			L	T	P	Cr.
B.Tech.(VSem.)		**POWERELECTRONICS**				
		CourseCode: R2331XXX	3	0	0	3

Pre-requisites: ElectricalCircuitAnalysis,SemiconductorPhysics,ControlSystems

Course Objectives:

- Toknowthecharacteristicsofvariouspowersemiconductor devices.
- Tolearntheoperationofsingle-phasecontrolledconvertersandperformharmonic analysis of input current.
- Tolearntheoperationof threephase-controlled convertersandAC/ACconverters.
- Tolearntheoperationof differenttypesofDC-DCconverters andcontroltechniques.
- Tolearntheoperationof PWMinvertersforvoltagecontrolandharmonicmitigation.

CourseOutcomes: At theendofthe course, thestudentwill beable to

C301.1	:	IllustratethestaticanddynamiccharacteristicsofSCR,Power-MOSFETand Power- IGBT.
C301.2	:	Analyzetheoperationofphase-controlledrectifiers.
C301.3	:	Analyzetheoperationofthree-phasefull–waveconverters,ACVoltageControllers andCycloconverters.
C301.4	:	Examinetheoperationand designofdifferent typesofDC-DC converters.
C301.5	:	AnalyzetheoperationofsquarewaveinvertersandPWMinvertersforvoltage control.

UNIT–I		10 hrs

PowerSemi-ConductorDevices:
Silicon controlled rectifier (SCR) – Two transistor analogy - Static and Dynamic characteristics – Turn on and Turn off Methods - Triggering Methods (R, RC and UJT) – Snubber circuit design. StaticandDynamicCharacteristicsofPowerMOSFETandPowerIGBT-Numericalproblems.

UNIT–II		10 hrs

Single-phaseAC-DCConverters:
Single-phasehalf-wavecontrolledrectifiers-RandRLloadswithandwithoutfreewheelingdiode - Single-phasefullycontrolledmid-pointandbridgeconverterwithRload,RLloadandRLEload - ContinuousandDiscontinuousconduction-EffectofsourceinductanceinSingle-phasefully controlledbridgerectifier–Expressionforoutputvoltages–Single-phaseSemi-ConverterwithR load- RL load and RLE load – Continuous and Discontinuous conduction - Dual converter and its mode of operation - Numerical Problems.

UNIT–III		10 hrs

	Three-phaseAC-DCConverters&AC–AC Converters: Three-phasehalf-waveRectifierwithRandRLload -Three-phasefullycontrolledrectifierwithR and RL load - Three-phase semi converter with R and RL load - Expression for Output Voltage - Numerical Problems. Single-phaseAC-ACpowercontrolbyphasecontrolwithRandRLloads-ExpressionforRMS outputvoltage–Single-phasestepdownandstepupCycloconverter-NumericalProblems.			
	UNIT–IV		10	hrs
	DC–DCConverters: Operation of Basic Chopper – Analysis of Buck, Boost and Buck-Boost converters in Continuous Conduction Mode (CCM) and Discontinuous Conduction Modes (DCM) - Output voltage equationsusingvolt-secbalanceinCCM&DCM–Expressionsforoutputvoltageripple and inductorcurrentripple–controltechniques– IntroductiontoPWMcontrol-NumericalProblems.			
	UNIT–V		10	hrs
	DC–ACConverters: Introduction - Single-phase half-bridge and full-bridge inverters with R and RL loads – Phase Displacement Control – PWM with bipolar voltage switching, PWM with unipolar voltage switching - Three-phase square wave inverters - 120^0 conduction and 180^0 conduction modes of operation-SinusoidalPulseWidthModulation-CurrentSourceInverter(CSI)-Numerical Problems.			
	TextBooks			
	1	PowerElectronics:Converters,ApplicationsandDesignbyNedMohan,ToreMUndeland, WilliamP Robbins,JohnWiley&Sons,2002.		
	2	PowerElectronics:Circuits,DevicesandApplications–byM.H.Rashid,PrenticeHallof India,2nd edition,2017.		
	ReferenceBooks			
	1	ElementsofPowerElectronics–PhilipT.Krein.OxfordUniversityPress;Secondedition, 2014.		
	2	PowerElectronics–byP.S.Bhimbra,KhannaPublishers.		
	3	ThyristorisedPowerControllers–byG.K.Dubey,S.R.Doradla,A.JoshiandR.M.K. Sinha,NewAge International(P)LimitedPublishers,1996.		
	E-RESOURCES:			
	1	https://archive.nptel.ac.in/courses/108/101/108101126		
CO-PO/PSOMappingMatrix				

	CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
	C301.1	2	3											3		
	C301.2	2	3											3		
	C301.3	2	3											3		
	C301.4	2	3											3		
	C301.5	2	3											3		
	Avg.	**2**	**3**											**3**		

			L	T	P	Cr
B.Tech.(VSem.)		**DIGITAL CIRCUITS**				
		CourseCode: R2331XXXX	3	0	0	3

Pre-requisites: Knowledgeofelectroniccomponentsandsemiconductordevices,number systems,binaryarithmetic,Booleanorswitchingalgebraandlogic gates.

Course Objectives:

- ToknowthesimplificationmethodsofBoolean functions
- Tounderstandtherealizationofarithmetic, dataroutingandmemorylogiccircuits.
- Toknowtheoperationanddesignofvariouscountersandregisters.
- Tounderstandtheanalysisanddesignofsynchronoussequentialcircuits.
- Tounderstandthebasicconceptsofdigitalintegrated circuits.

CourseOutcomes: At theendofthe course, thestudentwill beable to

C302.1	:	UsetheconceptsofBooleanalgebra,K-map,tabulationmethodinminimizationof switchingfunctionsandabletodesignthearithmeticcombinationalcircuits.
C302.2	:	Realizedifferenttypesof dataroutingcombinationalcircuitsandPLDs.
C302.3	:	Applyknowledgeofflip-flopsindesigningofregistersandcounters.
C302.4	:	Analyzesynchronoussequentialcircuitsandapplydifferentmethodsforthedesign ofsynchronoussequentialcircuits.
C302.5	:	Understandthelogicfamiliesintheformofdigitalintegrated circuits.

UNIT–I	10	hrs

Combinationallogiccircuits –I:

Definition of combinational logic, canonical forms, Generation of switching equations from truth tables, simplification of logic functions using Boolean theorems, NAND and NOR implementations, Karnaugh maps – 3,4,5 variables, Incompletely specified functions (Don‘t care terms), Simplifying Max term equations, Quine-McCluskey minimization technique, General approachtocombinationallogicdesign,Lookaheadcarryadder,Cascadingfulladders,4-bit adder-subtractorcircuit, BCDaddercircuit,Excess3adder,Binary comparators.

UNIT–II	10	hrs

Combinationallogiccircuits –II:

Decoders,BCDdecoders,7segmentdecoder,higherorderdecoder,multiplexer,higherorder multiplexing,de-multiplexers, higherorderde-multiplexing, realization ofBoolean functions using decoders,multiplexers,encoders,priorityencoder,ReadonlyandRead/WriteMemories, ProgrammableROM,PAL,PLA-Basicsstructures,programmingtablesofPROM,PAL,PLA, realization of Boolean functions.

UNIT–III	10	hrs

Sequentiallogiccircuits:

Timing considerations of flip-flops, master-slave flip-flop, edge triggered flip-flops, characteristic equations, flip-flops with reset and clear terminals, excitation tables, conversion from one flip-flop to another flip-flop, design of asynchronous and synchronous counters, design of modulus-N counters,Johnsoncounter, ring counter,designofregisters- buffer register,controlbuffer register, shiftregister,bi-directionalshiftregister,universalshiftregister.

UNIT–IV		14	hrs

SequentialCircuit Design:

MealyandMooremodels,Statemachinenotation,SynchronousSequentialcircuitanalysis, Constructionofstatediagrams,Analysisofclockedsequentialcircuits,realizationofsequence detectorcircuit,statereductionandassignments,designprocedure.

UNIT–V		10	hrs

Digitalintegrated circuits:

Logic levels, propagation delay time, power dissipation, fan-out and fan-in, noise margin, logic families – RTL and DTL Circuits, TTL, Emitter-Coupled Logic, Metal-Oxide Semiconductor, Complementary MOS, CMOS Transmission Gate Circuits.

TextBooks

1	SwitchingandfiniteautomatatheoryZvi.Kohavi,3rdedition,CambridgeUniversityPress, 2010.
2	M.MorrisMano andM.D. Ciletti,"DigitalDesign", 4thEdition,Pearson Education,2006.

ReferenceBooks

1	Fundamentalsof LogicDesignby CharlesH.Roth Jr, Jaico Publishers,5thEdition, 1992.
2	SwitchingTheoryandLogicDesignbyA.AnandKumar,PrenticeHallIndiaPvt.,Limited, ThirdEdition, 2016.

E-RESOURCES:

1	https://nptel.ac.in/courses/117106086.
2	https://nptel.ac.in/courses/108105113

CO-PO/PSOMappingMatrix

	CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
	C302.1	3	2													
	C302.2	3	2													
	C302.3	3	2													
	C302.4	3	2													
	C302.5	3	2													
	Avg.	**3**	**2**													

			L	T	P	Cr.
B.Tech.(VSem.)		**POWERSYSTEMS-II**				
		CourseCode: R2331XXXX	3	0	0	3

Pre-requisites: PowerSystems-I, ElectricalcircuitAnalysis.

Course Objectives:

- TounderstandtheconceptsofGMD&GMRtocomputeinductance&capacitanceof transmission lines.
- Todistinguishthemodelsofshort,mediumandlonglengthtransmissionlinesand analyzes their performance.
- Tolearntheeffectoftravellingwavesontransmissionlineswithdifferentterminal conditions.
- Tolearntheconceptsofcorona,thefactorseffectingcoronaandeffectsoftransmission lines.
- Todesignthesagandtensionoftransmissionlinesaswellastolearntheperformanceof lineinsulators.

CourseOutcomes: At theendofthe course, thestudentwill beable to

C303.1	:	Calculateparametersoftransmissionlinesfordifferentcircuitconfigurations.
C303.2	:	Analyzetheperformance ofshort,mediumandlongtransmission lines.
C303.3	:	Analyzethe effect oftravellingwavesontransmission lines.
C303.4	:	Estimatetheeffectsof coronaintransmission lines.
C303.5	:	Calculatesagand tensionoftransmission linesanddesign thelineinsulators.

UNIT–I		10	hrs

TransmissionLineParametersCalculations:

Conductor materials – Types of conductors – Calculation of resistance for solid conductors – Calculation of inductance for Single-phase and Three-phase single and double circuit lines– Concept of GMR and GMD–Symmetrical and asymmetrical conductor configuration with and without transposition–Bundled conductors, Skin and Proximity effects.

Calculationofcapacitancefor2wireand3wiresystems–Effectofgroundoncapacitance–

Capacitance calculations for symmetrical and asymmetrical single and Three-phase single and double circuit lines without and with Bundled conductors.

UNIT–II		10	hrs

PerformanceAnalysisofTransmissionLines:

Classification of Transmission Lines – Short, medium, long lines and their model representation – Nominal-T, Nominal-π and A, B, C, D Constants for symmetrical Networks.

RigorousSolutionforlonglineequations–RepresentationofLonglines–EquivalentTand

Equivalent π network models - Surge Impedance and Surge Impedance Loading of Long Lines - Regulation and efficiency for all types of lines – Ferranti effect.

UNIT–III		10	hrs

PowerSystem Transients:
TypesofSystemTransients–PropagationofSurges–Attenuation–Distortion–Reflectionand Refraction Coefficients.
Terminationoflineswithdifferenttypesofconditions:OpenCircuitedLine–ShortCircuitedLine,
Line terminated through a resistance and line connected to a cable. Reflection and Refraction at a T-Junction.

UNIT–IV		14	hrs

Corona&Effectsoftransmissionlines:
Description of the phenomenon – Types of Corona - critical voltages and power loss – Advantages and Disadvantages of Corona - Factors affecting corona - Radio Interference.

UNIT–V		10	hrs

SagandTensionCalculationsandOverheadLineInsulators:
SagandTensioncalculationswithequalandunequalheightsoftowers–EffectofWindandIce weight on conductor – Stringing chart and sag template and its applications.
TypesofInsulators–Voltagedistributioninsuspensioninsulators–Calculationofstringefficiency andMethodsforStringefficiencyimprovement–CapacitancegradingandStaticShielding.

TextBooks

1	ElectricalPowerSystems –byC.L.Wadhwa,NewAge International(P) Limited,1998.
2	PowerSystemEngineeringbyI.J.NagarathandD.P.Kothari,TataMcGrawHill,3rd Edition,2019.

ReferenceBooks

1	PowersystemAnalysis–byJohnJGraingerWilliamDStevenson,TMCCompanies,4th edition
2	PowerSystemAnalysisandDesign byB. R.Gupta,Wheeler Publishing.
3	ATextBookonPowerSystemEngineeringbyM.L.Soni,P.V.Gupta,U.S.BhatnagarA. Chakrabarthy,Dhanpat RaiCoPvt.Ltd.2016.
4	ElectricalPowerSystemsbyP.S.R.Murthy,B.S.Publications,2017.

E-RESOURCES:

1	https://archive.nptel.ac.in/courses/108/105/108105104
2	https://archive.nptel.ac.in/courses/108/102/108102047

CO-PO/PSOMappingMatrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3

	C303.1	2	3										3		
	C303.2	2	3										3		
	C303.3	2	3										3		
	C303.4	2	3										3		
	C303.5	2	3										3		
	Avg.	**2**	**3**										**3**		

		PROFESSIONALELECTIVE-I	**L**	**T**	**P**	**Cr.**
B.Tech.(VSem.)		**RENEWABLEANDDISTRIBUTEDENERGY TECHNOLOGIES**				
		CourseCode: R23PEXXXX	3	0	0	3

Pre-requisites: Toimpartknowledgeonvariousrenewablesourcessuchassolar,windandhydel perspectives.Toknowtherequirementsofvarioushybridsourcesasdistributedenergytechnologies.

