindle	2002

Online References:

Sr. No.	Website Name	URL	Modules Covered
1.	https://www.researchgate.net	https://www.researchgate.net/publication/224372998_Idea_Generation_Techniques_among_Creative_Professionals	M2
2.	https://discuss.codechef.com	https://discuss.codechef.com/t/programming-contest-detailed-syllabus-along-with-example-problems/17791	M3
3.	https://www.statpac.com	https://www.statpac.com/online-software-manual/Basic-Research-Concepts.htm	M4
4.	https://www.slideshare.net	https://www.slideshare.net/AsirJohnSamuel/1introduction-to-research-methodology?next_slideshow=1	M4