Course Objectives:

- Tounderstandthebasicconceptsonwindenergy systems.
- Tounderstandthevariousrelationsbetweenspeed,powerandenergyinthe windsystems.
- Toanalyzethesolarenergysystems,variouscomponentsofsolarthermalsystems, applications in the relevant fields and design of PV systems.
- To design the Hydel system components and to get an idea on different other sources like tidal, geothermal and gas-based units.
- Tounderstandtheconceptsofhybridrenewablesystems.

CourseOutcomes: At theendofthe course, thestudentwill beable to

C304A.1	:	Illustratebasicconceptsofrenewableanddistributedsourcesofwind energy.
C304A.2	:	Demonstratethecomponentsofwindenergyconversion systems.
C304A.3	:	ModelPVsystemsandanalyseMPPTTechniques.
C304A.4	:	Illustratetheconceptof EnergyProductionfromHydro -Tidaland Geothermal.
C304A.5	:	Explaintheaspectsofhybridrenewableenergysystems.

UNIT–I		10	hrs

Introductionandwindenergysystems:
Brief idea on renewable and distributed sources - their usefulness and advantages; Wind Energy Systems: Estimates of wind energy potential - wind maps - Instrumentation for wind velocity measurements-Aerodynamicandmechanicalaspectsofwindmachinedesign-Conversionto electricalenergy -Aspectsoflocationofwind farms.

UNIT–II		10	hrs

Windpowerandenergy:
Windspeedandenergy-Speedandpowerrelations-Powerextractionfromwind-Tipspeedratio (TSR)-Functionalstructureofwindenergyconversionsystems-Pitchandspeedcontrol-Power speed-TSRcharacteristics-Fixedspeedandvariablespeedwindturbinecontrol-Power optimization - Electrical generators - Self-Excited and Doubly-Fed Induction Generators operation and control.

UNIT–III		10	hrs

SolarPVsystems:

Solar PV Systems: Present and new technological developments in photovoltaic - estimation of solarirradiance - components ofsolar energy systems -solar-thermal system applications to power generation - heating - Types of PV systems - Modelling of PV cell - current-voltage and power-voltage characteristics - Effects of temperature - Solar array simulator - Sun tracking - Peak power operations-PVsystem-MPPTtechniques-Effectsofpartialshadingonthecharacteristiccurves andassociatedMPPTtechniques-Solarparkdesignoutline.

UNIT–IV		14	hrs

Smallhydroandother sources:

HydelPower:Waterpowerestimates-useofhydrographs-hydraulicturbine-characteristicsand part load performance - design of wheels - draft tubes and penstocks - plant layouts; Brief idea of other sources viz. - tidal - geothermal - gas-based - etc.

UNIT–V		10	hrs

Hybridrenewablesystems:

Requirements of hybrid/combined use of different renewable and distributed sources - Need of energy storage; Control of frequency and voltage of distributed generation in Stand-alone andGrid-connectedmode -useofenergy storageandpower electronicsinterfacesfortheconnection to gridandloads-Designandoptimization ofsizeofrenewablesourcesandstorages.

TextBooks

1	MathJ.Bollen-FainanHassan 'Integrationof DistributedGenerationinthe Power System'-IEEEPress- 2011.

ReferenceBooks

1	Studies'Craig AndersonandRudolfI. Howard'Windand HydropowerIntegration:Concepts -ConsiderationsandCase-NovaPublisher-2012.
2	AmandaE.NiemiandCoryM.Fincher'HydropowerfromSmallandLow-HeadHydro Technologies'- NovaPublisher-2011.
3.	D.YogiGoswami-FrankKreithandJanF.Kreider'PrinciplesofSolarEngineering'-Taylor&Francis 2000.
4.	MathJ.Bollen-FainanHassan 'Integrationof DistributedGenerationinthe Power System'-IEEEPress- 2011.
5.	S.HeierandR.Waddington'Grid Intergration ofWindEnergy ConversionSystems'–Wiley -2006.

CO-PO/PSOMappingMatrix

	CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
	C304A.1	2	3											**3**		
	C304A.2	2	3											**3**		
	C304A.3	2	3											**3**		
	C304A.4	2	3											**3**		
	C304A.5	2	3											**3**		
	Avg.	**2**	**3**											**3**		

		PROFESSIONALELECTIVE-I	**L**	**T**	**P**	**Cr.**
B.Tech.(VSem.)		**COMPUTERARCHITECTUREANDORGANIZATION**				
		CourseCode: R23PEXXXX	3	0	0	3

Pre-requisites: Basicknowledgeindigitalelectronics,fundamentalsofcomputers.

Course Objectives:

- Toexplain the basic workingof adigital computer.
- Tounderstandtheregistertransferlanguageand micro-operators.
- Tolearnvariousaddressingmodessupportedbythe processors.
- Tobefamiliarwithperipheralinterfacingwithprocessors.
- Tounderstandmemoryhierarchyincomputers.

CourseOutcomes: At theendofthe course, thestudentwill beable to

C304B.1	:	Demonstratetheinstructioncycleofa computer.
C304B.2	:	Understandvariousmicro-operationsandregistertransferlanguage.
C304B.3	:	Describeparallelprocessingandpipe-lining.
C304B.4	:	Interfacedifferentperipheralswith processors.
C304B.5	:	Knowtheadvantagesofcacheandvirtualmemory.

UNIT–I	10	hrs

Basic Computer Organization and Design: Instruction Codes, Computer Registers, Computer Instructions,TimingandControl,InstructionCycle,Memory-ReferenceInstructions,Input-OutputandInterrupt,CompleteComputerDescription,DesignofBasicComputer,Designof AccumulatorLogic.

UNIT–II	10	hrs

Register Transfer and Micro operations: Register Transfer Language, Register Transfer, Bus and Memory Transfers, Arithmetic Micro operations, Logic Micro operations, Shift Micro operations, ArithmeticLogicShiftUnit.MicroprogrammedControl:ControlMemory,AddressSequencing, MicroprogramExample, Designof ControlUnit.

UNIT–III	10	hrs

Central Processing Unit: Introduction, General Register Organization, Stack Organization, Instruction Formats, Addressing Modes, Data Transfer and Manipulation, Program Control, ReducedInstructionSetComputer(RISC)PipelineandVectorProcessing:ParallelProcessing, Pipelining,ArithmeticPipeline,InstructionPipeline,RISKPipeline,VectorProcessing,Array Processors.

UNIT–IV	14	hrs

Input/outputOrganization:PeripheralDevices,I/Ointerface,Asynchronousdatatransfer,Modes oftransfer,priorityInterrupt,Directmemoryaccess,Input-OutputProcessor(IOP),Serial Communication.

	UNIT–V		10	hrs
	MemoryOrganization:MemoryHierarchy,Mainmemory,Auxiliarymemory,AssociateMemory, CacheMemory, andVirtualmemory,MemoryManagementHardware.			
	TextBooks			
	1	ComputerSystemArchitecture,M.MorrisMano,PrenticeHallofIndiaPvt.Ltd.,3rdEdition, Sept.2008.		
	ReferenceBooks			
	1	ComputerArchitectureandOrganization,WilliamStallings,PHIPvt.Ltd.,EasternEconomy Edition,SixthEdition, 2003.		
	2	ComputerOrganizationandArchitecture,LindaNull,JuliaLobur,NarosaPublicationsISBN 81-7319-609-5		
	3	ComputerSystemOrganizationbyJohn.P.Hayes.		

CO-PO/PSOMappingMatrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C304B.1	2	3											**3**		
C304B.2	2	3											**3**		
C304B.3	2	3											**3**		
C304B.4	2	3											**3**		
C304B.5	2	3											**3**		
Avg.	**2**	**3**											**3**		

		PROFESSIONALELECTIVE-I	**L**	**T**	**P**	**Cr.**
B.Tech.(VSem.)		**COMMUNICATIONSYSTEMS**				
		CourseCode: R23PEXXXX	3	0	0	3

Pre-requisites: Basicknowledgeindigitalelectronics.

Course Objectives:

Analyzetheperformance ofanalogmodulationschemesintimeandfrequency domains.

- Analyzetheperformance ofanglemodulatedsignals.
- Characterizeanalogsignalsintimedomainasrandomprocessesandnoise
- Characterizetheinfluenceof channelonanalogmodulated signals
- Determinetheperformanceofanalogcommunicationsystemsintermsof SNR
- Analyzepulseamplitudemodulation,pulsepositionmodulation,pulsecodemodulation and TDM systems.

CourseOutcomes: At theendofthe course, thestudentwill beable to

C304C.1	:	Explainthefundamentalconceptsofanalogand digitalcommunicationsystems.
C304C.2	:	Analyzeamplitude,frequency,andphasemodulationtechniques.
C304C.3	:	Applysamplingtheoremandpulsemodulationtechniquesincommunication.
C304C.4	:	Evaluatetheperformanceofcommunicationsystemsundertheinfluence of noise.
C304C.5	:	Designsimpleanalogand digitalcommunicationsystemsforpracticalapplications.

UNIT–I		10	hrs

Basictoolsforcommunication,FourierSeries/Transform,Properties,Autocorrelation,Energy SpectralDensity,ParsevalsRelation,AmplitudeModulation(AM), Spectrumof AM,Envelope Detection, Power Efficiency, Modulation Index.

UNIT–II		10	hrs

DoubleSidebandSuppressedCarrier(DSB-SC)Modulation,Demodulation,CostasReceiver, SingleSidebandModulation(SSB),HilbertTransform,ComplexPre-envelope/Envelope, DemodulationofSSB,VestigialSidebandModulation(VSB)

UNIT–III		10	hrs

AngleModulation,FrequencyModulation(FM),PhaseModulation(PM),ModulationIndex, Instantaneous Frequency, Spectrum of FM Signals, Carsons Rule for FM Bandwidth, Narrowband FM Generation, Wideband FM Generation via Indirect Method, FM Demodulation

UNIT–IV		14	hrs

Introduction to Sampling, Spectrum of Sampled Signal, Aliasing, Nyquist Criterion, Signal Reconstruction from Sampled Signal, Pulse Amplitude Modulation**,** Quantization, Uniform Quantizers–MidriseandMidtread,Quantizationnoise,NonuniformQuantizers,Delta Modulation,DifferentialPulseCodeModulation(DPCM)

UNIT–V		10	hrs

	BasicsofProbability,ConditionalProbability,MAPPrinciple,RandomVariables,Probability DensityFunctions,ApplicationsinWirelessChannels,BasicsofRandomProcesses,Gaussian RandomProcess,Noise.	
	TextBooks	
	1	SimonHaykin,CommunicationsSystems,4thEdition.JohnWileyandSons,Inc
	2	FundamentalsofWirelessCommunicationbyDavidTse

CO-PO/PSOMappingMatrix

	CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
	C304C.1	2	3											3		
	C304C.2	2	3											3		
	C304C.3	2	3											3		
	C304C.4	2	3											3		
	C304C.5	2	3											3		
	Avg.	**2**	**3**											**3**		

PROFESSIONALELECTIVE-I

12WeekMOOCSSWAYAMNPTELCourse recommendedbyBOS

		OPENELECTIVE-I	**L**	**T**	**P**	**Cr.**
B.Tech.(VSem.)		**RENEWABLEENERGYSOURCES**				
		CourseCode: R23OEXXXX	3	0	0	3

Pre-requisites: BasicElectrical Engineering

Course Objectives:

- TostudythesolarradiationdataequivalentcircuitofPVcellanditsI-V&P-V characteristics.
- Tounderstandthe conceptof WindEnergyConversion &itsapplications.
- Tostudytheprinciplesofbiomass, hydelandgeothermal energy.
- TounderstandtheprinciplesofoceanThermalEnergyConversion,wavesandpower associated with it.
- Tostudythevariouschemicalenergysourcessuchasfuelcellandhydrogenenergyalong withtheiroperationand equivalentcircuit.

CourseOutcomes: At theendofthe course, thestudentwill beable to

C305A.1	:	Analyzesolarradiationdata,extra-terrestrialradiation,radiationonearth'ssurface andsolarEnergy Storage.
C305A.2	:	Illustratethecomponentsofwindenergy systems.
C305A.3	:	Illustratetheworkingofbiomass,hydelplantsandGeothermalplants.
C305A.4	:	DemonstratetheprincipleofEnergyproductionfromOTEC,TidalandWaves.
C305A.5	:	Evaluatetheconceptand workingofFuelcells&MHDpowergeneration.

UNIT–I		10	hrs

Solar Energy:
Introduction - Renewable Sources - prospects, solar radiation at the Earth Surface - Equivalent circuit of a Photovoltaic (PV) Cell - I-V & P-V Characteristics - Solar Energy Collectors: FlatplateCollectors,concentratingcollectors-SolarEnergystoragesystemsandApplications:Solar Pond-Solarwaterheating -SolarGreen house.

UNIT–II		10	hrs

WindEnergy:
Introduction - basic Principles of Wind Energy Conversion, the nature of Wind - the power in the wind - Wind Energy Conversion - Site selection considerations - basic components of WindEnergy Conversion Systems (WECS) - Classification - Applications.

UNIT–III		10	hrs

Biomass,HydelandGeothermalEnergy:
Biomass: Introduction - Biomass conversion technologies- Photosynthesis. Factors affecting Bio digestion.
Hydroplants: Basicworkingprinciple–Classificationofhydrosystems**:** Large,small,micro hydel plants.
GeothermalEnergy:Introduction,GeothermalSources–Applications-operationaland Environmentalproblems.

	UNIT–IV		14	hrs
	Energyfromoceans,Waves&Tides: **Oceans:**Introduction-OceanThermalElectricConversion(OTEC)–methods-prospectsof OTEC in India. **Waves:** Introduction-EnergyandPowerfromthewaves-WaveEnergyconversion devices. **Tides:**Basicprinciple ofTideEnergy -ComponentsofTidal Energy.			
	UNIT–V		10	hrs
	ChemicalEnergySources: **FuelCells**: Introduction-Fuel Cell Equivalent Circuit-operation ofFuelcell-typesofFuelCells -Applications. **HydrogenEnergy:** Introduction-MethodsofHydrogenproduction -StorageandApplications **MagnetoHydroDynamic(MHD)Powergeneration:** PrincipleofOperation- Types.			
	TextBooks			
	1	G.D.Rai,Non-ConventionalEnergySources,KhannaPublications, 2011.		
	2	JohnTwidell&TonyWeir,Renewable EnergySources,Taylor&Francis,2013.		
	ReferenceBooks			
	1	S.P.Sukhatme&J.K.Nayak,SolarEnergy-PrinciplesofThermalCollectionandStorage, TMH, 2011.		
	2	JohnAndrews&NickJelly,EnergyScience-principles,TechnologiesandImpacts,Oxford, 2nd edition,2013.		
	E-RESOURCES:			
	1	https://archive.nptel.ac.in/courses/103/103/103103206		
	2	https://archive.nptel.ac.in/courses/103/107/103107157		

CO-PO/PSOMappingMatrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C305A.1	2	3											3		
C305A.2	2	3											3		
C305A.3	2	3											3		
C305A.4	2	3											3		
C305A.5	2	3											3		
Avg.	**2**	**3**											**3**		

	OPENELECTIVE-I	**L**	**T**	**P**	**Cr.**
B.Tech.(VSem.)	**CONCEPTSOFENERGYAUDITING& MANAGEMENT**				
	CourseCode: R23OEXXX	3	0	0	3
Pre-requisites: BasicsofConservationofElectrical Energy					
Course Objectives:					

- Tounderstandbasic conceptsofEnergyAudit&variousEnergyconservationschemes.
- Todesignenergy anenergymanagementprogram.
- Tounderstandconceptof EnergyEfficientMotors andlightingcontrolefficiencies.
- Toestimate/calculatepowerfactorofsystemsandproposesuitablecompensationtechniques.
- Tocalculatelifecyclecostinganalysisandreturnoninvestmentonenergyefficient technologies.

CourseOutcomes: At theendofthe course, thestudentwill beable to

C305B.1	:	Understandtheprinciplesofenergyauditalongwithvarious Energyrelated terminologies.
C305B.2	:	AssestheroleofEnergyManager andEnergyManagement program.
C305B.3	:	Designanenergyefficientmotorsandgoodlightingsystem.
C305B.4	:	Analyzethemethodstoimprovethepowerfactorandidentifytheenergy instrumentsforvariousrealtime applications.
C305B.5	:	Evaluatethecomputationaltechniqueswithregardtoeconomic aspects.6

UNIT–I		10	hrs

BasicPrinciplesofEnergyAudit:
Energyaudit-definitions-concept-typesof**Energy**audit-energyindex-costindex-piecharts -Sankeydiagramsandloadprofiles-Energyconservationschemes-Energyauditofindustries- energy saving potential - energy audit of process industry, thermal power station - building energy audit - Conservation of Energy Building Codes (ECBC-2017)

UNIT–II		10	hrs

Energy Management:
Principlesofenergymanagement-organizingenergymanagementprogram-initiating-planning -controlling-promoting-monitoring-reporting.Energymanager-qualitiesandfunctions- language-Questionnaire–checklist fortop management.

UNIT–III		10	hrs

EnergyEfficientMotorsandLighting:
Energy efficient motors - factors affecting efficiency - loss distribution - constructional details - characteristics – variable speed - RMS - voltage variation-voltage unbalance-over motoring-motor energy audit. lighting system design and practice - lighting control - lighting energy audit.

UNIT–IV		14	hrs

PowerFactorImprovementandEnergyInstruments:
Powerfactor–methodsofimprovement-locationofcapacitors-Powerfactorwithnon-linear loads- effectofharmonicsonpower factor-power factormotorcontrollers–EnergyInstruments- wattmeter-dataloggers-thermocouples-pyrometers-luxmeters -tonguetesters.

UNIT–V		10	hrs

EconomicAspectsandtheirComputation:

Economics Analysis Depreciation Methods - time value of money - rate of return - present worth method-replacementanalysis-lifecyclecostinganalysis–Energyefficientmotors.Calculationof simple payback method - net present value method- Power factor correction - lighting – Applications of life cycle costing analysis - return on investment.

TextBooks

1	EnergymanagementbyW.R.Murphy&G.MckayButterworth-Heinemannpublications 1982.
2	Energymanagementhandbookby W.CTurner–John wileyandsons-1982.

ReferenceBooks

1	EnergyefficientelectricmotorsbyJohn.C.Andreas-MarcelDekkerIncLtd-2ndedition– 1995
2	EnergymanagementbyPaulo'Callaghan–Mc-grawHillBookcompany-1stedition- 1998
3	Energymanagementand goodlightingpractice:fuelefficiency-booklet12-EEO

E-RESOURCES:

1	https://nptel.ac.in/courses/108106022
2	https://archive.nptel.ac.in/courses/108/106/108106022

CO-PO/PSOMappingMatrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C305B.1	2	3													1
C305B.2	2	2	3												2
C305B.3	2	3											2	2	
C305B.4	2	3											2		1
C305B.5	2	3											2		

	Avg.	**2**	**2.83**	**3**									**2**	**2**	**1.33**

		OPENELECTIVE-I	**L**	**T**	**P**	**Cr.**
B.Tech.(VSem.)		**CONCEPTSOFCONTROL SYSTEMS**				
		CourseCode: R23OEXXX	3	0	0	3

Pre-requisites: BasicsofMathematicsandElectricalCircuit Analysis

Course Objectives:

- To learn the mathematical modelling of physical systems and to use block diagram algebra and signal flow graph to determine overall transfer function
- Toanalyzethetimeresponseoffirstandsecondordersystemsandimprovementofperformance using PI, PD, PID controllers.
- To investigate the stability of closed loop systems using Routh's stability criterion and root locus method.
- To learn Frequency Response approaches for the analysis of LTIsystems using Bode plots, polar plots and Nyquist stability criterion.
- TolearnstatespaceapproachforanalysisofLTIsystemsandunderstandtheconceptsof controllabilityandobservability.

CourseOutcomes: At theendofthe course, thestudentwill beable to

C305C.1	:	Derivethetransferfunctionofphysicalsystemsanddeterminationofoverall transferfunctionusingblockdiagramalgebraand signalflow graphs.
C305C.2	:	Determinetimeresponsespecificationsofsecondordersystemsandtodetermine error constants.
C305C.3	:	AnalyzeabsoluteandrelativestabilityofLTIsystemsusingRouth'sstability criterionandthe rootlocusmethod.
C305C.4	:	AnalyzethestabilityofLTIsystemsusingfrequencyresponse methods.
C305C.5	:	Representphysicalsystemsasstatemodelsanddeterminethe response. Understandingtheconceptsofcontrollabilityandobservability

UNIT–I		10	hrs

MathematicalModellingofControl Systems:
Classificationofcontrolsystems-openloopandclosedloopcontrolsystemsandtheirdifferences -transferfunction oflinearsystem -differential equations ofelectrical networks -translational and rotational mechanical systems – block diagram algebra – Feedback characteristics

UNIT–II		10	hrs

TimeResponse Analysis:
Standardtestsignals–timeresponseoffirstandsecondordersystems–timedomain specifications - steady state errors and error constants - P - PI & PID Controllers

UNIT–III		10	hrs

StabilityandRootLocus Technique:
The concept of stability – Routh-Hurwitz Criteria – limitations of Routh-Hurwitz criterion-.Rootlocus concept – construction of root loci (simple problems).

UNIT–IV		14	hrs

FrequencyResponse:
AnalysisIntroductiontofrequencydomainspecifications–Bodediagrams–Transferfunction from the Bode diagram – phase margin and gain margin.

UNIT–V		10	hrs

StateSpaceAnalysisofLinearTimeInvariant(LTI)Systems:
Concepts ofstate - state variables and state model - state space representation oftransferfunction - State Transition Matrix and it's properties - concepts of controllability and observability.

TextBooks

1	ModernControlEngineering byKotsuhiko Ogata-PrenticeHallofIndia.
2	AutomaticcontrolsystemsbyBenjaminC. Kuo-PrenticeHallof India-2ndEdition.

ReferenceBooks

1	ControlSystemsprinciplesanddesignbyM.Gopal-TataMcGrawHilleducationPvtLtd.-4 th Edition.
2	ControlSystemsbyManik DhaneshN-Cengage publications.
3	ControlSystemsEngineeringbyI.J.NagarathandM.Gopal-NewageInternational Publications-5thEdition.
4	ControlSystemsEngineeringbyS. Palani-Tata McGraw HillPublications.

CO-PO/PSOMappingMatrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C305C.1	2	3											2		
C305C.2	2	3											2		
C305C.3		3											2		
C305C.4		3											2		
C305C.5		3											2		
Avg.	**2**	**3**											**2**		

		L	**T**	**P**	**Cr.**
B.Tech.(VSem.)	**POWERELECTRONICS LAB**				

		CourseCode: R2331XXXL	0	0	3	1.5

Pre-requisites: Basicknowledgeonpowerelectronics

Course Objectives:

- To learn the characteristics of various power electronic devices and analyze firing circuits and commutation circuits of SCR.
- To analyze the performance of single–phase and three–phase full–wave bridge converters with both resistive and inductive loads.
- TounderstandtheoperationofACvoltageregulatorwithresistiveandinductiveloads.
- TounderstandtheworkingofBuckconverterandBoost converter.
- Tounderstandtheworkingofsingle-phase&three-phaseinverters.

CourseOutcomes: At theendofthe course, thestudentwill beable to

C306.1	:	Compilethedata,organizeandanalyzeitfordiscussionandreportthefindingsand observationsfromexperimentallearningactivitiesinthe laboratory.
C306.2	:	Buildholisticdevelopmentandpleasingdispositionbyreviewingandcorrectingthe performancetobecomeindependentand autonomous thinker.
C306.3	:	Studythecharacteristicsofpowerelectronicdevices,demonstratethefiringcircuits ofSCR,IGBTandAnalyzetheperformanceof converters.
C306.4	:	Explaintheoperationofsingle-phaseACvoltageregulator,inverters,Buckand Boost converters.

Any10oftheFollowingExperimentsaretobe conducted

1	CharacteristicsofSCR-PowerMOSFET&Power IGBT
2	R,RC& UJTfiring circuitsforSCR.
3	Single-Phasesemi-converterwithR&RLloads
4	Single-Phasefull-converterwithR &RL loads.
5	Three-Phasefull-converter withR &RL loads.
6	Single-phasedualconverterincirculatingcurrent&noncirculatingcurrentmodeof operation.
7	Single-PhaseACVoltageRegulatorwithR &RL Loads.
8	Single-phasestepdownCyclo-converterwithR&RLLoads
9	BoostconverterinContinuousConductionMode operation.
10	BuckconverterinContinuousConductionMode operation.
11	Single-Phasesquarewavebridgeinverterwith R& RL Loads.
12	Single-PhasePWMinverter.
13	Three-phasebridgeinverterwith$120^0$and 180^0 conduction mode.
14	SPWMcontrolof Three-phasebridge inverter

CO-PO/PSOMappingMatrix

	CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
	C306.1									3	2					3
	C306.2								2	3	2					3
	C306.3	2			3					3						3
	C306.4	2			3					3						3
	Avg.	**2**			**3**				**2**	**3**	**2**					**3**

			L	T	P	Cr
B.Tech.(VSem.)		**ANALOGANDDIGITALCIRCUITSLAB**				
		CourseCode: R2331XXXXL	0	0	3	1.5

Pre-requisites: Basicknowledgeonanalogcircuitsanddigital circuits

Course Objectives:

- Analysisoftransistor amplifiers
- Analysisoffeedbackamplifiersand oscillators
- Realizationofdigitalcircuitssuchdatarouting,registersandcounters.

CourseOutcomes: At theendofthe course, thestudentwill beable to

C307.1	:	Compilethedata,organizeandanalyzeitfordiscussionandreportthefindingsand observationsfromexperimentallearningactivitiesinthe laboratory.
C307.2	:	Buildholisticdevelopmentandpleasingdispositionbyreviewingandcorrectingthe performancetobecomeindependentand autonomous thinker.
C307.3	:	Analyzetheapplications oflinear IC's
C307.4	:	Demonstratetheoperationofdigitalcircuitssuchasarithmetic,datarouting, registersand counters.

Any5oftheFollowingExperimentsaretobeconductedfrom eachPART.

PART-A

1.	Analysisofclipperandclampercircuits.
2.	Analysisofself-biastoa transistor.
3.	Analysisofvoltageseriesandcurrentseries feedbackamplifiers.
4.	AnalysisofWienBridgeoscillatorandRC-phase shift oscillator.
5.	AnalysisofIntegratorandDifferentiatorCircuitsusingIC741.
6.	AnalysisofMonostable andAstablemultivibratoroperationusingIC555Timer.
7.	AnalysisofSchmittTriggerCircuitsusingIC741andIC555.
8.	VerifythePLLcharacteristicsusingIC565.
9.	Analysisof 8 bit AtoDand Dto Acircuits

PART-B

1.	DesignofFulladderandFullSubtractorusinglogicgates.
2.	Realizationofparalleladder/subtractorusing IC 7483.
3.	Implementationof3to8linedecoderusinglogic gatesandIC7445.
4.	Implementationof8to1multiplexerusinglogicgatesandIC74151.
5.	Verifytheoperationofmaster-slaveJKflip-flopusing IC7476.
6.	Realizationofthefollowingshiftregistersusing IC7495. a)SISO b)SIPO c)PISO d)PIPO
7.	ImplementationofMod-10ripplescounterusingflip-flopsand IC 7490.

	8.	ImplementationofMod-8synchronousup/down countersusingflip-flops.
	9.	Implementationof4-bitRingCounterandJohnsonCounterusingDflip-flops/J-Kflip-flops.

CO-PO/PSOMappingMatrix

	CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
	C307.1									3	2					
	C307.2								2	3	2					
	C307.3				3					3						
	C307.4				3					3						
	Avg.				**3**				**2**	**3**	**2**					

			L	T	P	Cr.
B.Tech.(VSem.)		**SKILLENHANCEMENTCOURSESOFT SKILLS**				
		CourseCode: R2331XXXXL	0	1	2	2

Pre-requisites: BasicEnglishKnowledge

Course Objectives:

- Topreparetofaceglobalcompetitionforemployment andexcellenceinprofession.
- To help the students understand and build interpersonal and interpersonal skills that will enable them to lead meaningful professional life.

CourseOutcomes: At theendofthe course, thestudentwill beable to

C308.1	:	AssimilateandunderstoodthemeaningandimportanceofsoftskillsandLearnhow todevelop them.
C308.2	:	Understandthesignificanceofsoftskillsintheworkingenvironmentfor Professionalexcellence.
C308.3	:	Preparetoundergotheplacementprocesswithconfidence andclarity.
C308.4	:	Readytofaceanysituationinlifeandequipthemselvestohandle themeffectively.
C308.5	:	Understandandlearntheimportanceofetiquetteinbothprofessionalandpersonal life.

UNIT–I:

INTRODUCTION:

Introduction- Emergence of life skills, Definition & Meaning, Importance& need, reasons for skill gap, Analysis--Soft Skills vs Hard skills, Linkage between industry and soft skills, Challenges, Personality Developments. Soft Skills, Soft Skills vs English - Improving Techniques.

UNIT–II:

Intra-Personal:

Definition-Meaning– Importance-SWOTanalysis,Johariwindows -Goal Setting-quotientskills - EmotionalIntelligence-Attitudinalskills-Rightthinking-ProblemSolving-Timemanagement, stressmanagement.

UNIT–III:

Inter-Personal:

Definition–Meaning–Importance-Communications skills - Team Work, managerial Skills-Negotiation Skills-Leadership skills, corporate etiquettes

UNIT–IV:

VerbalSkills:

Definition and Meaning-Listening skills, need- types, advantages, Importance-Improving Tips for Listening, Speaking, need- types, advantages, Importance- Improving Tips, Reading- Writing Skills,Report,Resume,statementofpurpose,need-types,advantages,Importance-Improving Tips.

UNIT–V:

Non-VerbalSkills&Interview skills:

Definition and Meaning – Importance- Facial Expressions- Eye Contact – Proxemics - Haptics - Posture, cross cultural body language, body language in interview room, appearance and dresscode –Kinetics-Para Language -tone, pitch, pause, neutralization of accent, use of appropriate language, Interview skills, interview methods and questions.

TextBooks

1	Sherfield,M.Robertatal,CornerstoneDevelopingSoftSkills,4/e,PearsonPublication,New Delhi, 2014.
2	AlkaWadkarLifeSkillsforSuccess,1/e,SagePublicationsIndiaPrivateLimited,2016.

ReferenceBooks

1	Sambaiah.M.TechnicalEnglish,Wileypublishers India.NewDelhi.2014
2	GangadharJoshi,FromCampustoCorporate,SAGETEXT.
3	Alex.K,SoftSkills,3rded.S.ChandPublication,NewDelhi, 2014.
4	ShaliniVarma,BodyLanguageforYourSuccessMantra,4/e,S.ChandPublication,New Delhi, 2014.

E-RESOURCES:

1	https://onlinecourses.nptel.ac.in/noc20_hs60/preview
2	https://www.youtube.com/@softskillsdevelopment6210
3	https://youtube.com/playlist?list=PLLy_2iUCG87CQhELCytvXh0E_ybOO1_q&si=Fs05Xh8ZrOPsR8F4

CO-PO/PSOMappingMatrix

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
C308.1	3	3													
C308.2	3	2													
C308.3												3			
C308.4					3				3	3		2			
C308.5					3					2					
Avg.	**3**	**2.5**			**3**				**3**	**2.5**		**2.5**			

		L	T	P	Cr.
B.Tech.(VSem.)	**TINKERINGLAB**				
	CourseCode: R23XXXXX	0	0	2	1

Pre-requisites: The aim oftinkeringlab for engineeringstudents is to provideahands-on learning environment where students can explore, experiment, and innovate by building and testing prototypes.Theselabsaredesignedtodemonstratepracticalskillsthatcomplementtheoretical knowledge.

Course Objectives:

- EncourageInnovationandCreativity
- ProvideHands-on Learning
- ImpartSkillDevelopment
- FosterCollaborationand Teamwork
- EnableInterdisciplinaryLearning
- ImpartProblem-Solvingmind-set
- PrepareforIndustryand Entrepreneurship

CourseOutcomes: Thestudentswillbeabletoexperiment,innovate,andsolvereal-world challenges.

C309.1	:	Applyengineeringfundamentalstodesignsimpleprototypesusingavailabletools andmaterials
C309.2	:	Usemoderntools,sensors,microcontrollersandsoftwareplatformsfor prototyping
C309.3	:	Collaborateeffectivelyin teamstobrainstorm,design,andimplementsolutions.
C309.4	:	Analyzereal-worldproblemsandproposefeasibletechnicalsolutionsusing tinkeringmethodologies

List ofexperiments:

1.	Makeyourownparallelandseriescircuitsusingbreadboardforanyapplicationofyour choice.
2.	Demonstrateatrafficlightcircuitusingbreadboard.
3.	BuildanddemonstrateautomaticStreetLightusingLDR.
4.	SimulatetheArduinoLEDblinkingactivityin Tinkercad.
5.	SimulatetheArduinoLEDblinkingactivityin Tinkercad.
6.	BuildanddemonstrateanArduinoLEDblinkingactivityusingArduinoIDE.
7.	Interfacing IRSensorandServoMotorwithArduino.
8.	BlinkLEDusing ESP32.
9.	LDRInterfacingwith ESP32.
10.	Controlan LEDusing Mobile App.
11.	Designand 3Dprint a Walking Robot
12.	Designand3DPrintaRocket.

	13.	Buildalivesoilmoisturemonitoringproject,andmonitorsoilmoisturelevelsofaremote planin yourcomputer dashboard
	14.	Demonstrateallthesteps indesignthinkingtoredesignamotorbike.

	E-RESOURCES:	
	1	https://aim.gov.in/pdf/Level-3.pdf
	2	https://aim.gov.in/pdf/equipment-manual-pdf.pdf
	3	https://atl.aim.gov.in/ATL-Equipment-Manual/
	4	https://aim.gov.in/pdf/Level-1.pdf
	5	https://aim.gov.in/pdf/Level-2.pdf

CO-PO/PSOMappingMatrix

	CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
	C309.1	2								3	2				3	
	C309.2	2							2	3	2				3	
	C309.3	2			3					3					3	
	C309.4	2			3					3					3	
	Avg.	**2**			**3**				**2**	**3**	**2**				**3**	

		L	T	P	Cr.
B.Tech.(VSem.)	**EVALUATIONOFCOMMUNITYSERVICE INTERNSHIP**				
	CourseCode: 23PCXXXXX	0	0	0	2

Pre-requisites: Identifyinganeed,developingaplan,recruitingvolunteers,andsecuringnecessary resources.

Course Objectives:

- Todemonstratethecapabilitytoparticipateincommunity-engagedservices/activitiesfor promoting the wellbeing of society
- Togainknowledgethroughfieldpracticeandexperiential learning
- Togainfirst-handunderstandingofthepolicies,regulations,organizationalstructures, processes, and programs that guide the socio-economic development process
- Toknowthewaysoftransformingthesocietythroughtechnologyandsystematic programme implementation
- Toconstructcoherentwrittenandpresenteffectiveoralformsofcommunication.

CourseOutcomes: At theendofthe course, thestudentwill beable to

C310.1	:	Demonstratethecapabilitytoparticipateincommunity-engagedservices/activitiesfor promotingthewellbeingof society
C310.2	:	Gainknowledgethrough fieldpracticeandexperientiallearning
C310.3	:	Gainfirst-handunderstandingofthepolicies,regulations,organizationalstructures, processes,andprogramsthatguidethesocio-economicdevelopmentprocess
C310.4	:	Knowthewaysoftransformingthesocietythroughtechnologyandsystematic programmeimplementation
C310.5	:	Constructcoherentwrittenandpresenteffectiveoralformsofcommunication.

e-resources

1	https://www.nitt.edu/home/students/facilitiesnservices/library/e-resources/#:~:text=National%20Digital%20Library%20(NDL)%20is%20an%20initiative,contents)%20for%20primary%20to%20PG%20level%20students.

CO-PO/PSOMappingMatrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
C310.1						3	3								3

	C310.2					3									3
	C310.3						3					2			3
	C310.4	3													3
	C310.5										3				3
	Avg.	**3**				**3**	**3**	**3**			**3**	**2**			**3**

KALLAMHARANADHAREDDYINSTITUTEOFTECHNOLOGY
(AUTONOMOUS)

ApprovedbyAICTE, NewDelhi&Permanently AffiliatedtoJNTUK Kakinada

DepartmentofElectricalandElectronicsEngineering

		L	T	P	Cr.
B.Tech. (VI_Sem)	**ELECTRICALMEASUREMENTSAND INSTRUMENTATION**				
	CourseCode:23PCXXXXX	3	0	0	3

Pre-requisites:
BasicsofElectricalandElectronics Engineering.

Course Objectives:

- Tounderstandandanalyzethefactorsthat affectthevariousmeasuringunits.
- Tochoosetheappropriatemetersformeasuringofvoltage,current,power,power factor and energy qualities and understand the concept of standardization.
- DescribetheoperatingprincipleofAC&DCbridgesformeasurementofresistance, inductance and capacitance.
- Tounderstandtheconceptofthetransducerandtheireffectivenessinconvertingfrom one form to the other form for the ease of calculating and measuring purposes.
- Tounderstandtheoperatingprinciplesofbasicbuildingblocksofdigitalsystems, record anddisplayunits.

CourseOutcomes: After thecompletionofthecoursethestudentshould beable to:

C311.1	:	Knowtheconstructionandworkingofvarioustypesofanaloginstruments.
C311.2	:	Describetheconstruction andworkingofwattmeterandpowerfactormeters
C311.3	:	Knowtheconstructionandworkingvariousbridgesforthemeasurement Resistanceinductanceandcapacitance
C311.4	:	Knowtheoperationalconceptsofvarioustransducers
C311.5	:	Knowtheconstructionandoperationdigitalmeters

UNIT–I — 10 hrs

AnalogAmmeterandVoltmeters

Classification – deflecting, control and damping torques – PMMC, moving iron type and electrostatic instruments – Construction– Torque equation – Range extension – Errors and compensations–advantagesanddisadvantages.Instrumenttransformers:CurrentTransformer andPotentialTransformer–theory–Ratioandphaseangleerrors–NumericalProblems.

UNIT–II — 10 hrs

AnalogWattmeter'sandPowerFactor Meters

	Electrodynamometertypewattmeter(LPFandUPF)–Powerfactormeters:Dynamometerand M. I type (Single phase and three phase) – Construction – torque equation – advantages and dis advantages. Potentiometers: Principle and operation of D.C Crompton's potentiometer – Standardization–Applications–ACPotentiometer(Polarandcoordinatetypes)– Standardization–Applications–Numerical Problems.			
	UNIT–III		10	hrs
	MeasurementsofElectrical parameters **DC Bridges:** Method of measuring low, medium and high resistance –Wheat stone's bridge or measuring medium resistance– Kelvin's double bridge for measuring low resistance – Loss of charge method for measurement of high resistance – Megger – measurement of earth resistance – Numerical Problems. **AC Bridges:** Measurement of inductance and quality factor – Maxwell's bridge – Hay's bridge – Anderson's bridge. Measurement of capacitance and loss angle – Desauty's bridge – Schering Bridge – Wien's bridge –Numerical Problems.			
	UNIT–IV		10	hrs
	Transducers Definition–Classification–Resistive,InductiveandCapacitiveTransducer–LVDT–Strain Gauge–Thermistors–Thermocouples–PiezoelectricandPhotoDiodeTransducers–Halleffect sensors – Numerical Problems.			
	UNIT–V		10	hrs
	Digital meters Digital Voltmeters – Successive approximation DVM – Ramp type DVM and Integrating type DVM–Digitalfrequencymeter–Digitalmultimeter–Digitaltachometer–DigitalEnergyMeter– Q meter. CRO – measurement of phase difference and Frequency using lissajious patterns – NumericalProblems.			
	TextBooks			
	1	ElectricalMeasurementsandmeasuringInstrumentsbyE.W.GoldingandF.C.Widdis-5thEdition-Wheeler Publishing.		
	2	ModernElectronicInstrumentationandMeasurementTechniquesbyA.D.Helfrickand W.D. Cooper-PHI -5thEdition -2002.		
	ReferenceBooks			
	1	Electrical&ElectronicMeasurement&InstrumentsbyA.K.SawhneyDhanpatRai&Co. Publications-19threvisededition - 2011.		
	2	ElectricalandElectronicMeasurementsandinstrumentationbyR.K.Rajput-S.Chand-3rd edition		
	3	ElectricalMeasurementsbyBuckinghamandPrice -Prentice–Hall		
	4	ElectricalMeasurementsbyForestK.Harris.John WileyandSons		

	E-RESOURCES:	
	1	https://archive.nptel.ac.in/courses/108/105/108105153

CO-PO/PSOMappingMatrix

	CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
	C311.1	2	3											3		
	C311.2	2	3											3		
	C311.3	2	3											3		
	C311.4	2	3											3		
	C311.5	2	3											3		
	Avg.	**2**	**3**											**3**		

			L	T	P	Cr.
B.Tech.(VISem)		**MICROPROCESSORSANDMICROCONTROLLERS**				
		CourseCode:23PCXXXXX	3	0	0	3

Pre-requisites: Basicknowledgeindigitalelectronics,fundamentalsofcomputers.

Course Objectives:

- Tounderstandtheorganizationandarchitectureof Microprocessor
- Tounderstandaddressingmodestoaccess memory
- Tounderstand8051microcontrollerarchitecture
- Tounderstandtheprogrammingprinciplesfor8086and 8051
- TounderstandtheinterfacingofMicroprocessor withI/Oaswellasother devices
- Tounderstandhowtodevelopcyberphysicalsystems

CourseOutcomes: After thecompletionofthecoursethestudentshould beable to:

C312.1	:	KnowtheconceptsoftheMicroprocessorcapabilityingeneralandexplorethe evaluationofmicroprocessors.
C312.2	:	Analysetheinstructionsets-addressingmodes-minimumandmaximummodes operationsof8086Microprocessors
C312.3	:	AnalysetheMicrocontrollerandinterfacingcapability
C312.4	:	Describethearchitecture andinterfacingof8051 controller
C312.5	:	KnowtheconceptsofPIC microcontrolleranditsprogramming.

UNIT–I		10	hrs

IntroductiontoMicroprocessorArchitecture

IntroductionandevolutionofMicroprocessors–Architectureof8086–MemoryOrganizationof 8086 – Register Organization of 8086– Introduction to 80286 - 80386- 80486 and Pentium (briefdescription about architectural advancements only).

UNIT–II		10	hrs

MinimumandMaximumModeOperations

Instruction sets of 8086 - Addressing modes – Assembler directives –Simple Programs-Generalbus operation of 8086 – Minimum and Maximum mode operations of 8086 – 8086 Control signal interfacing – Read and write cycle timing diagrams.

UNIT–III		10	hr.

MicroprocessorsI/Ointerfacing

8255 PPI– Architecture of 8255–Modes of operation– Interfacing I/O devices to 8086 using 8255– Interfacing A to D converters– Interfacing D to A converters– Stepper motor interfacing– Static memory interfacing with 8086 – Architecture and interfacing of DMA controller (8257).

UNIT–IV		10	hrs

8051 Microcontroller

Overviewof8051Microcontroller–Architecture–MemoryOrganization–Registerset–Instructionset–SimplePrograms-I/OportsandInterrupts–TimersandCounters–Serial Communication – Interfacing of peripherals.

UNIT–V		10	hrs

PICArchitecture

BlockdiagramofbasicPIC18microcontroller–registersI/Oports–ProgramminginCforPIC: Data types - I/O programming - logical operations - data conversion.

TextBooks

1. RayandBurchandi-"AdvancedMicroprocessorsandInterfacing"-TataMcGraw–Hill-3rd edition-2006.
2. KennethJAyala-"The8051MicrocontrollerArchitecture-ProgrammingandApplications" -Thomson Publishers -2nd Edition.
3. PICMicrocontrollerandEmbeddedSystemsusingAssemblyandCforPIC18-Muhammad AliMazidi–Rolind D.Mckinay-Dannycausey-PearsonPublisher21stImpression.

ReferenceBooks

1. MicroprocessorsandInterfacing - DouglasVHall -Mc–GrawHill-2ndEdition.
2. R.S.Kaler-"ATextbookofMicroprocessorsandMicroControllers"-I.K.International Publishing HousePvt. Ltd.

E-RESOURCES:

1. https://archive.nptel.ac.in/courses/108/105/108105102
2. https://archive.nptel.ac.in/courses/108/103/108103157

CO-PO/PSOMappingMatrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C312.1	3	3													
C312.2	3	3	3												
C312.3	3	3													
C312.4	3	3	1												
C312.5	3	3													
Avg.	**3**	**3**	**2**												

		L	**T**	**P**	**Cr.**
B.Tech.(VISem)	**POWERSYSTEM ANALYSIS**				
	CourseCode:23PCXXXXX	3	0	0	3

Pre-requisites: Conceptsofelectricalcircuitsandpowersystems-II.

Course Objectives:

- Todeveloptheimpedancediagram (p.u)andformationofYbus
- Tolearnthedifferentloadflowmethods.
- TolearntheZbusbuilding algorithm.
- Tolearnshortcircuitcalculationforsymmetricalfaults
- Tolearnthe effect ofunsymmetricalfaultsandtheir effects.
- Tolearnthestability ofpowersystemsand methodtoimprove stability.

CourseOutcomes: After thecompletionofthecoursethestudentshould beable to:

C313.1	:	Drawimpedancediagramforapowersystemnetworkandcalculateperunit quantities.
C313.2	:	Applytheloadflowsolutiontoapowersystemusingdifferentmethods.
C313.3	:	FormZbusfor apower systemnetworkandanalysetheeffectofsymmetrical faults.
C313.4	:	FindthesequencecomponentsforpowersystemComponentsand analyseitseffects ofunsymmetricalfaults.
C313.5	:	Analysethestabilityconceptsofapowersystem.

UNIT–I	10	hrs

Circuit Topology

Graph theory definitions – Formation of element node incidence and bus incidence matrices – Primitivenetworkrepresentation–Formation of Y_{bus} matrixbysingulartransformationanddirect inspection methods.

PerUnitRepresentation

PerUnitQuantities–Singlelinediagram–Impedancediagramofapowersystem–Numerical Problems.

UNIT–II	10	hrs

PowerFlowStudies

Necessityofpowerflow studies–Derivationofstaticpowerflowequations –Powerflow solution usingGauss-SeidelMethod –NewtonRaphsonMethod(Rectangularandpolarcoordinatesform) –DecoupledandFastDecoupledmethods–Algorithmicapproach–NumericalProblemson3–bus system only.

UNIT–III	10	hr.

Z-Bus Algorithm

Formation of Z_{bus}**:** AlgorithmfortheModificationof Z_{bus} Matrix(withoutmutualimpedance)– Numerical Problems.

SymmetricalFault Analysis

Reactance's ofSynchronous Machine– ThreePhase Short CircuitCurrents- Short circuit MVA calculations for Power Systems – Numerical Problems.

UNIT–IV	10	hrs

SymmetricalComponents

Definitionofsymmetricalcomponents–symmetricalcomponentsofunbalancedthreephase systems–Powerinsymmetricalcomponents–SequenceimpedancesandSequencenetworksof Synchronousgenerator, TransformersandTransmissionline-NumericalProblems.

UNIT–V		10	hrs

PowerSystemStability Analysis

Elementary concepts of Steady state – Dynamic and Transient Stabilities – Swing equation – Steady state stability – Equal area criterion of stability – Applications of Equal area criterion – Factors affecting transient stability – Methods to improve steady state and transient stability – Numerical problems.

TextBooks

1	PowerSystemAnalysisbyGraingerandStevenson -TataMcGraw Hill.2003
2	ModernPowersystemAnalysis–byI.J.Nagrath&D.P.Kothari:TataMcGraw–Hill Publishing Company-3rd edition-2007.

ReferenceBooks

1	PowerSystem Analysis– byA.R.Bergen-PrenticeHall -2ndedition- 2009.
2	PowerSystemAnalysisby Hadi Saadat–TataMcGraw–Hill3rd edition- 2010.
3	PowerSystem Analysisby B.R.Gupta-AHWheelerPublishing CompanyLimited-1998.
4	PowerSystemAnalysisandDesignbyJ.DuncanGlover-M.S.Sarma- T.J. Overbye–CengageLearningpublications-5th edition- 2011.

E-RESOURCES:

1	https://archive.nptel.ac.in/courses/117/105/117105140

CO-PO/PSOMappingMatrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C313.1	2	3											3		
C313.2	2	3											3		
C313.3	2	3											3		
C313.4	2	3											3		

	C313.5	2	3										3		
	Avg.	**2**	**3**										**3**		

		PROFESSIONALELECTIVE-II	**L**	**T**	**P**	**Cr.**
B.Tech.(VISem)		**SWITCHGEARAND PROTECTION**				
		CourseCode:23PEXXXXX	3	0	0	3

Pre-requisites: BasicconceptsofElectricalMachinesandPower Systems.

Course Objectives:

- Toexplaintheworkingprinciplesandapplicationsofcircuitbreakersinpowersystems, including MCBs, oil, SF6, and vacuum breakers.
- Toprovideanunderstandingofelectromagneticprotectionmechanisms,particularly relays used in fault detection and system protection (overcurrent, under-voltage, directional, differential).
- Toanalyzeprotectiontechniquesforgeneratorsandtransformers,includingfault protection schemes like percentage differential protection and Buchholz relays.
- Toexplorefeederandbusbarprotectionmethodsusingadvancedrelaysystemssuch as distance and static relays.
- Tostudyover-voltageprotectionsystemsincludinglightningarrestersandneutral groundingmethodstosafeguardthepowersystem.

CourseOutcomes: At theendofthe course,student willbeable to

C314A.1	:	Understandanddescribetheoperationofcircuitbreakers,includingtheirratings, principlesofarcinterruption,andtypes.
C314A.2	:	Analyzerelay-basedprotectionsystems,identifyingandexplainingtheirrolesin overcurrent,undervoltage,andfaultdetection.
C314A.3	:	Designprotectionschemesforgeneratorsandtransformers,addressingfaultslike restrictedearthfaultsandinter-turnfaults.
C314A.4	:	Implementfeederandbusbarprotectionusingadvancedrelayssuchasdistance, impedance,andstatic relays.
C314A.5	:	Evaluateover-voltageprotectionstrategies,includingtheuseoflightning arresters,andunderstand variousneutralgroundingtechniques.

UNIT–I		10	hrs

Circuit Breakers

Miniature Circuit Breaker (MCB)– Elementary principles of arc interruption– Restriking Voltage andRecoveryvoltages–Restrikingphenomenon-RRRV–AverageandMax.RRRV–Current choppingandResistanceswitching–Conceptofoilcircuitbreakers–Descriptionandoperationof Air Blast– Vacuum and SF_6circuit breakers– Circuit Breaker ratings and specifications– Concept of Auto reclosing.

UNIT–II		10	hrs

ElectromagneticProtection

Relayconnection–Balancedbeamtypeattractedarmaturerelay -inductiondiscandinductioncup relays– Torque equation - Relays classification–Instantaneous– DMT and IDMT types–Applications of relays: Over current and under voltage relays– Directional relays– Differential relaysandpercentagedifferentialrelays–Universaltorqueequation–Distancerelays:Impedance– Reactance–Mhoandoffsetmhorelays–Characteristicsofdistancerelays andcomparison.

UNIT–III		10	hr.

GeneratorProtection

Protectionofgeneratorsagainststatorfaults–Rotorfaultsandabnormalconditions–restricted earth fault and inter turn fault protection– Numerical examples.

TransformerProtection

Percentagedifferentialprotection–DesignofCT'sratio–Buchholzrelayprotection–Numerical examples.

UNIT–IV		10	hrs

FeederandBusbarProtection&Static Relays:

Over current Protection schemes – PSM – TMS – Numerical examples – Carrier current and three zonedistancerelayusingimpedancerelays.ProtectionofbusbarsbyusingDifferentialprotection. Staticrelays:Introduction –ClassificationofStaticRelays–BasicComponentsofStaticRelays.

UNIT–V		10	hrs

Protectionagainstovervoltageand grounding

Generation of over voltages in power systems– Protection against lightning over voltages– Valve type and zinc oxide lighting arresters. Grounded and ungrounded neutral systems – Effects of ungrounded neutral on system performance – Methods of neutral grounding: Solid–resistance– Reactance–Arcing grounds and grounding Practices.

TextBooks

1	Power SystemProtectionandSwitchgearbyBadriRamandD.NViswakarma-TataMcGraw HillPublications -2nd edition- 2011.
2	Powersystemprotection-StaticRelayswithmicroprocessorapplicationsbyT.S.Madhava Rao-Tata McGrawHill-2nd edition.

ReferenceBooks

1	FundamentalsofPower SystemProtectionbyPaithankarandS.R.Bhide.-PHI- 2003.
2	Art&ScienceofProtectiveRelaying – byCRMason -WileyEasternLtd.

E-RESOURCES:

1	https://archive.nptel.ac.in/courses/108/107/108107167
2	https://archive.nptel.ac.in/courses/108/105/108105167

CO-PO/PSOMappingMatrix

	CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
	C314A.1	2	3												3	
	C314A.2	2	3												3	
	C314A.3	2	3												3	
	C314A.4	2	3												3	
	C314A.5	2	3												3	
	Avg.	**2**	**3**												**3**	

		PROFESSIONALELECTIVE-II	**L**	**T**	**P**	**Cr.**
B.Tech.(VISem)		**ADVANCEDCONTROLSYSTEMS**				
		CourseCode:23PEXXXXX	3	0	0	3

Pre-requisites: BasicconceptsofControl Systems.

Course Objectives:

- To understand the concept of controllability, observability, and their tests for continuous-timesystems,aswellastheprincipleofdualityinstate-spaceanalysis.
- Tounderstandthestate-spacemethodstoassesscontrollability,observability,and design state feedback controllers via pole placement.
- Toknowthestabilityofnonlinearsystemsusingphase-planeanalysis,describing functions, and Lyapunov's stability theorems.
- ToLearnoptimalcontrolstrategiesusingthecalculusofvariations,including constrained minimization and the minimum principle.
- TolearnOptimalcontrol andstateregulatorproblems.

CourseOutcomes: At theendofthe course,student willbeable to

C314B.1	:	Explaincontrollability,observability,andtheprincipleofdualityinstate-space systems.
C314B.2	:	Applystate-spacemethodstoanalyzecontrollability,observability,anddesignstate feedbackcontrollers.
C314B.3	:	Analyzethestabilityofnonlinearsystemsusingphase-planeanalysisand Lyapunov'sstabilitytheorems.
C314B.4	:	Examinetheminimizationoffunctionaland controlvariableinequalityconstraints.
C314B.5	:	Formulateand solvetheoptimalregulatorproblems.

UNIT–I		10	hrs

Controllability-ObservabilityandDesignofPolePlacement

Generalconceptsofcontrollabilityandobservability -Testsforcontrollabilityandobservabilityfor continuous time systems - Principle of duality - Effect of state feedback on controllability and observability-Designofstatefeedbackcontrolthroughpoleplacement,fullorderandreduced order observers.

UNIT–II		10	hrs

Nonlinear Systems

Introductiontononlinearsystems-Typesofnonlinearities.Introductiontophaseplaneanalysis, construction ofphasetrajectories-Analytical and Isoclinemethod, describing function - Describing functions of on-off nonlinearity, on-off nonlinearity with hysteresis, and relay with dead zone.

UNIT–III		10	hrs

StabilityanalysisbyLyapunov Method

Stability in the sense of Lyapunov – Lyapunov's stability and Lyapunov's instability theorems – Direct method of Lyapunov for the linear and nonlinear continuous time autonomous systems.

UNIT–IV		10	hrs

Calculusof Variations

Minimizationoffunctionals-functionalsofsinglefunction–Constrainedminimization–Minimumprinciple–Controlvariableinequalityconstraints–Controlandstatevariableinequality constraints.

UNIT–V		10	hrs

OptimalControl

Necessary conditions for optimal control, Formulation of the optimal control problem, minimum time problem, minimum energy problem, minimum fuel problem, state regulator problem, output regulator problem.

TextBooks

1	ModernControl Engineering– byK. Ogata-PrenticeHall of India-3rd edition -1998
2	AutomaticControlSystemsbyB.C.Kuo-PrenticeHallPublication.

ReferenceBooks

1	ModernControlSystemTheory–byM. Gopal- NewAge InternationalPublishers - 2ndedition – 1996.
2	Optimalcontroltheory:anIntroductionbyDonald E. KirkbyDoverpublications.
3	ControlSystemsEngineeringbyI.J.NagarathandM.Gopal -NewAgeInternational(P)Ltd.

E-RESOURCES:

1	https://archive.nptel.ac.in/courses/108/103/108103007
2	https://archive.nptel.ac.in/courses/108/107/108107115

CO-PO/PSOMappingMatrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C314B.1	2	3												3	
C314B.2	2	3												3	
C314B.3	2	3												3	
C314B.4	2	3												3	
C314B.5	2	3												3	
Avg.	**2**	**3**												**3**	

	PROFESSIONALELECTIVE–II	**L**	**T**	**P**	**Cr.**
B.Tech.(VISem)	**SIGNALS&SYSTEMS**				
	CourseCode: 23PEXXXXX	3	0	0	3

Pre-requisites: A solid foundation in mathematics, particularly calculus (integration and differentiation), complex numbers, and linear algebra.

Course Objectives:

- To introduce the terminology of signals and systems.
- To introduce Fourier tools through the analogy between vectors and signals.
- To introduce the concept of sampling and reconstruction of signals.
- To analyze the linear systems in time and frequency domains.
- To study z-transforms as mathematical tool to analyze discrete-time signals and systems.

Course Outcomes: At the end of the course, the student will be able to

C314C.1	:	Characterize the signals and systems and principles of vector spaces, Concept of orthogonality.
C314C.2	:	Analyze the continuous-time signals and continuous-time systems using Fourier series, Fourier transform and Laplace transform.
C314C.3	:	Apply sampling theorem to convert continuous-time signals to discrete-time signal and reconstruct back.
C314C.4	:	Understand the relationships among the various representations of LTI systems
C314C.5	:	Understand the Concepts of convolution, correlation, Energy and Power density spectrum and their relationships.

UNIT–I 10 hrs

Introduction:

Definition of Signals and Systems, Classification of Signals, Classification of Systems, Operations on signals: time-shifting, time-scaling, amplitude-shifting, amplitude-scaling. Problems on classification and characteristics of Signals and Systems. Complex exponential and sinusoidal signals, Singularity functions and related functions: impulse function, step function signum function and ramp function. Analogy between vectors and signals, orthogonal signal space, Signal approximation using orthogonal functions, Mean square error, closed or complete set of orthogonal functions, Orthogonality in complex functions.

UNIT–II 10 hrs

Fourier Series and Fourier Transform:

Fourier series representation of continuous time periodic signals, properties of Fourier series, Dirichlet's conditions, Trigonometric Fourier series and Exponential Fourier series, Complex Fourier spectrum. Deriving Fourier transform from Fourier series, Fourier transform of arbitrary signal, Fourier transform of standard signals, Fourier transform of periodic signals, properties of Fourier transforms, Fourier transforms involving impulse function and Signum function. Introduction to Hilbert Transform.

UNIT–III 10 hrs

Sampling Theorem

Graphical and analytical proof for Band Limited Signals, impulse sampling, Natural and Flat top Sampling, Reconstruction of signal from its samples, effect of under sampling – Aliasing, Introduction to Band Pass sampling.

UNIT–IV 10 hrs

AnalysisofLinear Systems:

Linear system, impulse response, Response of a linear system, Linear time invariant (LTI) system, Linear time variant (LTV) system, Concept of convolution in time domain and frequency domain, Graphical representation of convolution, Transfer function of a LTI system. Filter characteristicsof linear systems. Distortion less transmission through a system, Signal bandwidth, system bandwidth, Ideal LPF, HPF and BPF characteristics, Causality and Poly-Wiener criterion for physical realization, relationship between bandwidth and rise time.

Cross-correlation and auto-correlation of functions, properties of correlation function, Energy density spectrum, Parseval's theorem, Power density spectrum, Relation between auto correlation function and energy/power spectral density function. Relation between convolution and correlation,Detectionofperiodicsignalsinthepresenceofnoisebycorrelation,Extractionof signalfrom noiseby filtering.

UNIT–V		10	hrs

LaplaceTransforms:

Review of Laplace transforms, Partial fraction expansion, Inverse Laplace transform, Concept of region of convergence (ROC) for Laplace transforms, constraints on ROC for various classes of signals,PropertiesofL.T's,RelationbetweenL.T's,andF.T.ofasignal.Laplacetransformof certainsignalsusingwaveformsynthesis.

UNIT–VI		10	hrs

Z–Transforms:

Fundamental difference between continuous-time and discrete-time signals, discrete time signal representation using complex exponential and sinusoidal components, Periodicity of discrete time using complex exponential signal, Concept of Z- Transform of a discrete sequence. Distinction between Laplace,Fourierand Z transforms. Region of convergenceinZ-Transform, constraintson ROCforvariousclassesofsignals,InverseZ-transform,propertiesofZ-transforms.

TextBooks

1	Signals,Systems &Communications-B.P.Lathi,BSPublications,2003.
2	SignalsandSystems-A.V.Oppenheim,A.S.WillskyandS.H.Nawab,PHI,2ndEdn.

ReferenceBooks

1	Signals&Systems–SimonHaykinandVanVeen,Wiley,2ndEdition.
2	PrinciplesofLinearSystems andSignals–BPLathi,OxfordUniversity Press,2015
3	SignalsandSystems–KRajaRajeswari,BVisweswaraRao,PHI, 2009
4	FundamentalsofSignals andSystems-MichelJ.Robert,MGHInternationalEdition, 2008.

CO-PO/PSOMappingMatrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3

	C314C.1	2	3											3	
	C314C.2	2	3											3	
	C314C.3	2	3											3	
	C314C.4	2	3											3	
	C314C.5	2	3											3	
	Avg.	**2**	**3**											**3**	

12WeekMOOCSSWAYAM NPTELCourse recommendedby BOS

		PROFESSIONALELECTIVE-III	**L**	**T**	**P**	**Cr.**
B.Tech.(VISem)		**ELECTRICDRIVES**				
		CourseCode:23PEXXXXX	3	0	0	3

Pre-requisites:
ElectricalCircuitAnalysis,Powerelectronics,ElectricalMachinesandControlSystems.

Course Objectives:

- Tolearnthefundamentalsofelectricdriveanddifferentelectricbraking methods.
- Toanalyzetheoperationofthreephaseconverter-controlleddcmotorsandfour quadrants operation of dc motors using dual converters.
- TodiscusstheDC-DCconvertercontrolofdcmotors.
- TounderstandtheconceptofspeedcontrolofinductionmotorbyusingACvoltage controllers, voltage source inverters and slip power recovery scheme.
- Tolearnthespeedcontrolmechanism ofsynchronousmotors.

CourseOutcomes: Afterthe completionofthecoursethe studentshouldbeable to:

C315A.1	:	Explainthefundamentalsofelectricdriveanddifferentelectric braking methods.
C315A.2	:	Analyzetheoperationofthree-phaseconverterfeddcmotorsandfourquadrant operationsofdcmotorsusingdualconverters.
C315A.3	:	DescribetheDC-DCconverterfedcontrolofdcmotorsinvariousquadrantsof operation
C315A.4	:	KnowtheconceptofspeedcontrolofinductionmotorbyusingACvoltage controllers and voltage source inverters and differentiate the stator side control and rotor side control
C315A.5	:	Learnthe conceptsofspeed controlof synchronousmotor with differentmethods.

UNIT–I		10	hrs

FundamentalsofElectricDrives
Electric drive and its components– Fundamental torque equation – Load torque components – Nature and classification of load torque – Steady state stability – Load equalization– Four quadrant operationofdrive(hoistcontrol)–Brakingmethods**:**DynamicBraking,PluggingandRegenerative Braking–Numericalproblems.

UNIT–II		10	hrs

ConverterFedDC Motor Drives
3-phase half and fully-controlled converter fed separately and self-excited DC motor drive – Output voltage and current waveforms – Speed-torque characteristics and expressions – 3-phase Dual converter fed DC motor drives – Numerical problems.

UNIT–III		10	hrs

DC–DCConverterFedDCMotor Drives

Single quadrant, two quadrant and four quadrant DC-DC converter fed separately excited and self-excited DC motors – Continuous Current Mode of operation - Output voltage and current waveforms–Speed-torquecharacteristicsandexpressions–Closedloopoperation(qualitative treatmentonly)–Numericalproblems.

UNIT–IV		10	hrs

Controlof3-phaseInductionmotorDrives

Stator voltage control using 3-phase AC voltage regulators – Waveforms –Speed torque characteristics– Variable Voltage Variable Frequency control of induction motor by PWM voltage source inverter – Closed loop V/f control of induction motor drives (qualitative treatment only). Staticrotorresistancecontrol–Slippowerrecoveryschemes–StaticScherBiusdrive–Static Kramerdrive–Performanceandspeedtorque characteristics–Numericalproblems.

UNIT–V		10	hrs

ControlofSynchronousMotorDrives

Separatecontrolofsynchronousmotor–self-controlofsynchronousmotoremployingloadcommutatedthyristorinverter-closedloopcontrolofsynchronousmotordrive(qualitative treatmentonly)–PMSM:Basicoperationandadvantages –Numericalproblems.

TextBooks

1	FundamentalsofElectricDrives–GKDubey-NarosaPublications-2nd edition–2002.
2	PowerSemiconductorDrives-S.B.Dewan-G.R.Slemon-A.Straughen-Wiley India-1984

ReferenceBooks

1	ElectricMotorsandDrivesFundamentals-TypesandApplications-byAustinHughes andBill Drury-Newnes.4th edition -2013.
2	ThyristorControlofElectricdrives–VedaSubramanyamTataMcGrawHill Publications- 1987.
3	PowerElectronicCircuits-DevicesandapplicationsbyM.H. Rashid-PHI -3rd edition -2009.

E-RESOURCES:

1	https://archive.nptel.ac.in/courses/108/104/108104140
2	https://nptel.ac.in/courses/108104011

CO-PO/PSOMappingMatrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3

	C315A.1	2	3											3	
	C315A.2	2	3											3	
	C315A.3	2	3											3	
	C315A.4	2	3											3	
	C315A.5	2	3											3	
	Avg.	**2**	**3**											**3**	

		PROFESSIONALELECTIVE-III	**L**	**T**	**P**	**Cr.**
B.Tech.(VISem)		**DIGITAL SIGNAL PROCESSING**				
		CourseCode:23PEXXXXX	3	0	0	3

Pre-requisites: LaplaceTransforms,Z-Transforms,Fourierseriesand transforms

Course Objectives:

- Toexplorethebasicconceptsofdigitalsignal processing.
- Toconnectthetimedomainsignaltofrequencydomainsignalsusing Fourier transform.
- Tounderstandthebasicstructuresof IRRsystems.
- TounderstandanddesignFIRDigitalfilters.
- ToexploretheconceptsofmultiplesamplingratesforDSP

CourseOutcomes: Afterthe completionofthecoursethe studentshouldbeable to:

C315B.1	:	Know the concepts of Digital signal processing - frequency domain representation &z- transform.
C315B.2	:	ComputediscreteFouriertransformandfastFouriertransformsfordifferent sequences.
C315B.3	:	DesignIIRfilterthroughanalogfilterapproximationandbasicstructureofIIR filters.
C315B.4	:	DesignFIRfilterswithwindowtechniquesandbasicstructureofFIR filters.
C315B.5	:	Learnthe conceptsofMultirateSignalProcessing.

UNIT–I	10	hrs

IntroductiontoDigitalSignal Processing

Discrete time signals & sequences - Classification of Discrete time systems - stability of LTI systems - Invertibility - Response of LTI systems to arbitrary inputs. Solution of Linear constant coefficient difference equations. Frequency domain representation of discrete time signals and systems.ReviewofZ-transforms-solutionofdifferenceequationsusingZ-transforms-System function.

UNIT–II	10	hrs

DiscreteFourierTransformsand FFTAlgorithms

DiscreteFourierSeriesrepresentationofperiodicsequences-PropertiesofDiscreteFourierSeries

-DiscreteFouriertransforms:PropertiesofDFT-linearfilteringmethodsbasedonDFT-Fast Fouriertransforms(FFT)-Radix-2decimationintimeanddecimationinfrequencyFFT Algorithms - Inverse FFT.

UNIT–III	10	hrs

	DesignandRealizationsofIIRDigital Filters Analog filter approximations– Butterworth and Chebyshev filters- Design of IIR Digital filtersfrom analog filters with examples. Analog and Digital frequency transformations. BasicstructuresofIIRsystems–Direct-FormStructures-TransposedStructures-Cascade-Form Structures-Parallel-FormStructuresLatticeand Lattice-Ladder Structures.			
	UNIT–IV		10	hrs
	DesignandRealizationsofFIRDigital Filters CharacteristicsofFIRFilterswithLinearPhase-FrequencyResponseofLinearPhaseFIRFilters -DesignofFIRDigitalFiltersusingWindowTechniquesandFrequencySamplingtechnique-Comparison of IIR & FIR filters. BasicstructuresofFIRsystems–Direct-FormStructure-Cascade-FormStructuresLinearPhase Realizations-Latticestructures.			
	UNIT–V		10	hrs
	MultirateDigitalSignalProcessing Decimation–Interpolation-SamplingRateConversionbyaRationalFactor–Implementationof sampling rate converters–Applications of Multirate Signal Processing-Digital Filter Banks.			
	TextBooks			
	1	DigitalSignalProcessing–PrinciplesAlgorithmsandApplications:JohnG.Proakis–DimitrisG.Manolakis -4th Edition-PearsonEducation/PHI- 2007.		
	2	DiscreteTimeSignalProcessing –A.V.OppenheimandR.W.Schaffer -PHI.		
	3	DigitalSignalProcessing:AComputerbasedapproach.SanjitKMitra-4thEdition-TMH-2014.		
	ReferenceBooks			
	1	DigitalSignalProcessing:AndreasAntoniou-TATAMcGrawHill-2006.		
	2	DigitalSignalProcessing:MHHayes -Schaum's Outlines -TATAMc-GrawHill- 2007.		
	3	DSP Primer-C. BrittonRorabaugh -Tata McGrawHill -2005.		
	4	FundamentalsofDigitalSignalProcessingusingMatlab–RobertJ.Schilling-SandraL. Harris-Thomson - 2007.		
	5	DigitalSignalProcessing–Alan V.Oppenheim- Ronald W.Schafer -PHI Ed.-2006.		
	6	DigitalSignalProcessing–KRajaRajeswari-1stedition-I.K.InternationalPublishing-House– 2014		

CO-PO/PSOMappingMatrix

	CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
	C315B.1	2	3												3	
	C315B.2	2	3												3	
	C315B.3	2	3												3	
	C315B.4	2	3												3	
	C315B.5	2	3												3	
	Avg.	**2**	**3**												**3**	

		PROFESSIONALELECTIVE-III	**L**	**T**	**P**	**Cr.**
B.Tech.(VISem)		**HIGHVOLTAGEENGINEERING**				
		CourseCode:23PEXXXXX	3	0	0	3

Pre-requisites:
MaterialScience,ElectromagneticFieldsandBasicsofTransient Circuits.

Course Objectives:

- TounderstandHVbreakdownphenomenain gases.
- Tounderstandthe breakdownphenomenon ofliquidsandsolid dielectrics.
- ToacquaintwiththegeneratingprincipleofoperationanddesignofHVDC,AC voltages.
- TounderstandthegeneratingprinciplesofImpulsevoltages&currents.
- TounderstandvarioustechniquesforAC,DCandImpulsemeasurementsofhigh voltages and currents.

CourseOutcomes: Afterthe completionofthecoursethe studentshouldbeable to:

C315C.1	:	Recognizethedielectricpropertiesofgaseousmaterialsusedin HV equipment.
C315C.2	:	Differentiatethebreakdownphenomenon inliquidandsoliddielectricmaterials.
C315C.3	:	Acquaintwith thetechniquesofgeneration ofhigh ACandDC voltages
C315C.4	:	AcquaintwiththetechniquesofgenerationofhighImpulsevoltagesand currents.
C315C.5	:	GettingtheknowledgeofmeasurementofhighAC-DC-Impulsevoltagesand currents.

UNIT–I		10	hrs

BreakdownphenomenoninGaseousandVacuum:
Insulating Materials: Types, properties and its applications. Gases as insulating media – Collision process – Ionization process – Townsend's criteria of breakdown in gases and its limitations – Streamers Theory of break down – time lag – Paschen's law- Paschen's curve, Penning Effect. BreakdownmechanismsinVacuum.

UNIT–II		10	hrs

Breakdownphenomenonin Liquids:
LiquidasInsulator–Pureandcommercialliquids–Breakdowninpureandcommercialliquids-Mechanisms.

Breakdownphenomenonin Solids:
Intrinsicbreakdown–Electromechanicalbreakdown–Thermalbreakdown–Breakdownof compositesolid dielectrics.

UNIT–III		10	hrs

	GenerationofHighDCvoltages: VoltageDoubler Circuit-VoltageMultiplierCircuit–Vande-Graaff Generator. **GenerationofHighACvoltages**: CascadedTransformers–ResonantTransformers–Tesla Coil.			
	UNIT–IV		10	hrs
	GenerationofImpulsevoltages: Specificationsofimpulse wave–AnalysisofRLCcircuits-MarxCircuit. **GenerationofImpulsecurrents:** Definitions – Circuits for producing Impulse current waves – Wave shape control - Tripping andcontrol of impulse generators			
	UNIT–V		10	hrs
	MeasurementofHighDC&AC Voltages: Resistancepotentialdivider-GeneratingVoltmeter-CapacitorVoltageTransformer(CVT)-Electrostatic Voltmeters – Sphere Gaps. **MeasurementofImpulseVoltages&Currents:** PotentialdividerswithCRO-HallGenerator-RogowskiCoils.			
	TextBooks			
	1	HighVoltageEngineering:FundamentalsbyE.Kuffel-W.S.Zaengl-J.KuffelbyElsevier -2nd Edition.		
	2	HighVoltageEngineeringbyM.S.NaiduandV.Kamaraju–TMHPublications-3rd Edition.		
	ReferenceBooks			
	1	HighVoltageEngineering andTechnology byRyan- IET Publishers-2nd edition.		
	2	HighVoltageEngineeringbyC.L.Wadhwa-NewAgeInternationals(P)Limited–1997.		
	3	HighVoltageInsulationEngineeringbyRavindraArora-WolfgangMosch -NewAge International(P)Limited-1995.		
	E-RESOURCES:			
	1	https://archive.nptel.ac.in/courses/108/104/108104048		
	2	https://bharatsrajpurohit.weebly.com/high-voltage-engineering-course.html		

CO-PO/PSOMappingMatrix

	CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
	C315C.1	2	3												3	
	C315C.2	2	3												3	
	C315C.3	2	3												3	
	C315C.4	2	3												3	
	C315C.5	2	3												3	
	Avg.	**2**	**3**												**3**	

12WeekMOOCSSWAYAMNPTEL CourserecommendedbyBOS

		OPENELECTIVE-II	**L**	**T**	**P**	**Cr.**
B.Tech.(VISem)		**FUNDAMENTALSOFELECTRICVEHICLES**				
		CourseCode:23OEXXXXX	3	0	0	3

Pre-requisites:
BasicknowledgeinPhysics,ChemistryandBasicsofElectricalandElectronics.

Course Objectives:

- Tofamiliarizethestudentswiththeneedandadvantagesofelectricandhybrid electric vehicles.
- Tounderstandvariouspowerconvertersusedinelectric vehicles.
- Tobefamiliarallthedifferenttypesofmotorssuitablefor electric vehicles.
- Toknowvariousarchitectureofhybridelectric vehicles.
- Tohaveknowledgeonlatestdevelopmentsinbatteriesandotherstoragesystems.

CourseOutcomes: Afterthe completionofthecoursethe studentshouldbeable to:

C316A.1	:	Illustratetheuseandadvantagesofdifferenttypes ofelectricvehicles.
C316A.2	:	UsesuitablepowerconvertersforEV application.
C316A.3	:	SelectsuitableelectricmotorforEVpowertrain.
C316A.4	:	Design HEVconfigurationforaspecificapplication.
C316A.5	:	AnalysevariousstoragesystemsandbatterymanagementsystemforEVs

UNIT–I 10 hrs

Introduction
Fundamentals of vehicles – Vehicle model –Calculation Road load and tractive force – Components of conventional vehicles – Ddrawbacks of conventional vehicles – Need for electric vehicles–AdvantagesandapplicationsofElectricVehicles–HistoryofElectricVehicles–EV Marketin Indiaandoutside India–TypesofElectricVehicles.

UNIT–II 10 hrs

ComponentsofElectric Vehicles
MaincomponentsofElectricVehicles–ElectricTractionMotorandController–Power Converters– Rectifiers usedin EVs–BidirectionalDC–DC Converters–VoltageSourceInverters –PWMinvertersusedinEVs.

UNIT–III 10 hrs

MotorsforElectricVehicles
Characteristicsoftractiondrive–requirementsofelectricmachinesforEVs–Comparisonof DifferentmotorsforElectricandHybridVehicles–InductionMotors–SynchronousMotors– Permanent Magnetic Synchronous Motors – Brushless DC Motors – Switched Reluctance Motors (Construction details and working only).

UNIT–IV 10 hrs

HybridElectricVehicles

Evolution of Hybrid Electric Vehicles – Advantages and Applications of Hybrid Electric Vehicles –ArchitectureofHEVs–SeriesandParallelHEVs–ComplexHEVs–RangeextendedHEVs–Examples–MeritsandDemerits.

UNIT–V		10	hrs

EnergySourcesforElectric Vehicles

Batteries– Types of Batteries – Lithium-ion – Nickel-metal hydride – Lead-acid – Comparison of Batteries–BatteryCharging–FastCharging–BatteryManagementSystem–Ultracapacitors–Flywheels–Compressedairenergystorage (CAES)–FuelCell –it's working.

TextBooks

1	IqbalHussein-ElectricandHybridVehicles:DesignFundamentals -CRCPress -2021.
2	TomDenton,HayleyPells-Electricandhybrid vehicles,ThirdEdition, 2024

ReferenceBooks

1	Kumar-L.Ashok-andS.AlbertAlexander.PowerConvertersforElectricVehicles. CRCPress-2020.
2	Chau-KwokTong.Electricvehiclemachinesanddrives:design-analysisand application.JohnWiley &Sons -2015.
3	Berg-Helena.Batteriesforelectricvehicles:materialsandelectrochemistry. Cambridgeuniversitypress – 2015

E-RESOURCES:

1	MOOCathttps://www.edx.org/learn/electric-cars
2	https://archive.nptel.ac.in/courses/108/106/108106170

CO-PO/PSOMappingMatrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C316A.1	2	3												3	
C316A.2	2	3												3	
C316A.3	2	3												3	
C316A.4	2	3												3	
C316A.5	2	3												3	
Avg.	**2**	**3**												**3**	

	OPENELECTIVE-II	**L**	**T**	**P**	**Cr.**
B.Tech.(VISem)	**ELECTRICALWIRINGESTIMATIONANDCOSTING**				

		CourseCode:23OEXXXXX	3	0	0	3

Pre-requisites:
ElectricalCircuits,BasicsofPowerSystemsandElectricalMachines.

Course Objectives:

- Introducethe electricalsymbolsandsimpleelectricalcircuits
- Abletolearnthedesignofelectrical installations.
- Abletolearnthedesignofelectricalinstallationfordifferenttypesofbuildingsand small industries.
- Learnthebasiccomponentsofelectricalsubstations.
- Familiarizewiththemotorcontrolcircuits

CourseOutcomes: Afterthe completionofthecoursethe studentshouldbeable to:

C316B.1	:	Demonstratethevarious electricalapparatusandtheir interconnections.
C316B.2	:	Examinevariouscomponentsofelectrical installations.
C316B.3	:	Estimatethecost forinstallationofwiringfordifferent typesofbuilding and small industries.
C316B.4	:	Illustratethecomponentsofelectricalsubstations.
C316B.5	:	Designsuitablecontrol circuitforstarting ofthree phaseinductionmotor and synchronousmotor.

UNIT–I 10 hrs

ElectricalSymbolsandSimpleElectrical Circuits
Identificationofelectricalsymbols-ElectricalwiringDiagrams-Methodsofrepresentationof wiringdiagrams-introductiontosimplelightandfancircuits-systemofconnectionofappliances andaccessories.

UNIT–II 10 hrs

DesignConsiderationsofElectricalInstallations
Electric supply system - Three-phase four wire distribution system - protection of electric installation against overload - short circuit and earth fault - earthing- neutral and earth wire - types of loads - systems of wiring - permissible of voltage drops and sizes of wires - estimating and costing of electrical installations.

UNIT–III 10 hrs

ElectricalInstallationforDifferentTypesofBuildingsandSmall Industries
Electricalinstallationsforelectricalbuildings-estimatingandcostingofmaterial-simple examples on electrical installation for residential buildings - electrical installations for commercial buildings - electrical installation for small industries-case study.

UNIT–IV 10 hrs

Substations
Introduction - types of substations - outdoor substations-pole mounted type – indoor substations-floor mounted type - simple examples on quantity estimation-case study.

	UNIT–V		10	hrs
	Motorcontrolcircuits Introduction to AC motors - starting of three phase squirrel cage induction motors - starting of wound rotor motors - starting of synchronous motors - contractor control circuit components - basiccontrolcircuits-motorprotection–Schematicandwiringdiagramsformotorcontrol circuits.			
	TextBooks			
	1	ElectricalDesign andEstimation Costing -K.B.RainaandS. K.Bhattacharya– New AgeInternationalPublishers- 2007.		
	ReferenceBooks			
	1	Electricalwiringestimatingandcosting–S.L.UppalandG.C.Garg–Khanna publishers-6th edition-1987.		
	2	Acourseinelectricalinstallationestimatingandcosting–J.B.Gupta–KatariaSK& Sons- 2013.		
	E-RESOURCES:			
	1	https://onlinecourses.swayam2.ac.in/nou25_ec07/preview		

CO-PO/PSOMappingMatrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C316B.1	2	3											3		
C316B.2	2	3											3		
C316B.3	2	3											3		
C316B.4	2	3											3		
C316B.5	2	3											3		
Avg.	**2**	**3**											**3**		

	OPENELECTIVE– II	**L**	**T**	**P**	**Cr.**
B.Tech.(VI_Sem.)	**SAFETY ENGINEERING**				
	CourseCode:**23OEXXXXX**	3	0	0	3

Pre-requisites: BasicElectricalEngineering

Course Objectives:

- Tounderstandtheconceptsofindustrialsafetyand management.
- Todemonstratetheaccidentpreventionsandprotective equipment.
- Tounderstandand applytheknowledgeofsafetyacts
- Tohavetheknowledgeaboutfirepreventionandprotectionsystems
- Tounderstandand applyfiresafetyprinciplesinbuildings

CourseOutcomes: At theendofthe course, thestudentwill beable to

C316C.1	:	Learnthe conceptsofindustrialsafetyandmanagement.
C316C.2	:	Demonstratetheaccidentpreventionsandprotectiveequipment
C316C.3	:	Applytheknowledgeof safetyacts.
C316C.4	:	Analyseaboutfirepreventionandprotection systems.
C316C.5	:	Applythe firesafety principlesin buildings

UNIT–I		10	hrs

Introduction to The Development of Industrial Safety and Management: History and development of Industrial safety: Implementation of factories act, Safety and productivity, Safety organizations.Safetycommitteesandstructure,Roleofmanagementandroleof Govt.in industrial safety.

UNIT–II		10	hrs

Accident Preventions and Protective Equipment: Personal protective equipment, Survey the plant for locations, Part of body to be protected, Education and training in safety, Preventioncausesandcostofaccident,Housekeeping,Firstaid,Accidentreporting,Investigations.Industrial psychologyinaccidentprevention,Safetytrials,Safetyrelatedtooperations.

UNIT–III		10	hrs

Safety Acts: Features of Factory Act, Introduction of Explosive Act, Boiler Act, ESI Act, Workman's compensation Act, Industrial hygiene, Occupational safety, Diseases prevention, Ergonomics,Occupationaldiseases,stress,fatigue,health,safetyandthephysicalenvironment, Engineeringmethodsofcontrollingchemicalhazards,safetyandthephysicalenvironment, Controlofindustrialnoiseandprotectionagainstit,Codeandregulationsforworkersafetyand health,codesforsafetyofsystems.

UNIT–IV		10	hrs

Fire Prevention and Protection: Sources of ignition – fire triangle – principles of fire extinguishing – activeand passivefireprotection systems – various classes offires – A,B, C, D, E Fire extinguishing agents- Water, Foam, Dry chemical powder, Carbon-dioxide Halon alternatives Halocarbon compounds-Inert gases, dry powders – types of fire extinguishers – fire stoppers – hydrant pipes – hoses – monitors – fire watchers – layout of stand pipes – fire station- fire alarms andsirens–maintenanceoffiretrucks–foamgenerators–escapefromfirerescueoperations– firedrills – firstaid for burns.

UNIT–V		10	hrs

	BuildingFireSafety:Objectivesoffiresafebuildingdesign,Fireload,fireresistantmaterialand firetesting–structuralfireprotection–structuralintegrity–conceptofegressdesign-exit– width calculations - fire certificates – fire safety requirements for high rise buildings.	
	TextBooks	
	1	PurandareD.D&AbhayD.Purandare,"HandbookonIndustrialFireSafety"P&A publications,NewDelhi, 2006.
	2	McElroy,FrankE.,"AccidentPreventionManualforIndustrialOperations",NSC,Chicago, 1988.
	ReferenceBooks	
	1	Installation,ServicingandMaintenanceBhattacharya,S.N. -S.ChandandCo.
	2	JainVK"FireSafetyinBuilding"NewAge International1996.
	3	OccupationalSafetyManagementandEngineeringWillieHammer–Prentice Hall.

CO-PO/PSOMappingMatrix

	CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
	C316.1	2	3												3	
	C316.2	2	3												3	
	C316.3	2	3												3	
	C316.4	2	3												3	
	C316.5	2	3												3	
	Avg.	**2**	**3**												**3**	

			L	T	P	Cr.
B.Tech.(VISem)		**ELECTRICALMEASUREMENTSAND INSTRUMENTATIONLAB**				
		CourseCode:23PEXXXXX	0	0	3	1.5

Pre-requisites: Basicknowledgeonmeasurements

Course Objectives:

- Tounderstandstudentshowdifferenttypesofmeterswork andtheir construction.
- Tomakethestudentsunderstandhowtomeasureresistance,inductanceandcapacitance by AC & DC bridges.
- TounderstandthetestingofCTand PT.
- To Understand and the characteristics of Thermo couples, LVDT, Capacitive transducer, piezoelectric transducer and measurement of strain and choke coil parameters.
- Tostudytheprocedureforstandardizationandcalibrationofvarious methods.

CourseOutcomes: Afterthe completionofthecoursethe studentshouldbeable to:

C317.1	:	Knowaboutthephantomloadingandcalibrationprocess.
C317.2	:	Measuretheelectricalparametersvoltage-current-power-energyand electricalcharacteristicsofresistance-inductanceandcapacitance.
C317.3	:	Gaintheskillknowledge ofvariousbridesandtheirapplications
C317.4	:	LearntheusageofCT's-PT'sformeasurement purpose.
C317.5	:	Know the characteristics of transducers and measure the strains - frequencyandphasedifference.

List ofExperiments
(Anytenexperimentsfromthefollowing list)

	1	Calibrationofdynamometerwattmeterusingphantom loading
	2	MeasurementofresistanceusingKelvin'sdoubleBridgeandDeterminationofits tolerance
	3	MeasurementofCapacitanceusingSchering Bridge.
	4	MeasurementofInductanceusingAndersonBridge.
	5	CalibrationofLPFWattmeterbydirect loading.
	6	Measurementsof3phasereactivepowerusingsinglewattmetermethodforabalanced load.
	7	TestingofC.T.usingmutualinductor–Measurementof%ratioerrorandphaseangleof givenC.T. byNull deflection method.

	8	P.T.testingbycomparison–V.GasNulldetector–Measurementof%ratioerrorand phaseangle of thegivenP.T.
	9	DeterminationofthecharacteristicsofaThermocouple.
	10	DeterminationofthecharacteristicsofaLVDT.
	11	Determinationofthecharacteristicsfora capacitivetransducer.
	12	Measurementof strain forabridgestrain gauge.
	13	MeasurementofChokecoilparametersandsingle-phasepowerusingthreevoltmeterand threeammetermethods.
	14	Calibrationofsingle-phaseInductionTypeEnergyMeter.
	15	CalibrationofDC ammeterandvoltmeter usingCromptonDC Potentiometer
	16	ACPotentiometer:PolarForm/CartesianForm-CalibrationofACvoltmeter-Parametersof choke.

ReferenceBooks

1	Electrical&ElectronicMeasurement&InstrumentsbyA.K.SawhneyDhanpatRai&Co. Publications.
2	ElectricalandElectronicMeasurementsandinstrumentationbyR.K.Rajput,S.Chand.

CO-PO/PSOMappingMatrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C317.1									3	2					3
C317.2								2	3	2					3
C317.3	2			3					3						3
C317.4	2			3					3						3
Avg.	**2**			**3**				**2**	**3**	**2**					**3**

			L	T	P	Cr.
B.Tech.(VISem)		**MICROPROCESSORSANDMICROCONTROLLERS LAB**				
		CourseCode: 23PEXXXXX	0	0	3	1.5

	Pre-requisites: ConceptsofMicroprocessorsandMicrocontrollers		
	Course Objectives:		
	• Tostudyprogrammingbasedon 8086microprocessorand8051 microcontrollers. • Tostudy8086microprocessor-basedALP usingarithmetic,logicalandshift operations. • Tostudytointerface8086withI/Oandother devices. • Tostudyparallelandserialcommunicationusing8051&PIC18microcontrollers.		
	CourseOutcomes:Afterthecompletion ofthecoursethe studentshouldbeable to:		
	C318.1	:	Writeassemblylanguage programusing8086 microprocessorsbasedonarithmetic-logicalnumbersystemsandshiftoperations.
	C318.2	:	Writeassemblylanguage programsfornumericoperationsandarrayhandling problems.
	C318.3	:	Writeanassembly programonstring operations.
	C318.4	:	Interface8086with I/O andotherdevices.
	C318.5	:	Doparallelandserialcommunicationusing8051&PIC18microcontrollers
	List ofExperiments **(Anytenexperimentsfromthefollowing list)**		
	8086MicroprocessorPrograms		
	1.		Arithmeticoperations–Two16-bitnumbersandmultibytenumbers:addition-subtraction -multiplicationanddivision–Signedandunsignedarithmeticoperations-ASCII–Arithmetic operations.
	2.		Logicoperations–Shiftandrotate–ConvertingpackedBCDtounpackedBCD-BCDto ASCIIconversion–BCDnumbersaddition.
	3.		Arrangethegivenarrayinascendinganddescendingorder Determine the factorial of a given number ByusingstringoperationandInstructionprefix:Moveblock-ReversestringSorting-
			Inserting-Deleting-Lengthof thestring -String comparison.
	4.		Findthefirst andnthnumberof‘n’ naturalnumbersofa Fibonacci series.
	5.		Findthenumberand sumofeven andodd numbersofagiven array
	6.		Findthesumof‘n’naturalnumbersandsquaresof‘n’natural numbers
	7.		Arithmeticoperationson 8051
	8.		Conversionofdecimal numberto hexaequivalentand hexa equivalent todecimal number.
	Programson Interfacing		

	9.	Interfacing8255–PPIwith8086.
	10.	Steppermotorcontrolusing8253/8255.
	11.	ReadingandWritingonaparallelportusing 8051
	12.	Timerindifferentmodesusing 8051
	13.	Serialcommunicationimplementationusing8051
	14.	Understandingthreememoryareasof00–FFUsing8051external interrupts.
	15.	TrafficLightControllerusing 8051.

ReferenceBooks

1	R.S. Kaler, "A Text book of Microprocessors and Micro Controllers", I.K. InternationalPublishingHousePvt.Ltd.
2	AjayV.Deshmukh,"Microcontrollers–TheoryandApplications",TataMcGraw–Hill Companies–2005.

CO-PO/PSOMappingMatrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C318.1									3	2					
C318.2								2	3	2					
C318.3	2			3					3						
C318.4	2			3					3						
Avg.	**2**			**3**				**2**	**3**	**2**					

			L	T	P	Cr.
B.Tech.(VISem)		**IOT APPLICATIONSOF ELECTRICAL ENGINEERINGLAB**				
		CourseCode: 23PEXXXXX	0	0	3	1.5

Pre-requisites:
ConceptsofComputerOrganization,Computer Networks.

Course Objectives:

- Tounderstand theworking ofArduino.
- TolearntheprogrammingofRaspberry PI.
- ToknowvarioussensorswithArduino/RaspberryPi.
- TointerfacevariousdisplayswithArduino/RaspberryPi.
- Toconnectwithvariouswirelesscommunication devices

CourseOutcomes: Attheendofthe course-studentswillbeableto:

C319.1	:	OperatetheArduino IntegratedDevelopmentEnvironmentwithembeddedc.
C319.2	:	ProgramtheembeddedPythoninRaspberryPiOS.
C319.3	:	InterfacevarioussensorswithArduino/RaspberryPiintheIoT environment.
C319.4	:	ConnectdifferentdisplayswithArduino/RaspberryPi

List ofExperiments
(Anytenexperimentsfromthefollowing list)

1.	FamiliarizationwithArduino/RaspberryPiandperformnecessarysoftwareinstallation.
2.	InterfacingofLED/BuzzerwithArduino/RaspberryPiandwriteaprogramtoturnON LEDfor1secafterevery2 seconds.
3.	InterfacingofPushbutton/Digitalsensor(IR/LDR)withArduino/RaspberryPiandwritea programtoturnONLED whenpush buttonispressed oratsensordetection.
4.	InterfacingoftemperaturesensorwithArduino/RaspberryPiandwriteaprogramtoprint temperatureandhumidityreadings
5.	InterfacingofOrganicLightEmittingDiode(OLED)withArduino/RaspberryPi
6.	InterfacingofBluetoothwithArduino/RaspberryPiandwriteaprogramtosendsensor datato smartphoneusingBluetooth
7.	InterfacingofBluetoothwithArduino/RaspberryPiandwriteaprogramtoturnLED ON/OFFwhen ‘1’/’0’is receivedfromsmartphoneusingBluetooth
8.	WriteaprogramonArduino/RaspberryPitouploadandretrievetemperatureandhumidity datatothingspeakcloud.
9.	Interfacingof7SegmentDisplaywithArduino/RaspberryPi

	10.	InterfacingofJoystickwithArduino/RaspberryPi
	11.	InterfacingofAnalog Input&DigitalOutputwithArduino/RaspberryPi
	12.	Night Light Controlled& Monitoring System
	13.	InterfacingofFireAlarm UsingArduino/RaspberryPi
	14.	IRRemoteControlforHome Appliances
	15.	AHeart RateMonitoring System
	16.	AlexabasedHomeAutomation System

ReferenceBooks

1. Designingthe Internetof Things,AdrianMcEwenandHakimCassimally,Wiley
2. GettingStartedwiththe InternetofThings,CunoPfister,Oreilly.

CO-PO/PSOMappingMatrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C319.1									3	2				3	
C319.2								2	3	2				3	
C319.3			3	3					3					3	
C319.4			3	3					3					3	
Avg.			**3**	**3**				**2**	**3**	**2**				**3**	

			L	T	P	Cr.
B.Tech (VIISem.)		**RESEARCHMETHODOLOGY**				
		CourseCode: R23XXXX	3	0	0	3

Pre-requisites:

Course Objectives:

- Familiarizestudentswiththefundamentalsof researchprocessandmethodologies.
- Enablestudentstoidentify,formulate,anddefineresearchproblems systematically.
- Developskillsinliteraturereview,datacollection,analysis,andinterpretation.
- Exposestudentstoresearchethics,plagiarism,and intellectualproperty rights
- Trainstudentsintechnicalwriting,presentation,anddocumentationofresearchoutcomes.

CourseOutcomes: At theendofthe course, thestudentwill beable to

C320.1	:	Explainresearch concepts,types,andtheoverallresearchprocess.
C320.2	:	Identifyanddefineresearchproblemsthroughsystematicliteraturereviewandgapanalysis.
C320.3	:	Applyappropriate researchdesign,methodology,andtoolsfordatacollectionand analysis.
C320.4	:	Interpretresearch resultsanddrawvalidconclusionsinlinewithresearchobjectives.
C320.5	:	Demonstrate awareness of research ethics, plagiarism, and intellectual property rights andPreparetechnicalreports,researchpapers,andeffectivelycommunicateresearch outcomes

UNIT–I		10	hrs

Foundations of Research: Meaning, Objectives, Motivation, Utility. Concept of theory,empiricism, deductive and inductive theory. Characteristics of scientific method – Understanding the language of research – Concept, Construct, Definition, Variable

Research Process: Problem Identification & Formulation – Research Question – Investigation Question–MeasurementIssues–Hypothesis–QualitiesofagoodHypothesis–NullHypothesis &AlternativeHypothesis.Hypothesis Testing–Logic&Importance

UNIT–II		10	hrs

Research Design: Concept and Importance in Research – Features of a good research design – Exploratory Research Design – concept, types and uses, Descriptive Research Designs – concept, types and uses. Experimental Design: Concept of Independent & Dependent variables

QualitativeandQuantitativeResearch: Qualitativeresearch–Quantitativeresearch–Concept